



instinct^{and}
reason

Community attitudes towards gene technology

Date:	July 2019
Prepared for:	Office of the Gene Technology Regulator
Consultants:	Craig Cormick, Rob Mercer
Reference:	J2853

SYDNEY

Level 1, 420 Elizabeth
Street, Surry Hills
NSW, 2010 Australia

+61 (2) 9283 2233

LONDON

Suite 1,
7 Ridgmount Street
WC1 E7AE United Kingdom

+44 (0) 203 355 4454

CANBERRA

103/11 Trevillian Quay,
Kingston
ACT, 2604 Australia

+61 (2) 6231 0350

Contents

CONTENTS	3
1. EXECUTIVE SUMMARY	7
2. BACKGROUND, OBJECTIVES AND METHODOLOGY	9
Objectives	9
Methodology	10
3. SUMMARY OF FINDINGS	13
Awareness and understanding of biotechnologies	13
Attitudes by states and territories	14
Beliefs about GM foods.....	14
Awareness of organisations responsible for regulation of GM.....	15
Trust in what organisations say about gene technology.....	15
Attitudes and beliefs towards government involvement	16
Sources of information and trust in them.....	16
Values based segmentation	17
4. LITERATURE REVIEW.....	18
5. KEY FINDINGS.....	20
Awareness and understanding of biotechnologies	20
Perceptions of whether GM technologies will improve our way of life.....	22
Levels of support for GMOs and gene technology.....	23
Perceptions towards science and technology.....	27
Attitudes and beliefs.....	29
Confidence in food and the influence of GM on food consumption	29
Genetic modification in Australia.....	36
Modifying genes of plants to produce food.....	37
GM in food production.....	37
GM crops in your state or territory	41
Awareness of GM crops grown in states and territories.....	43
Support for growing GM crops in your state/territory	46
Public opinion on using GM technology to produce food.....	48
Reasons for being in favour of or against gene technology.....	49
The value placed on the different objectives for GM plants for food.....	52
Attitudes to GM for industrial or therapeutic uses.....	54
Information and trust	55
What people want to know to be assured GM crops and food are safe	55

Awareness of organisations responsible for regulation of GM.....	57
Trust in what organisations say about gene technology.....	59
Attitudes and beliefs towards government involvement	61
Sources of information and trust in them.....	62
Attitudes towards information and ideas	66
Main driver underpinning decisions about GM foods and crops.....	68
Support for GM sciences and technologies	68
Value based segmentation	69
6. CONCLUSIONS	83
7. APPENDIX 1 – SAMPLE PROFILE.....	85
8. REFERENCES	87

List of figures

Figure 1: Awareness and understanding of biotechnologies.....	20
Figure 2: Perceptions of whether technologies will improve our way of life.....	22
Figure 3: Support for gene technology in food and crops	23
Figure 4: Means - Support for gene technology in food and crops by gender	25
Figure 5: Levels of support for GMOs and gene technology	26
Figure 6: Levels of support for other GMOs and gene technology.....	27
Figure 7: Attitudes towards science and technology.....	28
Figure 8: Attitudes towards science and technology.....	29
Figure 9: Willingness to eat GM food	31
Figure 10: Willingness to eat GM food by age	32
Figure 11: Willingness to eat GM food by gender	33
Figure 12: Willingness to eat products from GM animals and animals fed GM food - by state and territory.....	34
Figure 13: Confidence in GM foods - by state and territory.....	34
Figure 14: Confidence in GM food and organic food - by state and territory	35
Figure 15: Confidence in food grown with pesticides and preservatives - by state and territory	35
Figure 16: Attitudes towards genetic modification in Australia	36
Figure 17: How acceptable it is to modify the genes of plants to produce food.....	37
Figure 18: Attitudes to GM in food production	38
Figure 19: Historic changes in attitudes towards different types of genetic modification	39
Figure 20: Attitudes to different types of modification by age	40
Figure 21: Attitudes to different types of modification by gender.....	41
Figure 22: Attitudes to different types of modification by state/territory.....	42
Figure 23: Awareness of GM crops being grown in respondents' states - by state/territory	44
Figure 24: Awareness of GM crops grown in the state/territory - state/territory comparison	45
Figure 25: Awareness of specific GM crops grown in their state/territory	45
Figure 26: In favour of growing GM crops in their state/territory - comparison by state/territory	47
Figure 27: Whether those opposed would be in favour if they knew the following existed	48
Figure 28: Attitudinal category in using GM technology to produce food	49
Figure 29: Why people are in favour of GM foods	51
Figure 30: Why people are opposed to GM foods.....	51
Figure 31: Attitudes to GM traits in plants	53
Figure 32: Attitudes to genetic modification for industrial or therapeutic uses	55
Figure 33: What people want to hear from the Regulator	56
Figure 34: What people want to know from the Regulator.....	57
Figure 35: Organisation/s they believe are responsible for the regulation of genetic modification in Australia	57
Figure 36: Awareness of organisations.....	58

Figure 37: Trust in what certain organisations say about GM and gene technology	60
Figure 38: Awareness and trust in OGTR over 20 years	61
Figure 39: Attitudes and belief in government rules and regulation	62
Figure 40: Sources of information	63
Figure 41: Trust in sources of information.....	64
Figure 42: Sources of information - by attitudes to GM food segments	65
Figure 43: Attitudes and behaviours towards sources of information	66
Figure 44: Sources of information used - by attitudes towards information	67
Figure 45: Acceptance of GM technologies - by attitudes towards information	67
Figure 46: Attitudes towards how decisions about GM foods and crops should be made.....	68
Figure 47: Support for biotechnology sciences and technologies	69
Figure 48: Awareness of terminology and understanding - by values segments	75
Figure 49: How technologies will impact our way of life - by values segments	76
Figure 50: Support for uses of genetic modification or gene technology - by values segments.....	77
Figure 51: Perceptions towards scientific technology - by value segments	78
Figure 52: Awareness of organisations responsible for regulation of GM - by values segments.....	79
Figure 53: Familiarity with organisations responsible for gene technology in Australia - by values segments.....	79
Figure 54: Trust in what organisations say about gene technology - by values segments.....	81
Figure 55: GM rules and regulation and whether they are rigorous and complied with - by value segments.....	82

List of tables

Table 1: Awareness of GMOs.....	21
Table 2: Definitions provided in the survey	21
Table 3: Support for GM food - analysis over time.....	24
Table 4: Support for GM use generally - by age	25
Table 5: Ranking of willingness to eat GM foods compared with those produced using pesticides and preservatives.....	30
Table 6: Ranking of lack of willingness to eat GM foods compared with those produced using pesticides and preservatives.....	30
Table 7: Ranking of willingness to eat GM in foods between 2012, 2015, 2017 and 2019.....	32
Table 8: Whether the objectives of genetically modifying plants to produce food is valuable	54
Table 9: Comparison between who was thought responsible for regulation and prior awareness	59
Table 10: Sources of information and trust in the source	65

1. Executive summary

The overall finding of the 2019 survey is that attitudes to genetically modified organisms (GMOs) have moved more towards neutral middle positions, as well as an increase in those who aren't sure or don't know, and some reduction in those with stronger views.

Those most strongly opposed to GMOs, however, have stayed constant at about 13% of the population across different measures (Figure 3), and these respondents stood out as having more extreme attitudes to food and agriculture than any other group, as well as low overall trust.

We can see a trend emerge whereby the proportion of those who are less supportive of GMOs has declined since 2015, and the proportion of respondents who are neutral has increased significantly (Figure 3). Support for GMOs is more varied and cannot be given just one figure because it is so often conditional, based on regulation and safety being ensured, and the type of modification and its purpose. For example, there is a wide difference in support for GMOs in medical (58%), industrial (53%), and food and crops (35%), (Figure 5).

The support for growing GM crops overall was similar to previous years, with 36% in favour and 32% opposed, however we have seen a gradual significant increase in the proportion of 'don't know' responses from 26% in 2015 to 32% in 2019. The data also indicates a reduction in those who are opposed to growing GM crops in their state or territory, from 36% in 2017 to 32% in 2019, with more now in favour than opposed (Figure 26).

Of note, the *don't know* or *unsure* ratings were high across almost all questions.

Awareness of the Office of the Gene Technology Regulator (OGTR) as an organisation remains on par with previous years at 13% (Figure 36), there was still a high level of trust in the organisation relative to other regulators surveyed. The findings were clear about the issues that most people want to hear from the regulator—health effects, transparency, proper testing and evidence of no long-term impacts on people or the environment.

Responses on sources of information indicated that television remains very popular, ranking as the 2nd, 3rd and 4th most likely source of information (Figure 40). The number one source stated was a general Google search. However, there has been a general drop in key sources of media being cited as sources for information on gene technology (documentaries, news stories, current affairs specifically).

Looking at trust in information sources saw TV documentaries and friends and family ranked the highest, followed by specific news website, Wikipedia and current affairs shows. Social media and Facebook rated very poorly for both information and trust.

Other key findings included:

- Knowledge about what foods in Australia were genetically modified is generally poor.
- Over time the trend is that those opposed to GM foods and to modifying the genes of plants to produce food is diminishing (Table 3 and Figure 17).
- 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 (Figure 18).
- Awareness of whether GM crops were grown in a respondent's state was generally not high, varying between 13% and 35% correctly stating whether or not GM crops were grown in their state (Figure 24).
- Those organisations thought to be regulators of GM included the Department of Agriculture (40%), CSIRO (38%), Food Standards Australia New Zealand (32%), the Department of Health (31%), the Office of the Gene Technology Regulator (27%), state governments (27%), the National Health and Medical Research Council (23%), the Therapeutic Goods Administration (20%), and the Australian Pesticides and Veterinary Medicines Authority (18%) (Figure 35).
- 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 a significant number of *don't know* responses (25% *don't know* for both rules and regulations being sufficiently rigorous, and for being complied with) (Figure 39).
- Most respondents (62%) felt that biotechnology would improve our way of life in the future, while only 45% felt that GMOs would improve our way of life in the future (Figure 2).
- Although only 41% of people had any awareness or knowledge of synthetic biology, there was moderate to strong support for it (once given a definition) with 48% of respondents stating they felt it would improve our way of life in the future (which was, however, a significant drop from the strong 2017 response of 62%) (Figure 2).
- Significantly more than half the respondents (61%) stated they were aware of gene editing and 52% thought it might improve our way of life in the future, but 19% thought it might make things worse. Gene editing received quite high acceptance (36%) relative to other techniques, when asked about *making a small change to an existing gene within a plant, as is done in gene editing*, despite a drop from the 2017 level of 42% acceptance (Figure 18).

2. Background, objectives and methodology

The Gene Technology Regulator (the Regulator) administers the *Gene Technology Act 2000* to protect the health and safety of people and the environment by identifying risks posed by or as a result of gene technology, and managing those risks by regulating certain dealings with genetically modified organisms (GMOs).

Gene technology is a form of biotechnology. Biotechnology describes the use of biology in agriculture, 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. 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 of developments in emerging technologies. This study continues to track those community attitudes and behaviours.

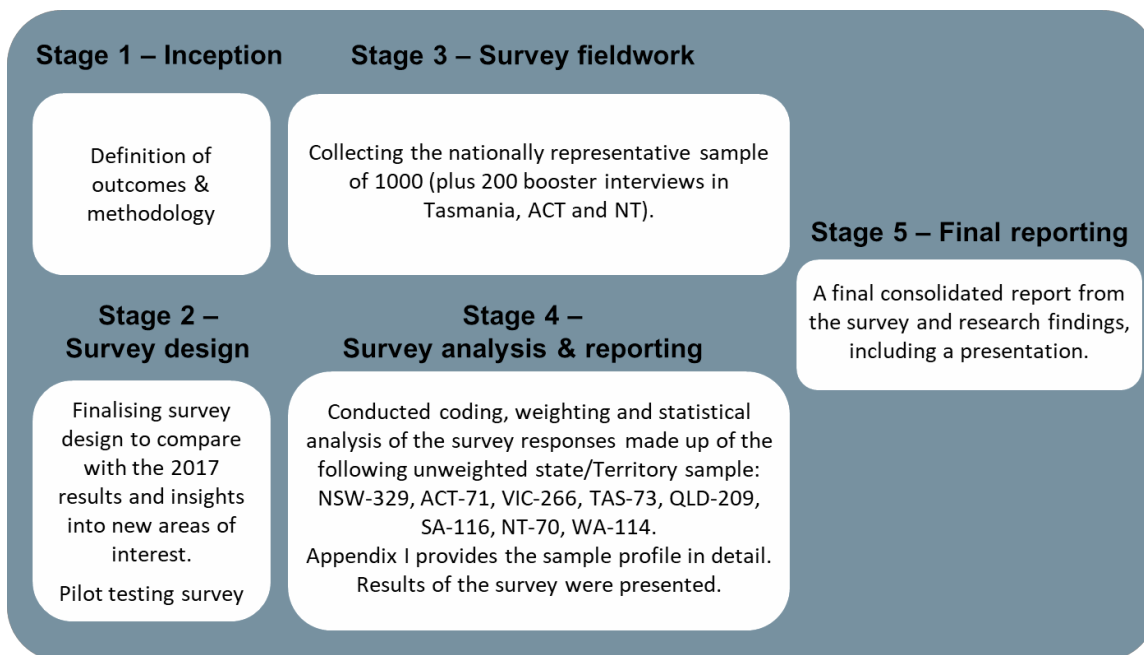
Objectives

The research objectives for this study were:

- 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.

Methodology

This research used a mixed methodology of both quantitative and qualitative approaches. In summary:



Stage 1 – Inception, planning and review of existing literature

An initial meeting was held with the Office of the Gene Technology Regulator (OGTR) to define the outcomes being sought and assess the 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 and initiatives, and the effectiveness of these.

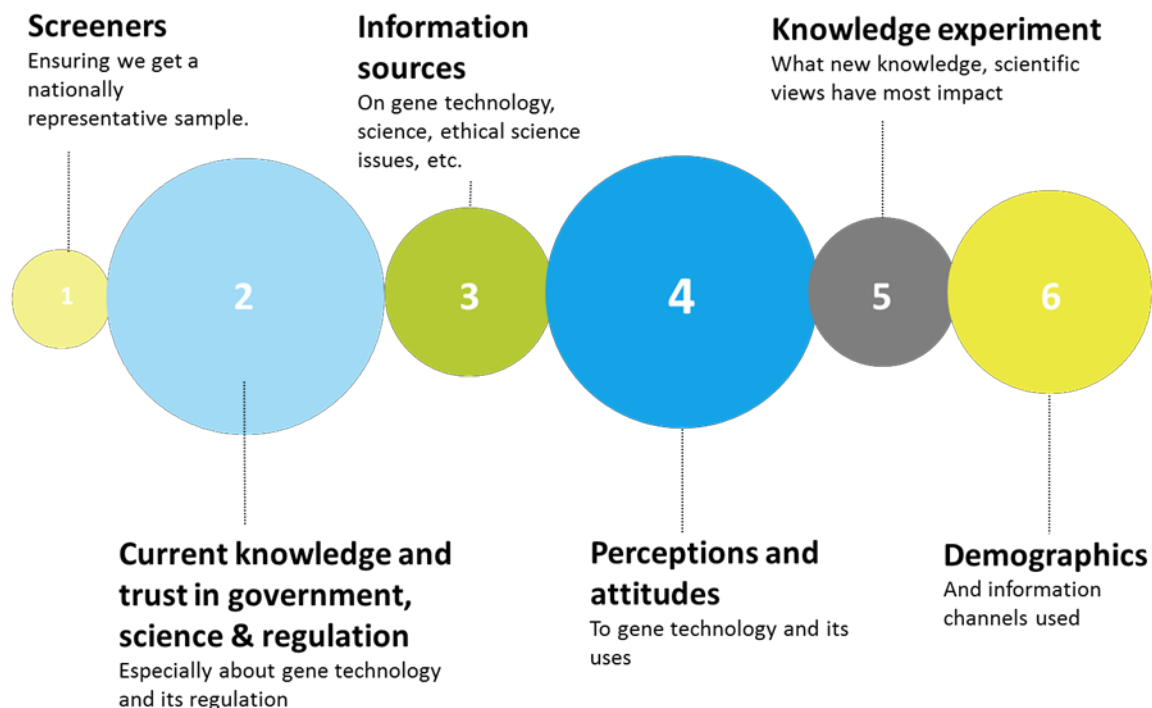
External factors affecting perceptions of gene technology, innovations and its regulation and also the social, technological, political, economic and legislative contexts affecting these were discussed.

Survey methodology was agreed upon, replicating the survey methodologies of previous years and eliminating the impact of externalities.

Stage 2 – Survey design

Survey questions ensured accurate and reliable tracking from previous years and additional questions were asked based on new data from the literature review. 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.

The survey covered the following areas:



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

Stage 3 – Survey fieldwork

The roughly 15-minute survey was completed in June 2019 using an online survey and with booster CATI (phone) interviews to ensure a nationally representative sample of 1248 Australians (with appropriate representation from Tasmania, NT and the ACT). Quotas were set for states and territories, rural and metropolitan, and gender. Recruitment for the online survey was taken from a reputable research-only panel.

The male to female ratio was 48:52 with 593 males and 655 females and represented a similar age profile to that of the 2017 study. 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, captured the movement of attitudes across the broader population.

Stage 4 – Survey analysis and reporting

Data cleaning and coding was conducted on the survey responses. The results were weighted to the Australian population based on 2016 ABS data by State/Territory, age and gender. The unweighted state/territory sample was: NSW-329, ACT-71, VIC-266, TAS-73, QLD-209, SA-116, NT-70, WA-114.

Appendix I provides the sample profile in detail. The analysis included frequency counts and cross tabulations, significant testing, mean calculations and cluster analysis. The survey results were presented to the OGTR.

Weighting of the data – The actual sample profile provides the unweighted responses. The results presented in the rest of the report are weighted to the Australian population based on 2016 ABS data by state/territory, age and gender.

Statistical significance – 5% at 95 percent level of confidence – All tests for statistical significance have been undertaken at the 95 percent level of confidence, and unless otherwise noted, any notation of a ‘difference’ between subgroups means that the difference discussed is significant at the 95 percent level of confidence. The report only notes those differences that are statistically significant, these differences are marked in the graphs and tables by a red or a green circle, where they are different to the 2017 results. Differences that are statistically different to 2015 are indicated by an arrow.

Treatment of means – Where responses are scale variables, for example 1 to 5 where 1 is disagree strongly and 5 is agree strongly, the mean is also calculated with the removal of don’t know and reported and also compared for statistical significance at the 95% level of confidence.

Rounding of figures – may result in anomalies of +/- 1% - All results have been rounded to the nearest whole percentage figure and anomalies of about +/- 1% may occur in charts i.e. in the chart above, total percentages for each bar add to 99%, or 100% or 101% due to rounding error.

Net figures are also rounded, which may also result in anomalies. Net results are also rounded after summing the separate proportions rather than simply summing two rounded figures (e.g. ‘% total agree’). For this reason, anomalies of about 1% sometimes occur between net results and rounded results shown in charts. For example, a proportion of 33.3% ‘agree’ rounds to 33%, and a proportion of 12.4% ‘strongly agree’ rounds to 12%. However, when combined to derive the total agree (i.e. agree plus strongly agree), 33.3% plus 12.4% equals 45.7%, which would be rounded to 46%. In this case, the results would be shown in a chart as 33% agree and 12% strongly agree, but the proportion reported as ‘total agree’ would be 46%.

Stage 5 – Final reporting

The following provides a final and consolidated report from both the quantitative (survey) and qualitative research findings.

3. Summary of findings

Awareness and understanding of biotechnologies

There has been a general continued decrease in awareness of the key terms of biotechnology and genetic modification, and the largest response category to questions about awareness tended to be those who had heard of an application but knew very little about it. As in 2017, the exception was for synthetic biology and gene editing which both recorded very high *Have NOT heard of it* responses (see figure 1).

Understanding of the term biotechnology dropped significantly, from 17% to 12%, with those who had not heard of it rising from 20% to 27%. Also of significance, those who responded that they knew enough about an application to explain it to a friend, dropped over four years quite drastically. For those who knew enough about biotechnology to explain it, the drop was from 19% in 2015, to 17% in 2017 to 12% in 2019.

Likewise, GMOs and cloning of animals, which had relatively high responses to those who said they knew enough about them to explain to friends in 2015, suffered strong drops. For GMOs the drop was from 33% in 2015 to 30% in 2017 and 22% in 2019. And for cloning of animals the drop was from 39% in 2015 to 35% in 2017 to 23% in 2019.

There has also been a slow drop in the percentage of respondents who felt that biotechnology would improve our way of life in the future (71% in 2017 to 62% in 2019), but also a slow decrease in those who felt that GMOs would make things worse in the future (29% in 2015 to 26% in 2017 to 24% in 2019). This is getting close to double the amount of people thinking GMOs or genetic modification will improve our way of life in the future as those who feel it will make things worse (45% to 24%) (Figure 2).

Those who felt that synthetic biology would make our lives better dropped overall from 59% in 2015 to 48% in 2019. Given that synthetic biology was the lowest rated application for people know enough about it to explain to a friend (7% in 2019) or having heard of it but knowing little or nothing about it (34% in 2019), there is clearly still a strong response based on what a technology sounds like or feels like rather than what people know about it.

The data shows that 13% are completely against gene technology and 8% are completely in favour of it (see Figure 3). These figures have not changed much over the years but represent those who tend to be most active in lobbying for and against gene technologies. When looked at in context of the overall population, just under a quarter of all people have strong views on the subject. While this is still a significant number, it is perhaps less than those at polar opposites are perceived to be.

Data across the age groups (clustered into three age cohorts of 16–30, 31–50 and 51–75) showed a general trend of younger people being more supportive of GM foods of all kinds, and those aged 51–75 being the least supportive (Table 4).

Looking at the data by gender confirmed the general trend that males were more supportive of GM foods than females (Figure 11).

Attitudes by states and territories

GM crops

The support for growing GM crops overall was similar to previous years, with 36% in favour and 32% opposed, however we have seen a gradual significant increase in the proportion of ‘don’t know’ responses from 26% in 2015 to 32% in 2019. The data indicates a reduction in those who are opposed from 36% in 2017 to 32% in 2019 (Figure 26).

Across the states and territories New South Wales and Victoria tended to have the highest levels of support for GM animal related products and GM crops, sitting slightly above the average score and Queensland, Western Australia and South Australia tended to sit slightly below the national average, although not statistically significant (Figure 12).

Of interest, in terms of genetic modification, there were a couple of significant differences found: Victorians were more supportive of ‘introducing the genes of a bacterium’ than any other state, with a third (32%) finding this acceptable, compared to the national average of 24%. (Figure 22) Whilst Western Australians were significantly more opposed to introducing the genes of an animal (41% opposed compared to the national average of 29%). Unlike previous years there were no significant differences between capital cities and non-capital cities (Figure 22).

Beliefs about GM foods

Using a series of attitudinal statements, respondents were placed in one of four categories related to attitudes to GM food (Figure 28):

1. Strongly support GM foods (17%)
2. Only if regulations are in place to make sure they are safe (51%)
3. Against until the science proves they are safe (21%)
4. Strong against GM foods (12%)

When the 12% who most opposed to GM foods were measured across other questions asked in the survey, they were shown to have the lowest levels of trust.

There was an overall drop in the values that people placed on the different objectives of genetically modifying plants and foods for particular outcomes (Figure 31). Those seen as very valuable were: drought resistance (38%); healthier (38%); pest-resistance (31%); frost resistance (27%); ability to grow in salty soils (24%); to make the food cheaper (32%); to make the food last longer (25%); to make the food taste better (21%); to make the plants herbicide tolerant (20%); and to make the plants mature more quickly (16%). While all of these responses represented a diminution of those who saw the attributes as very valuable, there was not a general corresponding increase in attitudes that these attributes were not valuable. Rather there was a general increase in the Don't Know responses, and a slipping of values from very valuable to somewhat valuable.

For instance, making plants healthier slipped from 43% seeing it as very valuable in 2017 to 38% in 2019, while those who felt it was somewhat valuable rose from 30% to 34%. The combined responses for not valuable and not at all valuable remained at 17% and those who did not know rose from 9% in 2017 to 12% in 2019 (Figure 31).

Awareness of organisations responsible for regulation of GM

Survey respondents were shown a list and asked 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 low awareness of the organisations responsible for the regulation of GM in Australia, with a significant don't know response (29%). Those organisations that were most commonly believed to regulate GM were the Department of Agriculture (40%), CSIRO (38%), Food Standards Australia New Zealand (FSANZ) (32%), Department of Health (31%), the Office of the Gene Technology Regulator (OGTR) (27%), State governments (27%), the National Health and Medical Research Council (NHMRC) (23%), TGA (20%), and the Australian Pesticides and Veterinary Medicines Authority (APVMA) (18%) (Figure 35).

Overall findings of awareness of the agencies that might be responsible for GM regulation were fairly similar to 2017 results, with no significant differences.

Trust in what organisations say about gene technology

All the regulators polled received considerable levels of trust in relation to the information that they might produce on gene technology, with trust ratings between 55% and 67% for high trust. Low levels of trust were only between 5% and 8% (Figure 37).

Industry groups and environmental organisation groups rated much lower for trust though, at 27% and 35%, and also the highest levels of low trust (17% and 16%).

A new question, asked about overseas regulators, also showed they have very low levels of trust, with only 19% of high trust and the most pronounced low trust rating of all organisations listed, at 26% (Figure 37).

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, the majority agreed but there was also a significant don't know response (Figure 39).

That the rules regulating the uses of GM in agriculture and food production were sufficiently rigorous was agreed to by 31% on the top cohort on a Likert scale, and 10% were less sure (and 25% did not know). That the rules regulating the uses of GM in medical research were sufficiently rigorous was agreed to by 35%, and 8% were less sure (25% didn't know).

Sources of information and trust in them

The overall finding was that television and Google ruled information sources. A general Google search was stated by 44% of respondents, followed by documentaries on television (42%), news stories on television (31%) and current affairs shows on television (25%). This is similar to other surveys on sources of information on science issues, which tend to show that across the broad population, television is still the main source of information (Figure 40).

There were drops in key media sources compared to 2017. Documentaries on TV dropped significantly from 42% in 2017 to 38% in 2019, current affairs shows on television dropped significantly from 29% in 2017 to 25% in 2019, and stories in the newspaper dropped significantly from 23% to 19% (Figure 40).

Those who accept that GM is a safe way to produce foods were more likely to get their information from Wikipedia, friends and family, and Facebook posts, and less likely from current affairs shows (Figure 42).

Comparing sources of information to their trust shows that information preferences and trust are not necessarily closely aligned. The highest rating for trust was television documentaries, with 18% rating them as very trustworthy. The next closest was friends and family, with 14% rating them as very trustworthy. Overall most media rated only between 6% and 11% trust, with current affairs shows on television rating the best of general media at 11%, and news on the radio, TV and newspapers all rating 8%. Talkback radio rated only 6% very trustworthy (Figure 41).

Wikipedia rated above all the mainstream news media, at 11%, but general social media discussions and Facebook posts rated the lowest at 5% and 4% respectively.

The most trusted medium for combined trust was for information from documentaries on television with 18% finding them very trustworthy and 61% finding them somewhat trustworthy (totalling 79%). This was followed by specific news websites (12%) very trustworthy and 56% somewhat trustworthy, totalling 68%. The third most trustworthy source of information was news on the radio

(8% very trustworthy and 56% somewhat trustworthy, totalling 64%), rating equally friends and family (14%) and 50% somewhat trustworthy, totalling 64% trust (Table 10).

Values based segmentation

Of the four segments, the Disciples was the segment that responded most positively to gene technology in general. This group were more likely to live 'elsewhere in NSW' and speak only English at home.

Although they were not necessarily more aware, more likely to claim to 'have heard of but know little about' many of the technologies compared to other segments, they generally believe that they will 'improve our way of life in the future'. They were the segment most likely to be willing to eat GM related food, more accepting of modifying genes of plants and introducing new genes, and most likely to be in favour of growing GM crops in their state/territory.

4. Literature review

Over the past twenty years methods of surveying public attitudes has become increasingly sophisticated and tend to look beyond finding a simple figure for what the public think about the technology, but why they think this way. Early studies that looked at knowledge as a driver of attitudes (Bauer, Allum et al, 2007), were replaced by personal risk-benefit perceptions and trust (Lyndhurst, 2009; Biotechnology Australia, 2005; Gaskell et al., 2006; Hossain et al., 2003).

Looking at different studies it is clear that there is no one easily obtainable figure for public support or rejection of GM foods and previous studies of public attitudes towards biotechnology in Australia have shown that the level of support or rejection depends on many things, including the intended use of the technology, the type of gene being transferred and the objective of the modification, and the responses may vary depending on how the questions are framed and perceived (Biotechnology Australia, 2005, 2007).

It has also been shown that a person's individual values are strong drivers of attitudes to GM foods and crops, with those who value more healthy eating, for example, being more likely to be concerned about GM foods (Funk and Kennedy, 2016).

Australian studies have also confirmed the importance of world views being more important in influencing attitudes than knowledge of the science. A study of women with scientific backgrounds working either in plant sciences or health science, found stark differences in support for GM foods. Those who were plant scientists said that lack of any evidence of harm meant to them that GM food was safe to eat, while the health scientists said that lack of any evidence of safety made them cautious about eating them. The researchers concluded that attitudes were based more on core food values and disciplinary background than knowledge of the science (Bray and Ankeny, 2017).

Another key finding in the evolution of studies in attitudes towards GMOs has been segmentation studies of audiences based on values. Earlier studies that have looked at audience segmentation generally focused on demographic differences such as age and gender (Bauer et al., 2007; Rollin, Kennedy and Wills, 2011; Heiman et al, 2011; Qin and Brown, 2007; and Siegrist, 2000). Such approaches have largely been replaced by segmentations based on values or world views.

Australian studies, such as those carried out by OGTR have been at the forefront of better understanding of audience segmentation in regard to attitudes to GMOs, continuing the work begun by Biotechnology Australia (Biotechnology Australia, 2007) in values-based segmentation.

Attitudinal segmentation can provide not only a deeper understanding of what drives public attitudes, but by unpacking the world views or the values driving them, they can allow for framing more effective public engagements that align with these world views.

Recent international trends

International studies into public attitudes towards biotechnologies, conducted over the past few years, have become much more nuanced and either look in more detail at drivers of attitudes, or have moved away from GM foods and crops towards human uses of gene technology.

A 2018 study seeking to understand if CRISPR technology would be treated similarly to GMOs, looked at consumer willingness to purchase different products in North America, France and Australia, and found similar preferences for both CRISPR and GM technology, although it was stated that attitudes to CRISPR-produced products was still largely theoretical (Shew et al, 2018).

Two studies that received considerable media attention, that looked at impacts of information flows and attitudes to GMOs found:

- Teaching people the science behind genetic engineering leads to more positive attitudes toward GM foods – although it should be pointed out that respondents received a considerable amount of education over five weeks – significantly longer than can easily be imparted to members of the public (McPhetres et al, 2019).
- Another study looking at US, France and German data found that the most extreme opponents of genetically modified foods know the least about the science behind it, but believe they know the most (Fernback et al, 2019).

Although questions are not directly comparable, the recently released Special Eurobarometer - April 2019 “Food safety in the EU” Report found that genetically modified ingredients in food or drinks were a concern for 27% of respondents compared to being the fourth issue respondents were most worried about in the 2010 at 66%. The 2019 survey also found that 60% were aware of genetically modified ingredients in food or drinks (Kantar for the European Union, 2019).

Wider applications of gene technologies

A major study by the British Royal Society, Report on Genetic Technologies, found the UK public were cautiously optimistic about genetic technologies. A key finding was the public is not, and should not be seen as, monolithic, highlighting that top line findings often fail to do justice to the complexity of public attitudes (van Mil, Hopkins and Kinsella, 2017).

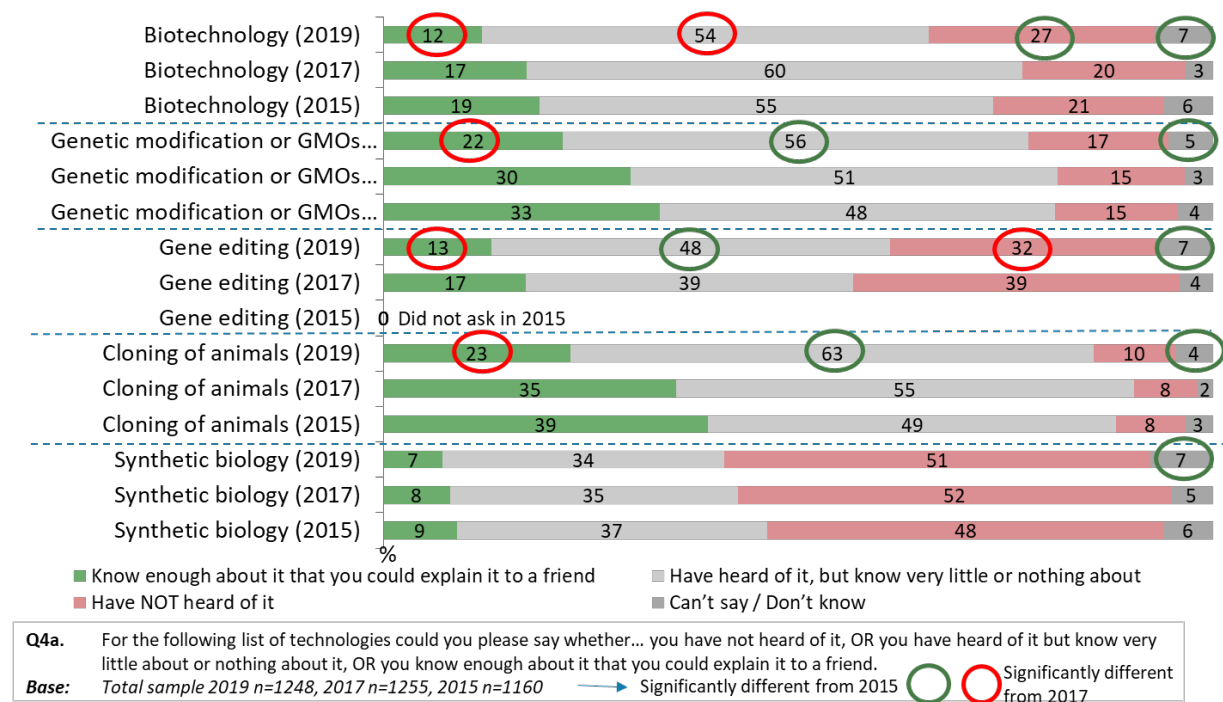
Looking at synthetic biology, a US study found that the public does not generally feel well informed about it, nor believe it is personally important to them (Akin et al, 2017).

5. Key findings

Awareness and understanding of biotechnologies

The general finding relating to attitudes and awareness was that awareness of most applications has dropped over the past two years, and the largest response category to questions about awareness tended to be those who had heard of an application but knew very little about it. As was seen in 2017, the exception was for synthetic biology which recorded very high *Have NOT heard of it* responses.

Figure 1: Awareness and understanding of biotechnologies



Understanding of the term biotechnology dropped significantly, from 17% to 12%, with those who had not heard of it rising from 20% to 27%, and those who knew enough about it to explain it to a friend dropping from 19% to 12% over four years. This is more likely to be a reflection of the diminution of biotechnology in public debates and general media coverage, rather than any dumbing down of the population.

Likewise, there was a strong drop for those who felt they knew enough to explain both GMOs and cloning of animals. These both had relatively high responses to this in 2015, and GMOs the drop was from 33% in 2015 to 30% in 2017 and 22% in 2019, and for cloning of animals the drop was from 39% in 2015 to 35% in 2017 to 23% in 2019.

These were interesting results, indicating that as topics slide off the public agenda so does a person's confidence in being able to know enough to explain it to a third person. There were few differences (no significant differences) in awareness by gender, as shown in the table below.

Table 1: Awareness of GMOs

Awareness	Total	Males	Females
Have NOT heard of it	17%	17%	16%
Have heard of it, but know very little or nothing about	56%	53%	59%
Know enough about it that you could explain it to a friend	22%	23%	20%
Can't say / Don't know	5%	6%	4%

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.

Table 2: Definitions provided in the survey

Term	Definitions provided in the survey
Genetic modification or GM	Genetic modification or GM 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).
Gene editing	Gene editing also known as genome editing, is a laboratory technique to make small, targeted changes to the genes of an organism. It does not involve the transfer of a gene from one living thing to another. One of the most common techniques used to edit genes is CRISPR (clustered regularly interspaced short palindromic repeats).
Biotechnology	Biotechnology 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	Cloning of animals 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 nor change an animal's DNA.
Synthetic biotechnology	Synthetic biology 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

Nanotechnology is the manipulation of matter on an atomic, molecular, and supramolecular scale (nanoscale – which is about 1 to 100 nanometres) to take advantage of enhanced properties such as higher strength, lighter weight, increased control of light spectrum, and greater chemical reactivity.

Perceptions of whether GM technologies will improve our way of life

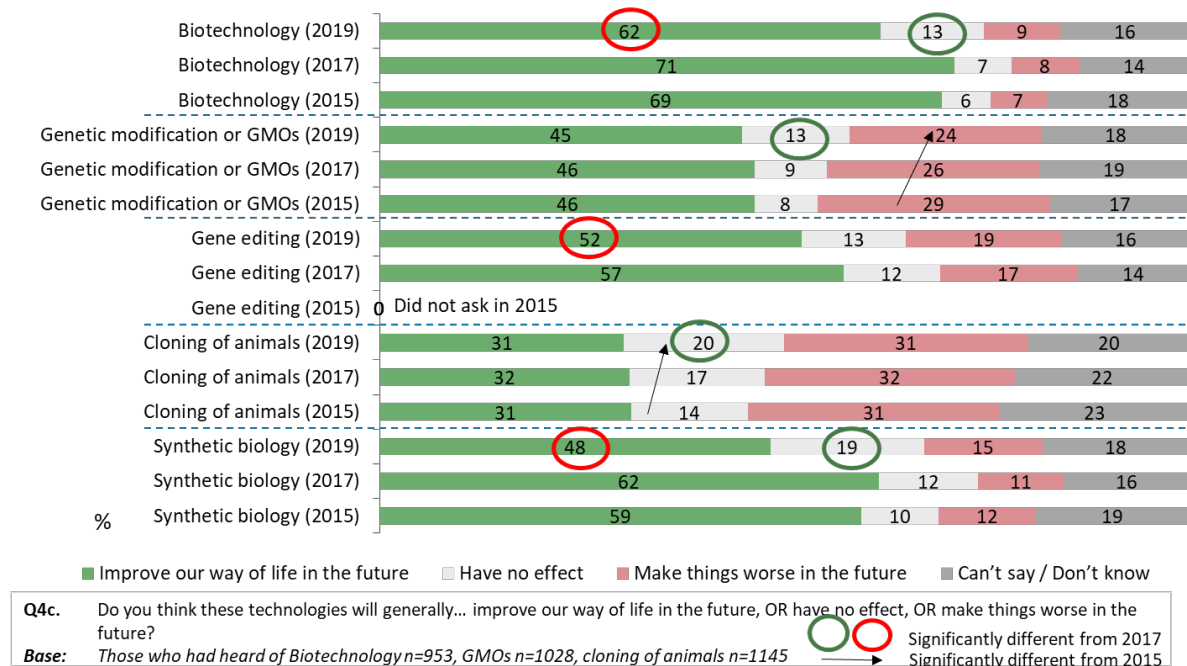
While a clear majority of respondents felt that biotechnology would improve our way of life in the future, this has dropped since 2017 (71% to 62%).

Gene editing also had more than half (52%) indicating it would improve our way of life in the future, albeit a drop from 2017 (57%).

Belief that GMOs and cloning of animals would improve our way of life in the future, however, remained fairly static at 45% and 31% respectively, with cloning of animals having equal numbers believing it would improve our way of life as believed it would make things worse in future (31% in 2015, 32% in 2017 and 31% in 2019).

Looking at those who felt GMOs would make our life worse in the future, the percentage has dropped slowly over the past four years from almost 29% to 24%.

Figure 2: Perceptions of whether technologies will improve our way of life



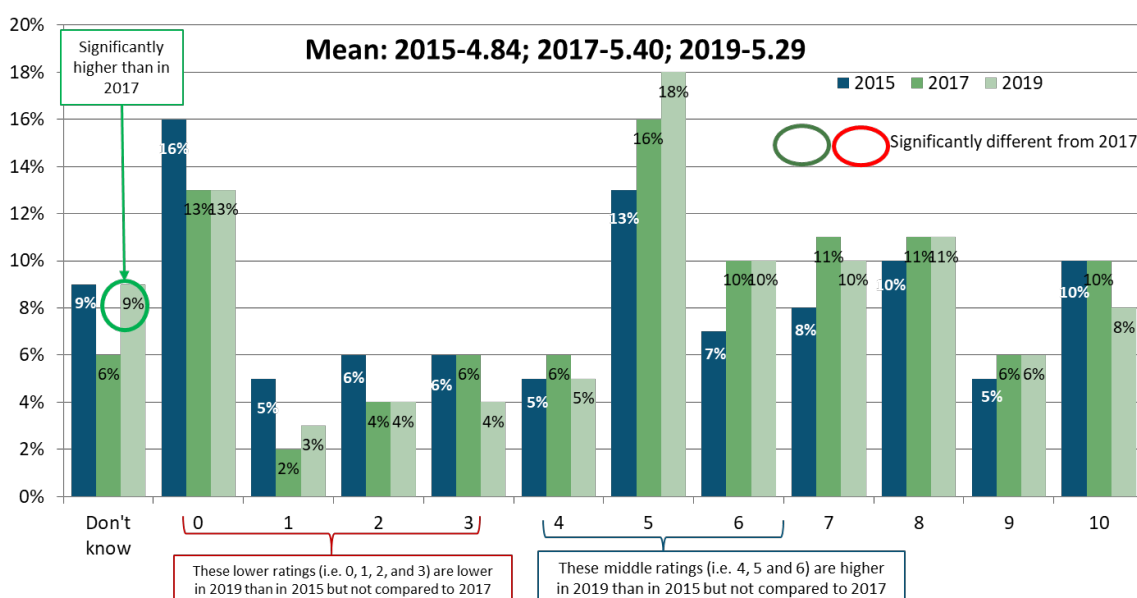
Levels of support for GMOs and gene technology

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 always be minorities who are either strongly for or strongly against GM foods—and these are important to understand—but the majority of the population tends to be more moderate in their attitudes and reflecting this breadth of attitudes is more useful in understanding attitudes.

The data shows that 13% of respondents are completely against gene technology – which has not changed from 2017, and 8% are completely in favour of it. These figures have not changed much over the years and represent those who tend to be most active in lobbying for or against gene technologies. It is important to remember, however, that in the context of the general population they represent less than a quarter of all people. While this is still a significant number, it is perhaps fewer than many believe. Those at the polar opposites generally stay there, but those in the middle are more likely to move back and forward according to different factors, and this is where movements in the population are best recorded. The mean for those who support the use of gene technology in food and in crops has dropped a little since 2017, but it is notably higher than it was in 2015 (4.84 in 2015, 5.40 in 2017 and 5.29 in 2019).

Looking at the general trend, it is essentially unchanged over four years, with attitudes moving more to the middle, and an increase in those who don't know over 2015 (9% up from 6%).

Figure 3: Support for gene technology in food and crops



Q5. On a scale of 0 – 10, where 10 is completely supportive and 0 is completely against it please indicate how supportive you are for the following uses of genetic modification or gene technology.

Base: Total sample 2019 n=1248, 2017 n=1255, 2015 n=1160

It is worth noting, that similarly to previous years, public attitudes are spread across a wide spectrum. Attitudes at the two extremes should not be generalised or attributed to a much wider range of views between the two extremes.

On closer examination of Figure 3, when comparing the 'Bottom box' (support values 0-3), 'Middle box' (support values 4-6) and 'Top box' (Support values 7-10), we can see a trend whereby the proportion in the bottom box has declined significantly since 2015, and the proportion in the middle box has increased significantly since 2015. This pattern is captured in Table 3, indicating a reduction in respondents with strong attitudes and an increase in more neutral views in 2019, compared to 2015.

Table 3: Support for GM food - analysis over time

Support on a 0-10 scale		2015	2017	2019
Net BOTTOM box (0-3)		23%	18%	16% →
Net MIDDLE box (4-6)		33%	38%	41% →
Net TOP box (7-10)		33%	38%	33%

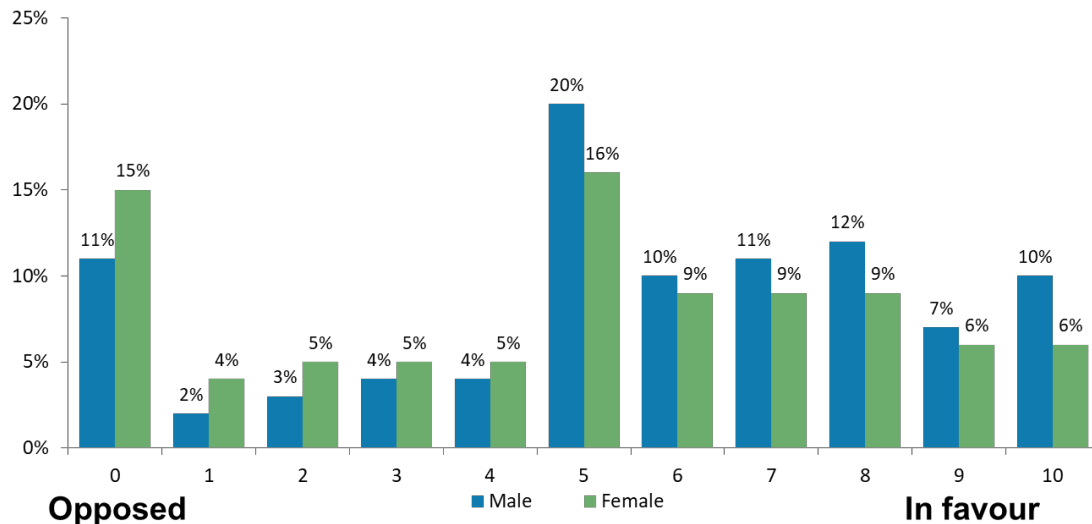
Q5. For the following statements, on a scale of 0-10 where 10 is completely supportive and 0 is completely against it, please indicate how supportive you are for the following uses of genetic modification or gene technology: For use in food and crops

Base: Total sample 2019 n=1248, 2017 n=1255, 2015 n=1160 → Significantly different from 2015

Breaking down the responses by gender, there was a clear trend of higher support for GM foods and crops by males and less by females. Generally speaking, women were more concerned than men about the possible negative impact and gene technology and older people were more concerned than younger people.

When looking at attitudes by age the data shows that support for gene technology generally decreases as one grows older. Those in the 51–75 age group were more likely to indicate a low level of support for gene technology generally, but those in the 16–30 age group were more likely to indicate a high level of support for gene technology generally, and for use in foods and crops.

Figure 4: Means - Support for gene technology in food and crops by gender



Q5. For use in foods and crops - 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

Base: Total sample n=1248, Male n= 593, Female n=655

Table 4: Support for GM use generally - by age

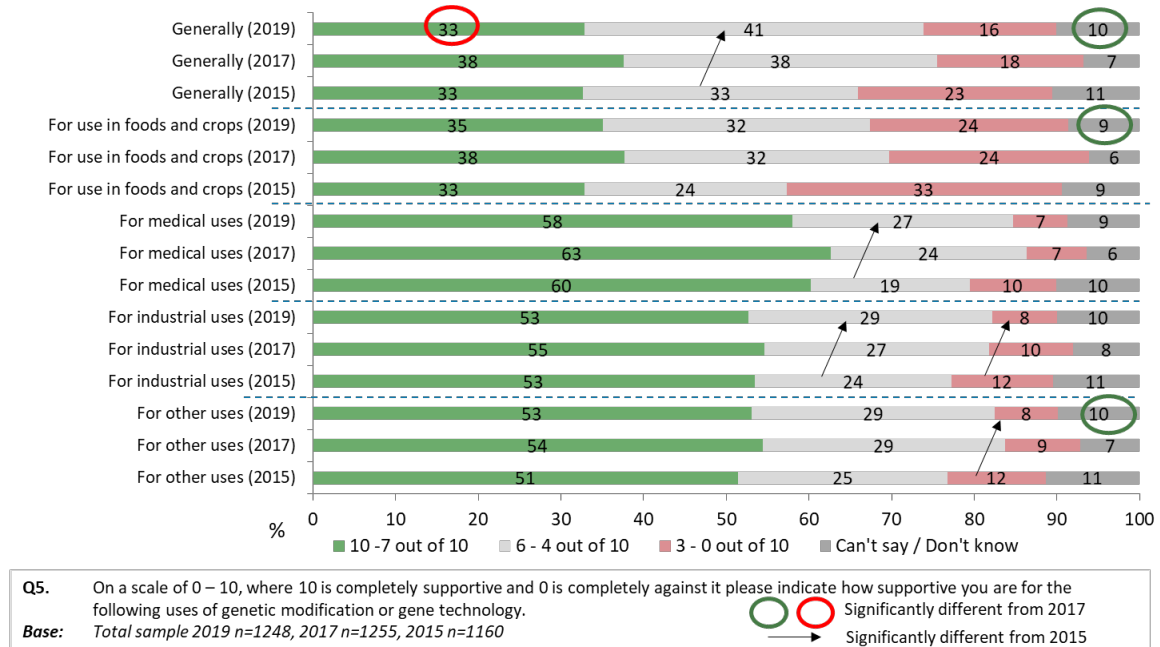
Support on a 0-10 scale	Total	16-30	31-50	51-75
Net BOTTOM box (0-3)	16%	12%	15%	20%
Net MIDDLE box (4-6)	41%	38%	40%	44%
Net TOP box (7-10)	33%	41%	33%	27%
Don't know/can't say	10%	9%	11%	10%

Q5. For the following statements, on a scale of 0-10 where 10 is completely supportive and 0 is completely against it, please indicate how supportive you are for the following uses of genetic modification or gene technology: GM use generally

Base: Total sample 2019 n=1248, 2017 n=1255, 2015 n=1160

Data from an 11-fold response across a Likert scale of support was grouped into three major response cohorts for ease of reading as shown below (including the *can't say/ don't know* responses), representing those most in support, those in the middle and those with the least support.

Figure 5: Levels of support for GMOs and gene technology



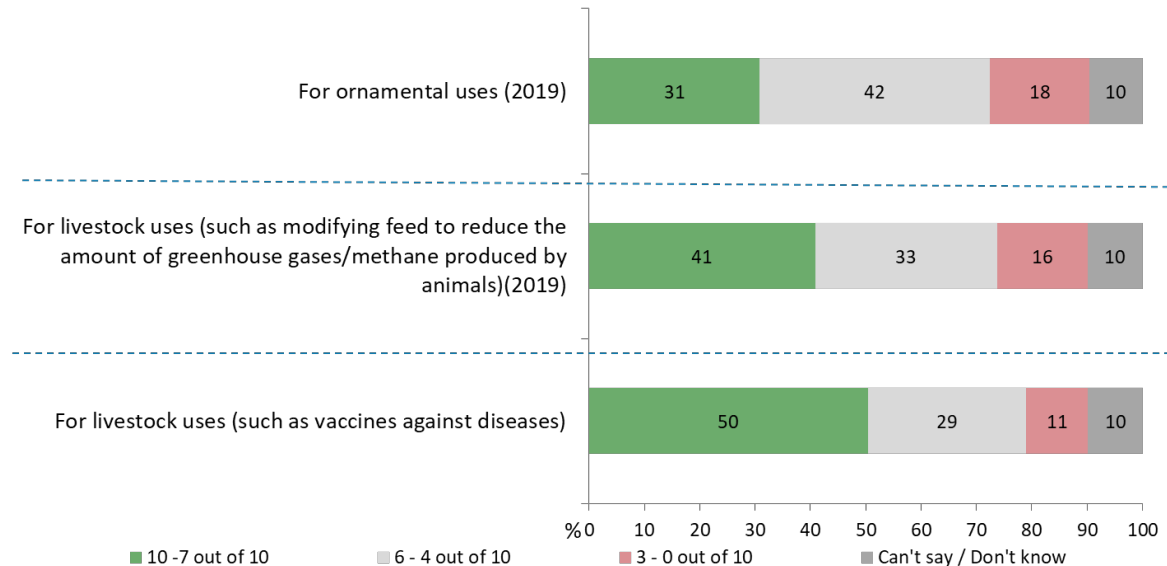
The general results tended to be closer to those from the 2015 survey than they were to 2017 results, with highest levels of support for genetic modification and gene technology being 33% in 2015, 38% in 2017 and 33% again in 2019.

The use of genetic modification for medical uses – which had the highest overall support at 58% in 2019, has seen a significant rise in the middle box score since 2015, from 19% to 27% scoring between 4 and 6 out of 10.

Likewise, there has been a gradual rise in those whose support for industry use is in the middle box (from 24% in 2015 to 29% in 2019), accompanied by a decline for those in the bottom box (from 12% in 2015 to 8% in 2019).

Those who opposed using gene technology in food and crops remained at the 2017 figure of 24% (having dropped from a high 33% in 2015).

Figure 6: Levels of support for other GMOs and gene technology



Q5. On a scale of 0 – 10, where 10 is completely supportive and 0 is completely against it please indicate how supportive you are for the following uses of genetic modification or gene technology.
Base: Total sample n=1248

A new component to this question, asked only in 2019, was whether people supported the use of genetic modification of gene technology for ornamental uses, for livestock (such as modifying feed to reduce the amount of greenhouse gases/methane produced by those animals, and for livestock uses (such as vaccines against diseases). The results showed the highest support was for livestock uses such as developing vaccines that had 50% high support, and 11% low support.

Livestock uses were supported by 41% of respondents with 16% opposing them. Ornamental uses, which had the lowest support of these new questions, had 31% support and 18% opposed.

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. Five key statements were tested across a Likert scale to gauge public sentiments and to inform values-based segmentation.

The five statements were:

- 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
- Science and technology creates more problems than it solves
- Technological change happens too fast for me to keep up with.

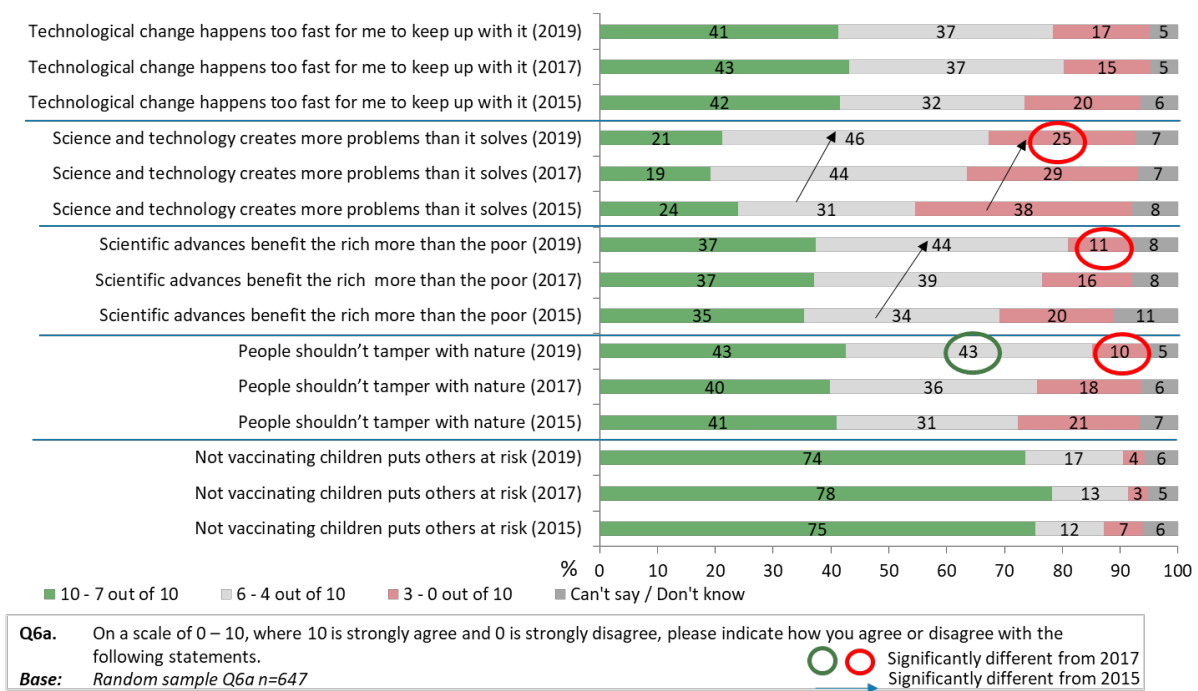
Those statements that received the highest levels of support were not vaccinating children puts others at risk (74% of respondents ranking the highest level of support). The next highest ranked support was for the statements People shouldn't tamper with nature (43% in the top box, on par with previous years) and technological change happens too fast for me to keep up with (41% ranked in the highest level of support, on par with previous years also).

By contrast, the statement with the lowest support was science and technology creates more problems than it solves (21% ranked the highest levels of support). There was also an increasing proportion of people who scored in the middle box with that statement, from 31% in 2015 to 46% in 2019, as the proportion who disagreed fell to 25% in 2019.

The same trend was seen for the statement 'scientific advances benefit the rich more than the poor', whereby those who disagree fell from 20% to 11% in 2019.

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

Figure 7: Attitudes towards science and technology

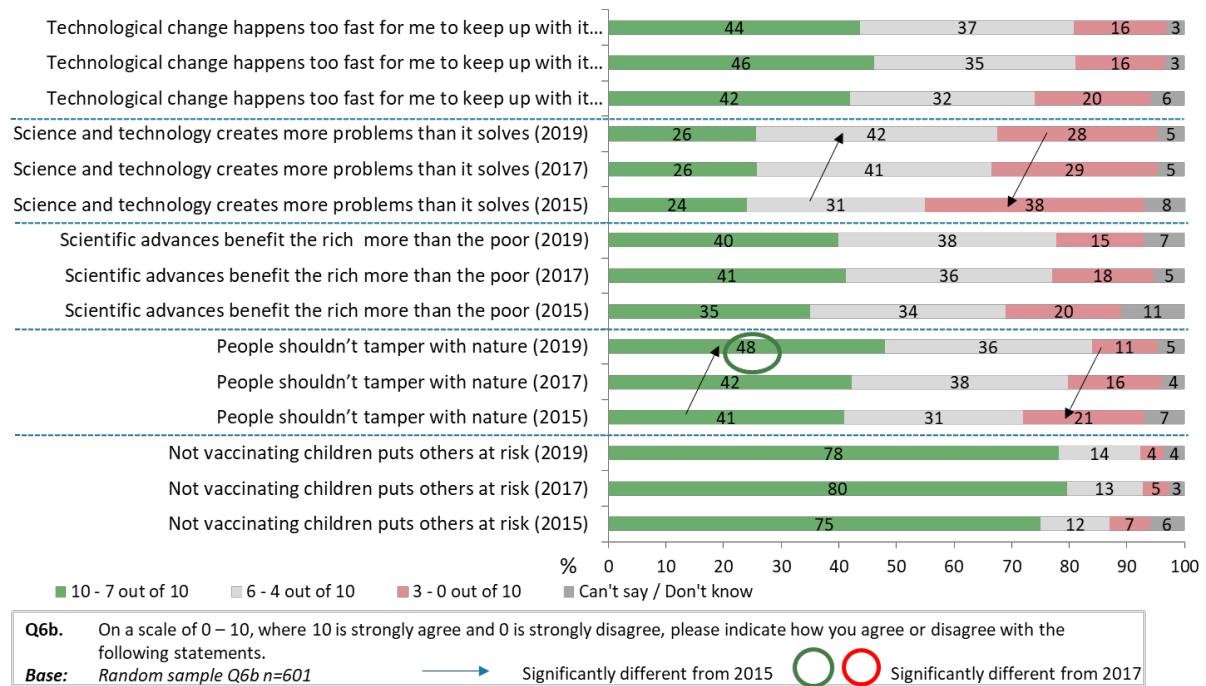


The same question was then asked to half of the respondents who had been asked question 6a earlier, to determine if engaging with issues relating to biotechnology had any impact on people's attitudes.

The results showed an increase in both positive attitudes and in negative attitudes across all the question asked, which implies that engaging in issues about biotechnology increases perceptions of positive attitudes and also of negative attitudes as well.

For example, random sample A also saw a drop in those who disagree that science creates more problems, benefits the rich and that we shouldn't tamper with nature, while random sample B saw a rise in agreement we shouldn't tamper with nature.

Figure 8: Attitudes towards science and technology



Attitudes and beliefs

Confidence in food and the influence of GM on food consumption

To obtain more nuances from responses to support for different types of GM foods, it is useful to compare attitudes to different applications and also to other food concerns.

While previous studies have benchmarked GM food concerns as similar with concerns about the use of pesticides and preservatives in food, 2017 saw several GM applications receive higher levels of support than for food produced with pesticides and preservatives.

This is noteworthy for there is data showing how people's concern about buying foods containing preservatives and pesticides is not reflected in actual shopping data (with people actually buying foods with preservatives and pesticides used at a higher rate than they say they would prefer to purchase them).

If this were extended to concerns about GM foods, there is also a strong possibility that stated preferences will be a poor indicator of actual consumer behaviour.

The following tables show the percentage of people willing to consume different food types and the percentage of those not willing.

Table 5: Ranking of willingness to eat GM foods compared with those produced using pesticides and preservatives

Processed foods such as cakes and biscuits that contain only a small amount of GM ingredients	33%
Processed foods such as bread and soymilk that has been made from GM crops	33%
Meat and other products from animals that have been fed GM stock feed	32%
Genetically modified fruit and vegetables	31%
Food containing preservatives	30%
Products from GM animals	28%
Food grown with the use of pesticides	26%

Table 6: Ranking of lack of willingness to eat GM foods compared with those produced using pesticides and preservatives

Products from GM animals	29%
Genetically modified fruit and vegetables	29%
Food containing preservatives	28%
Food grown with the use of pesticides	25%
Meat and other products from animals that have been fed GM stock feed	24%
Processed foods such as bread and soymilk that has been made from GM crops	24%
Processed foods such as cakes and biscuits that contain only a small amount of GM ingredients	24%

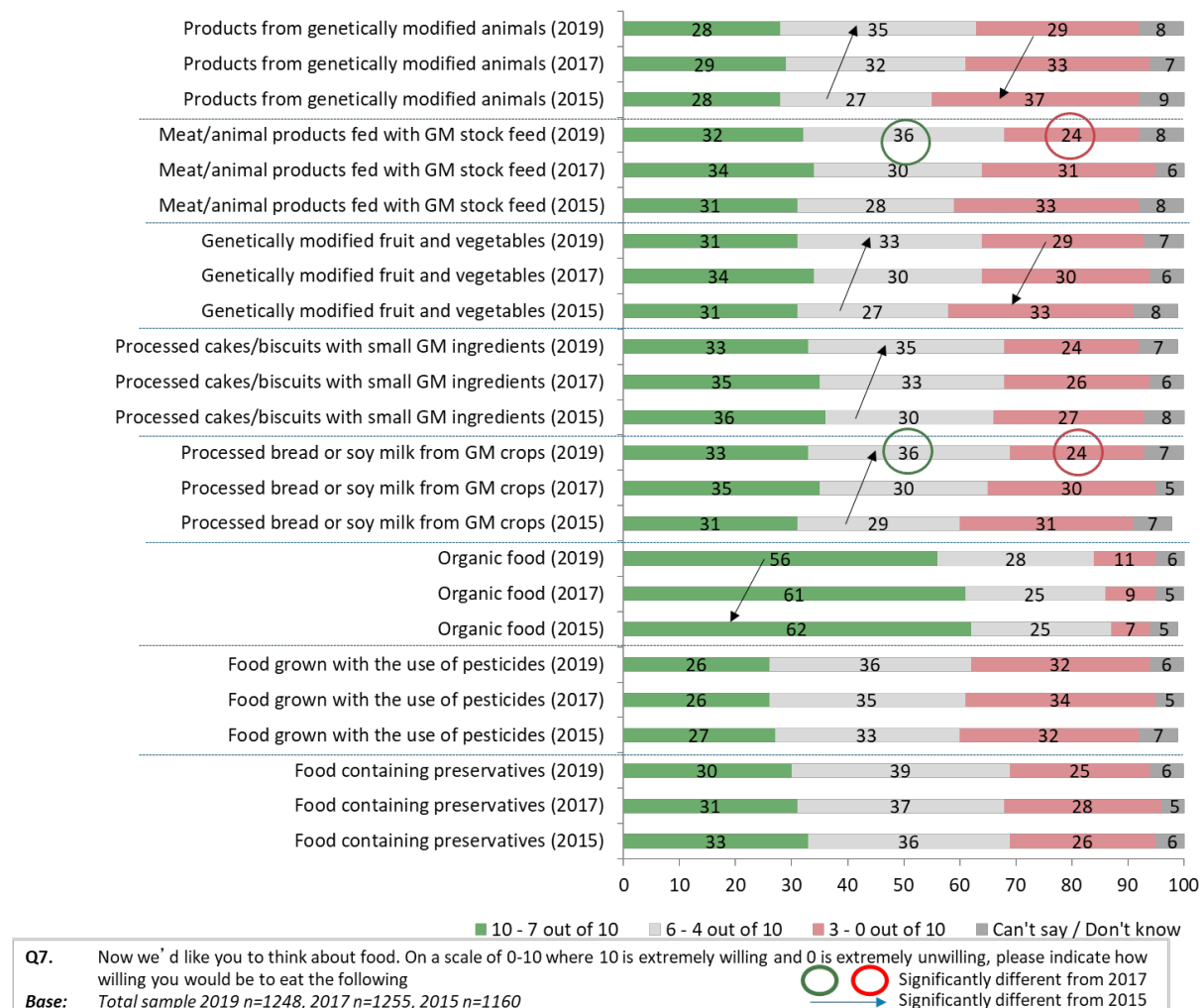
The data shows that people are more willing to eat all the varieties of GM foods listed, than to eat foods produced with pesticides or preservatives, with the exception of food products from GM animals (which sat between pesticides and preservatives).

Looking at the lack of willingness to consume products from various food technologies gave a different spread of attitudes, with the greatest concern (or highest percentage of respondents not willing to consume) being for products from GM fruits and vegetables and products from GM animals. Concerns over the uses of pesticides and preservatives followed.

These findings are showed with changes from 2015, 2017 and 2019, including preferences for eating organic food in Figure 9 on the next page.

Support for eating meat from animals fed with GM stock feed and processed bread or soy milk from GM crops has shifted with a decline in those strongly opposed and an increase in those in the middle box (from 30% to 36% for meat/animal products and from 29% to 36% for bread/soy milk). Meanwhile, strong support for eating organic food dropped from 62% in 2015 to 56% in 2019.

Figure 9: Willingness to eat GM food



Looking at the spread of support by age showed some significant differences across the population. Generally speaking, there was an increased lack of support as people got older.

For most applications there was a much higher level of support amongst the youngest cohort (16-30 years old). For instance, while 27% of those aged 51-75 years supported processed foods containing small amounts of GM ingredients, 39% of those aged 16-30 supported this.

Figure 10: Willingness to eat GM food by age

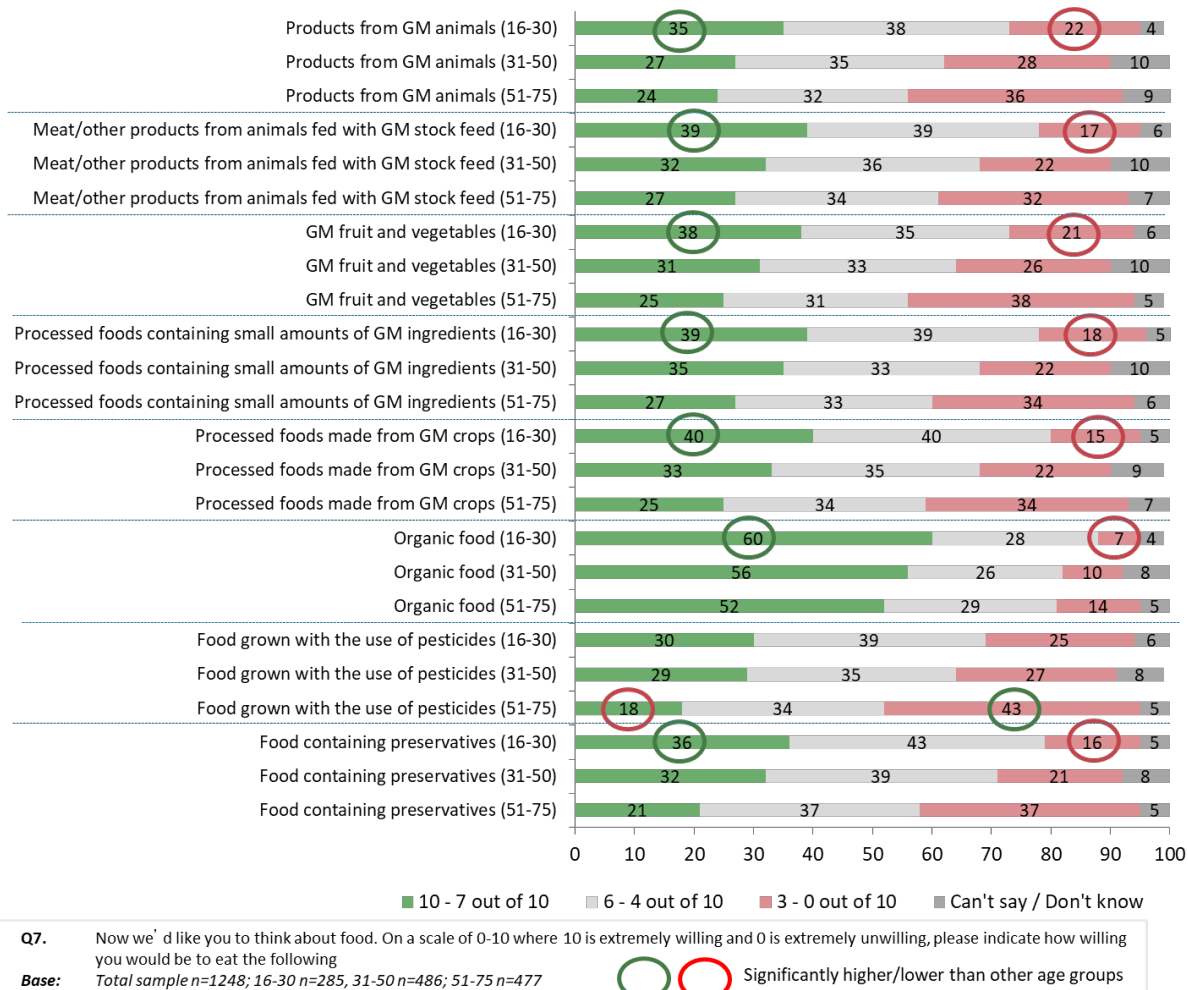


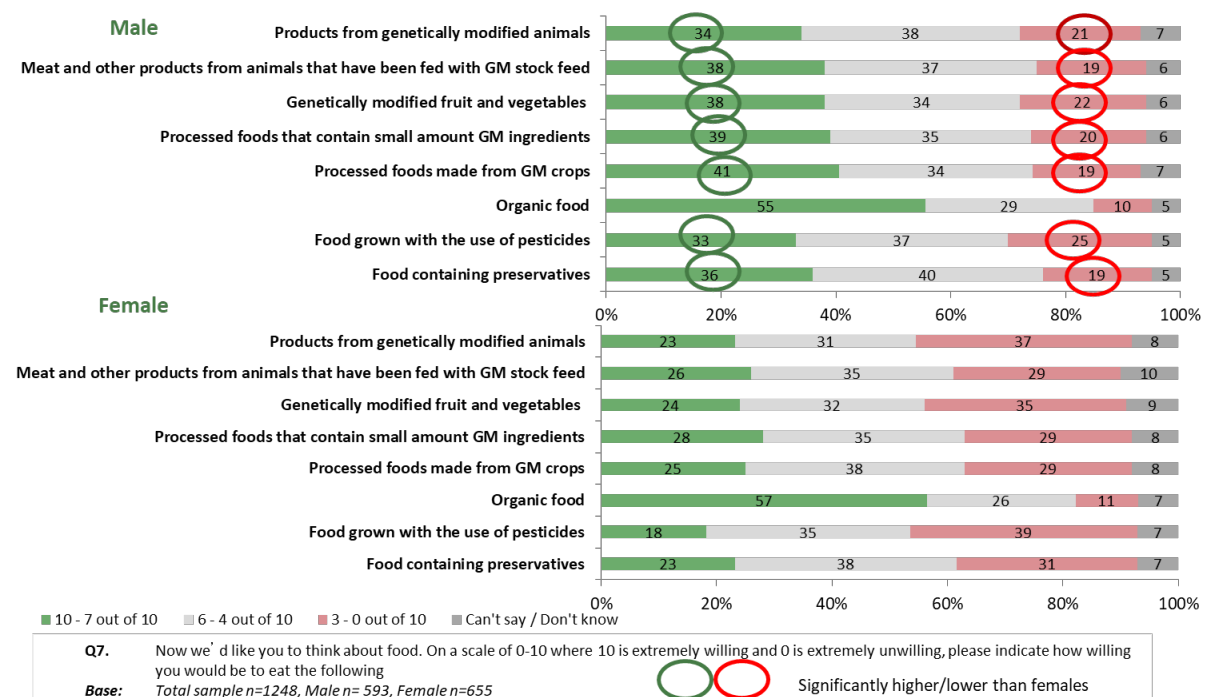
Table 7: Ranking of willingness to eat GM in foods between 2012, 2015, 2017 and 2019

	2012	2015	2017	2019
Processed foods such as cakes and biscuits that contain only a small amount of GM ingredients	33%	36%	35%	33%
Food containing preservatives	28%	33%	31%	30%
Meat and other products from animals that have been fed GM stock feed	39%	31%	34%	32%
Genetically modified fruit and vegetables	38%	31%	34%	31%
Processed foods such as bread and soymilk that has been made from GM crops	36%	31%	35%	33%
Products from GM animals	45%	28%	29%	28%
Food grown with the use of pesticides	38%	27%	26%	26%

Looking at the data by gender confirmed the general trend that males were more supportive of GM foods than females– except for both having similar willingness to eat organic food.

Women’s highest concern was for the use of pesticides in foods (39%) which also had the lowest levels of support at 18%. The next highest GM food concerns for women were for products from GM animals (37%), GM fruit and vegetables (35%) and food containing preservatives (31%).

Figure 11: Willingness to eat GM food by gender



However, looking at trends across the states and territories showed no significant differences, despite scores for confidence across different GM foods tend to be slightly higher for NSW and VIC than for QLD or SA. For instance, high level support in products with GM foods sits at 30% and 32% for NSW and VIC, but at 27% and 20% for QLD and SA. A general trend across the larger states was that there was a higher level of support for all GM applications than there was rejection of them. Looking further into the data, where the error rates increase across the smaller states, Tasmania and the ACT rated as the jurisdictions most supportive of GM foods across the diversity of applications tested.

Of note there was also no significant difference between capital and non-capital city ratings.

Figure 12: Willingness to eat products from GM animals and animals fed GM food - by state and territory

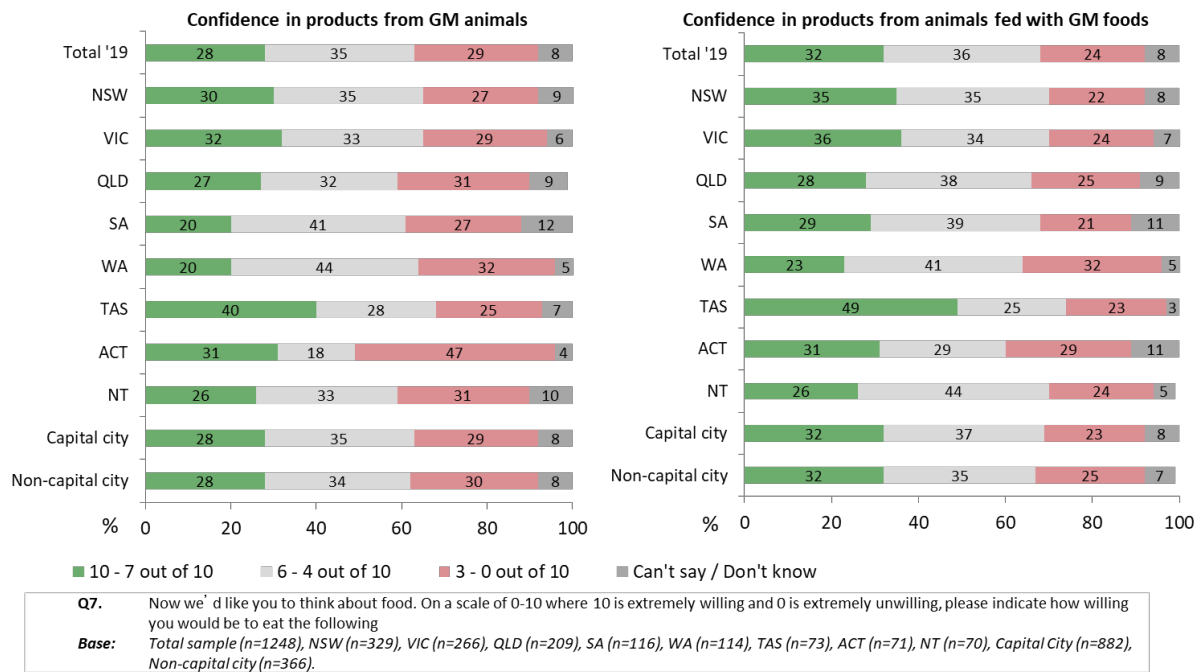
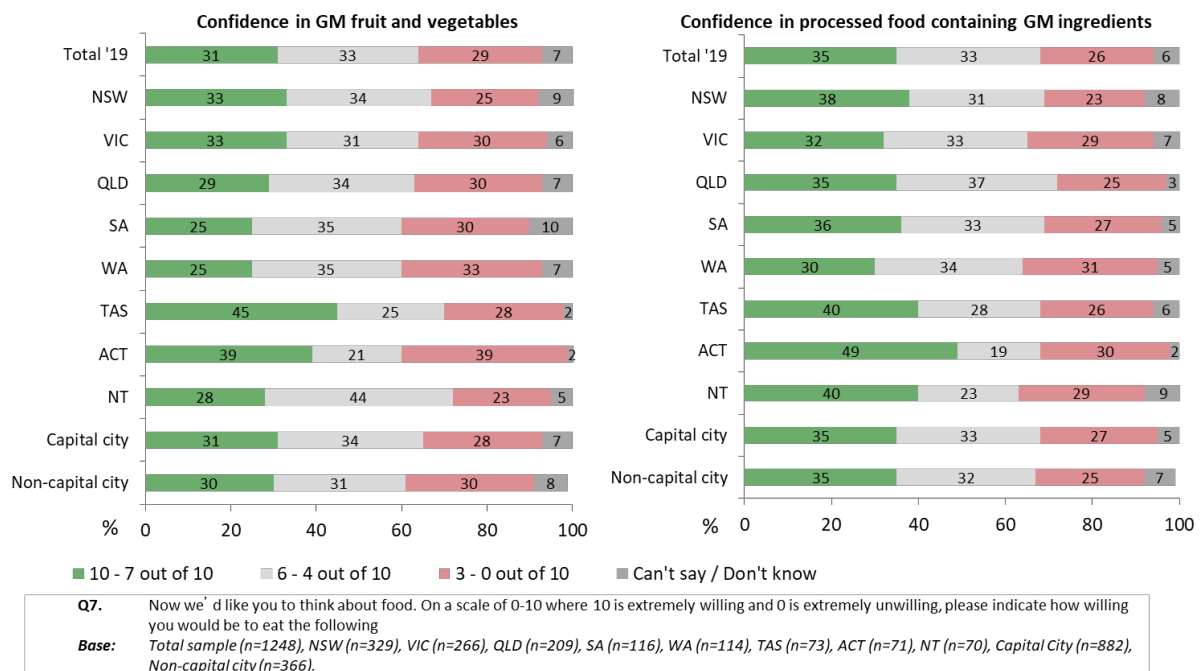


Figure 13: Confidence in GM foods - by state and territory



Willingness to consume organic foods was high across all states and territories, with the highest being Tasmania (77%), and all other states lying between a very narrow range of 54% and 59%.

Figure 14: Confidence in GM food and organic food - by state and territory

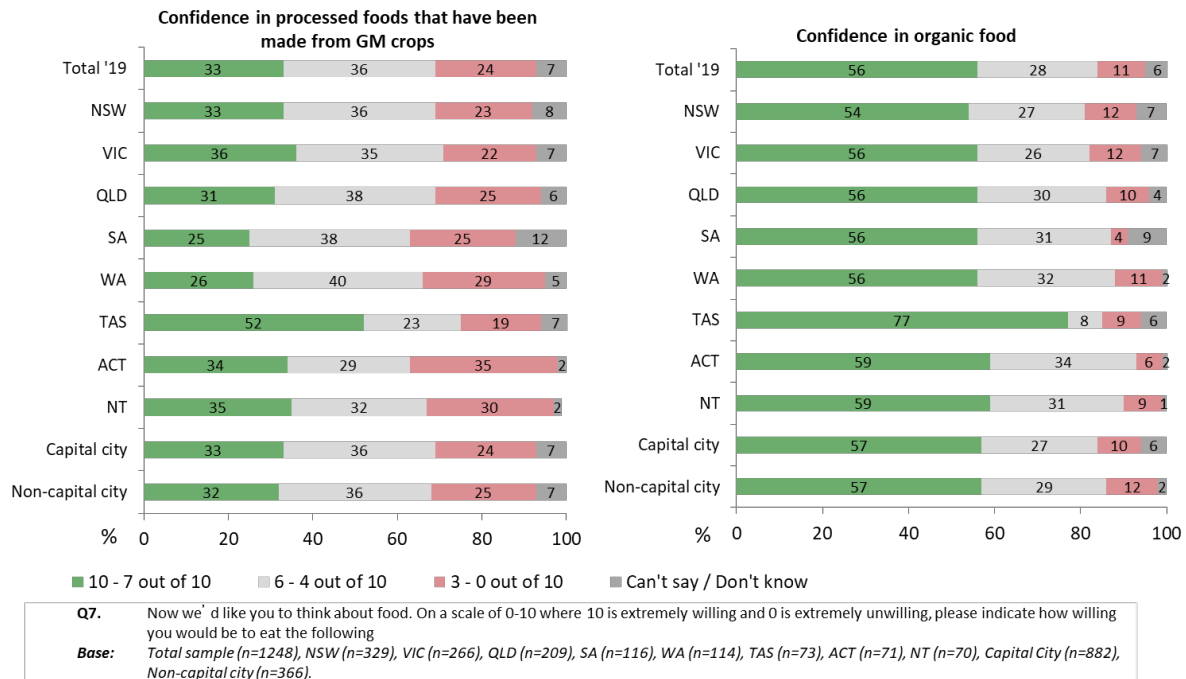
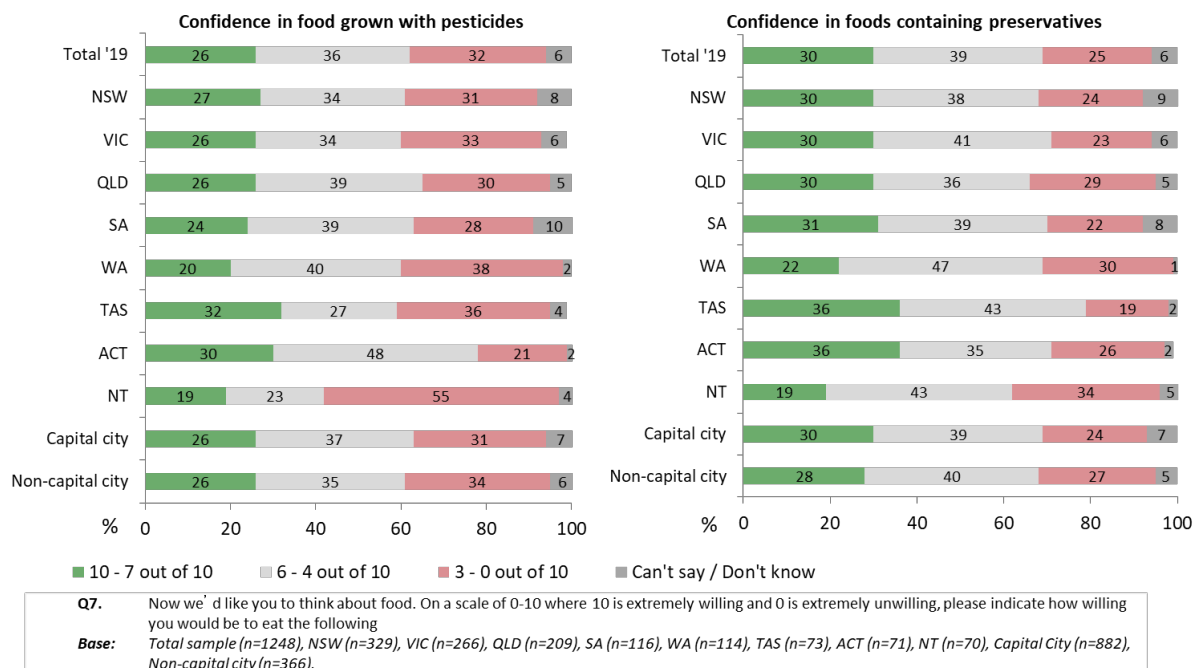


Figure 15: Confidence in food grown with pesticides and preservatives - by state and territory



Genetic modification in Australia

There was little overall movement in beliefs about what foods were genetically modified in Australia from 2015. The only significant changes were for belief that most of the cotton grown in Australia was genetically modified, dropping from 35% who believed it was True, to 30% who believed it was True, and believing the processed foods in supermarkets is genetically modified down from 36% in 2017 to 32% in 2019.

In general, knowledge about GM foods was poor, with *Don't Know* always being close to 50% of responses, and respondents often getting the statements wrong. For instance, 29% believed the statement that most of the vegetable oils produced in Australia are made from genetically modified crops was True, while 24% believed it was false. And 32% believed most of the processed foods in Australian supermarkets contain genetically modified ingredients, while 26% believed it was false.

Conversely, only 23% of respondents believed that most of the fresh fruits and vegetables grown in Australia are genetically modified, while 38% correctly believed this was false, and 30% correctly stated that most of the cotton grown in Australia is genetically modified, compared to 18% who believed this was false.

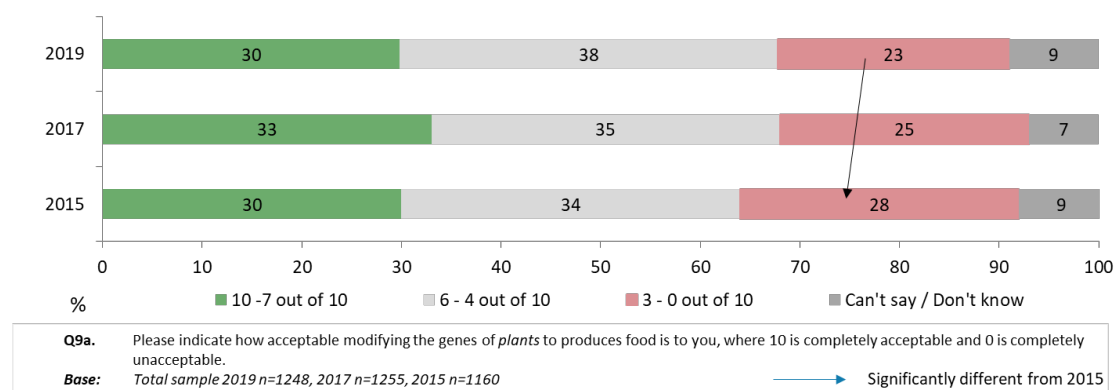
Figure 16: Attitudes towards genetic modification in Australia



Modifying genes of plants to produce food

Interestingly, given that many people incorrectly believed that much of their foods were genetically modified (as shown in the section above), the community was relatively evenly split on how acceptable this was to them. Almost a third indicated that it was acceptable, another third was less sure and were hedging their bets and a quarter clearly believed it was not acceptable. However, 9% indicated *don't know*. However, over time the trend is that those opposed to modifying the genes of plants to produce food is diminishing (28% opposed in 2015 to 23% opposed in 2019).

Figure 17: How acceptable it is to modify the genes of plants to produce food



GM in food production

As has repeatedly been shown in previous studies, people can have quite different attitudes towards different applications of GM or different modifications. Women were less likely to accept any or to indicate don't know/can't, while men were much more likely to indicate acceptance and those in the 51-75 age group were less likely to accept the technology compared to those in the 16- 30 age group.

Figure 18: Attitudes to GM in food production

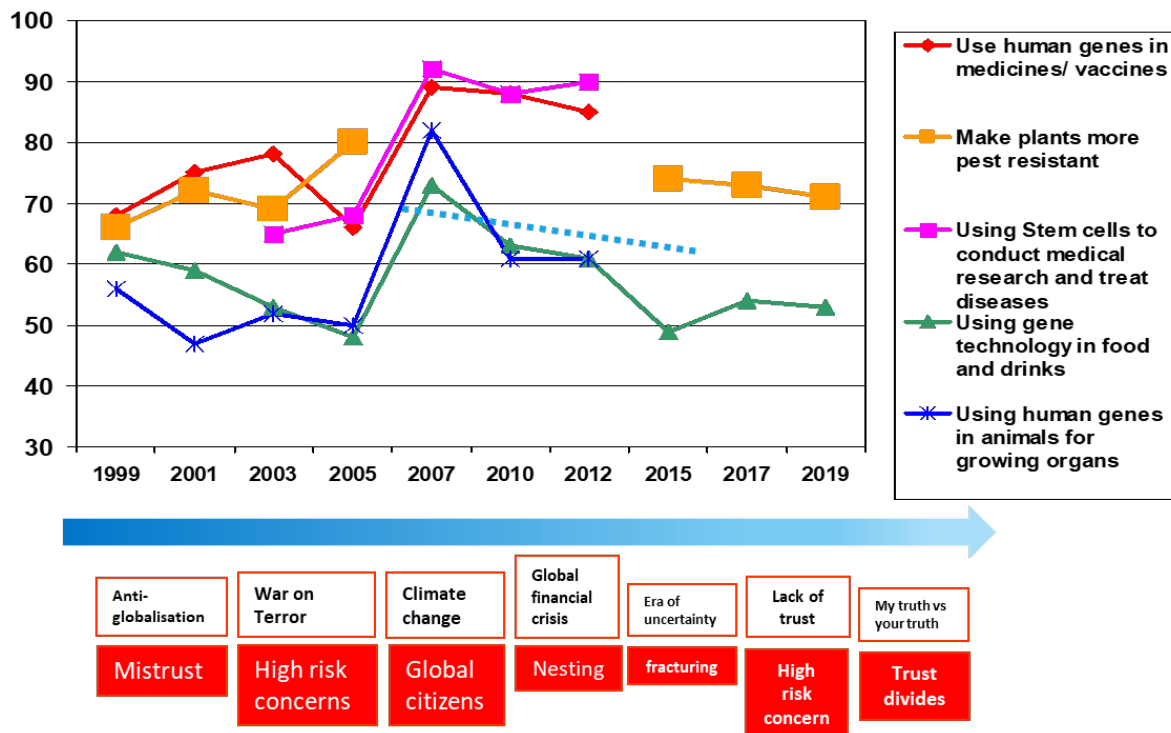


As the data from this study shows, there is more support for modifications that are perceived to be less radical or extreme. So the highest levels of support were for *Introducing the genes of a plant of the same species* (40%) and *Making small changes to the existing genes within a plant, as is done in gene editing* (36%) – though it should be noted there was quite a drop from the 2017 figure of 42%.

Support for introducing the genes of a bacterium or an animal stayed low at 24%, though interestingly however, fewer people found the idea of introducing the genes of a bacterium as unacceptable (21%) than found the idea of introducing the genes of an animal (29%). The only single application where support was lower than opposition to it was *Introducing the genes of an animal* (22% support and 29% opposing), for all other applications, support was higher than opposition, with the largest different being for *Making a small change to an existing gene within a plant as is done in gene editing*, 36% support and 15% opposing it.

This high *don't know* response to these questions, ranging up to 20% indicated a significant number of respondents didn't feel they knew enough to answer the question well.

Figure 19: Historic changes in attitudes towards different types of genetic modification



Q. From historic tracking: Do you support the following technology or not? Chart shows percentage of yes responses
Base: From sample averages around n=1000 for each year

Historic tracking of attitudes towards genetic modification shows that using genes to make plants more pest resistant has slightly declined in acceptance from the mid 70% supporting it, to the lower 70% supporting it, since 2015. The overall level of support appears to be in line with where it was back in 2003 (after it shot up in 2005!). However, the acceptance of the use of gene technology in food and drinks has risen slightly since 2015, and is also closer to 2003 levels, having dropped significantly since where it was in the 70% and 60% during the global financial crisis.

This report indicates a shift in the levels of concern about GMOs in Australia, specifically a gradual reduction over the years in those with strong concerns and an increase in respondents who are undecided and those who *don't know*. Although not directly comparable to other international data, the findings appear to align with the recently released Special Eurobarometer - April 2019 "Food safety in the EU" Report which found that genetically modified ingredients in food or drinks were a concern for only 27% of respondents compared to 66% in 2010. The 2019 survey also found that 60% were aware of genetically modified ingredients in food or drinks. (Kantar for the European Union, 2019).

Assessing the responses by age, the trend lines were similar to previous responses. Again, younger people were less concerned about different degrees of gene transfer – and the elder the age cohort

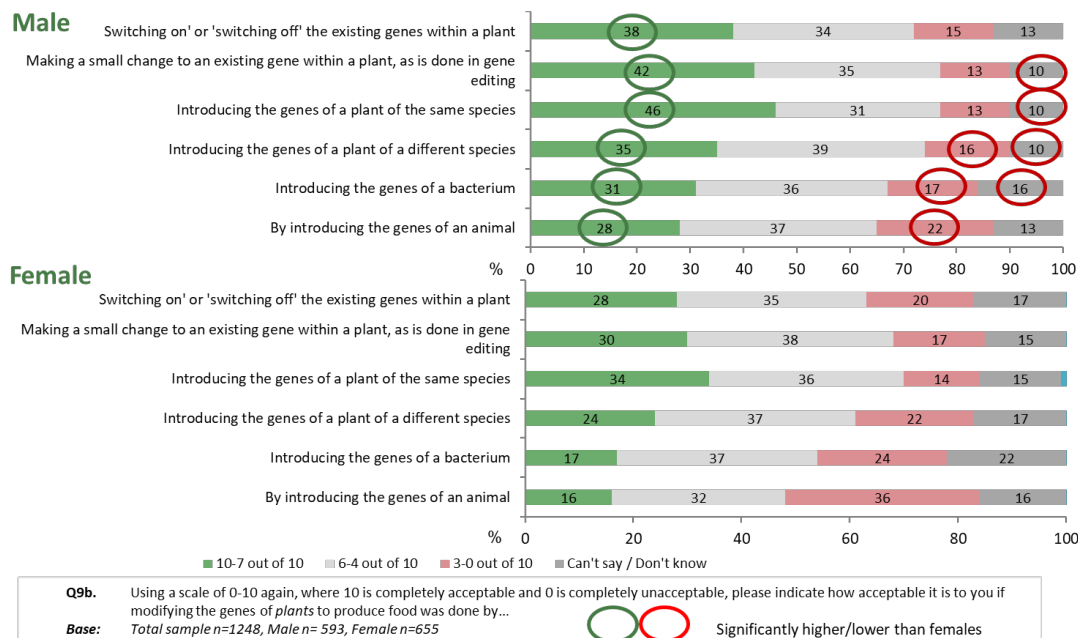
the more concerned they were about different types of modifications. Also, the older respondents got the more likely they were to respond with a *Don't Know* answer.

Figure 20: Attitudes to different types of modification by age



The following figure shows analysis of the responses by gender.

Figure 21: Attitudes to different types of modification by gender



It indicates that females were more concerned about different types of genetic modification. For example, 46% of males supported introducing the genes of the same species, while only 34% of females supported this. And while 36% of females did not support the introduction of genes from an animal, only 22% of males did not support it. Male support was not only higher than female support, but male opposition was lower than female opposition.

GM crops in your state or territory

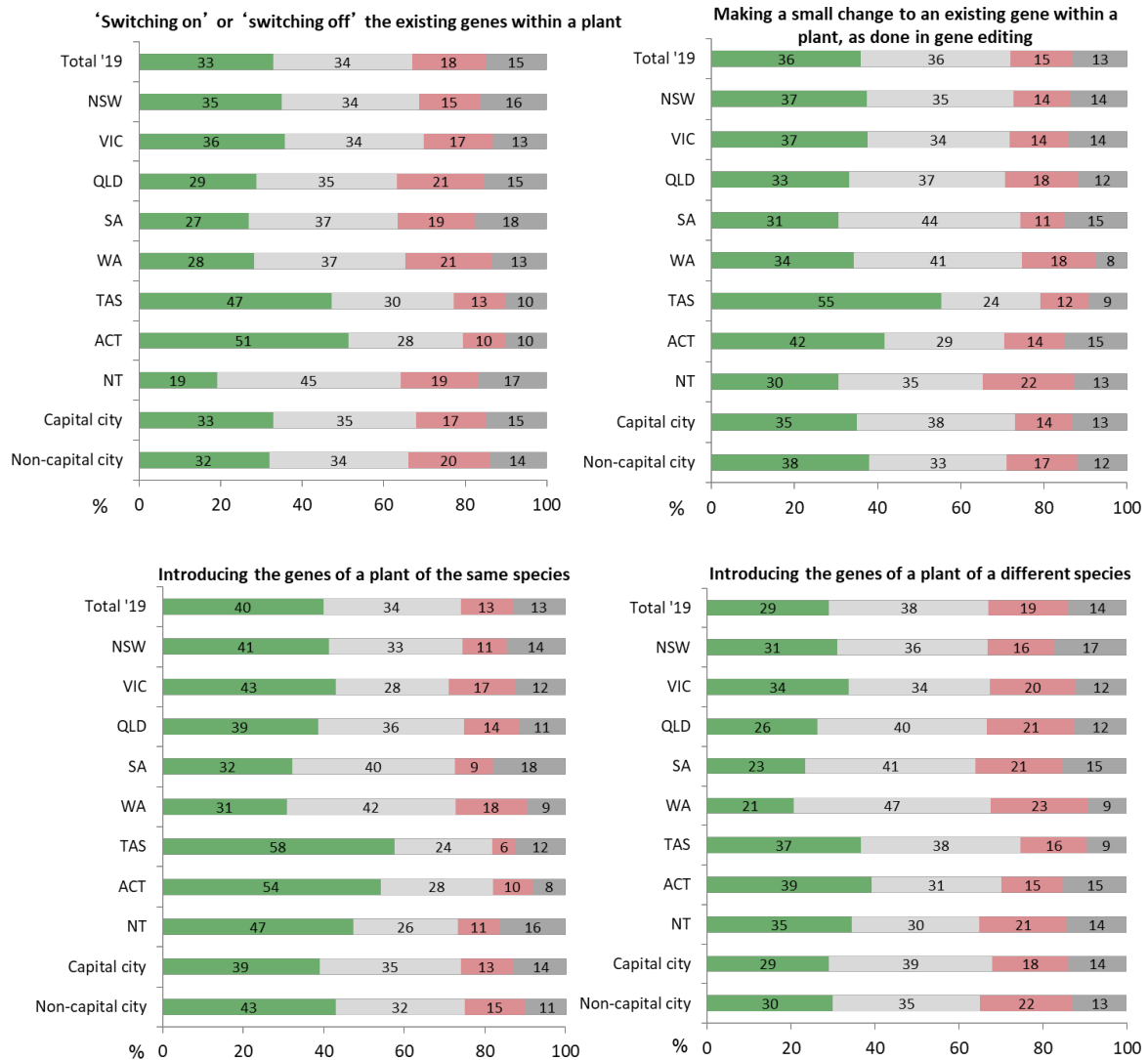
State-based responses to different types of gene technology showed a similar pattern as to different applications of gene technology in foods, with the larger states having fairly close responses and the smaller jurisdictions with the larger sampling error showing the most support (Tasmania and the ACT). Again, New South Wales and Victoria tended to have slightly higher levels of support, than Queensland, Western Australia or South Australia. However, there were overall few significant differences.

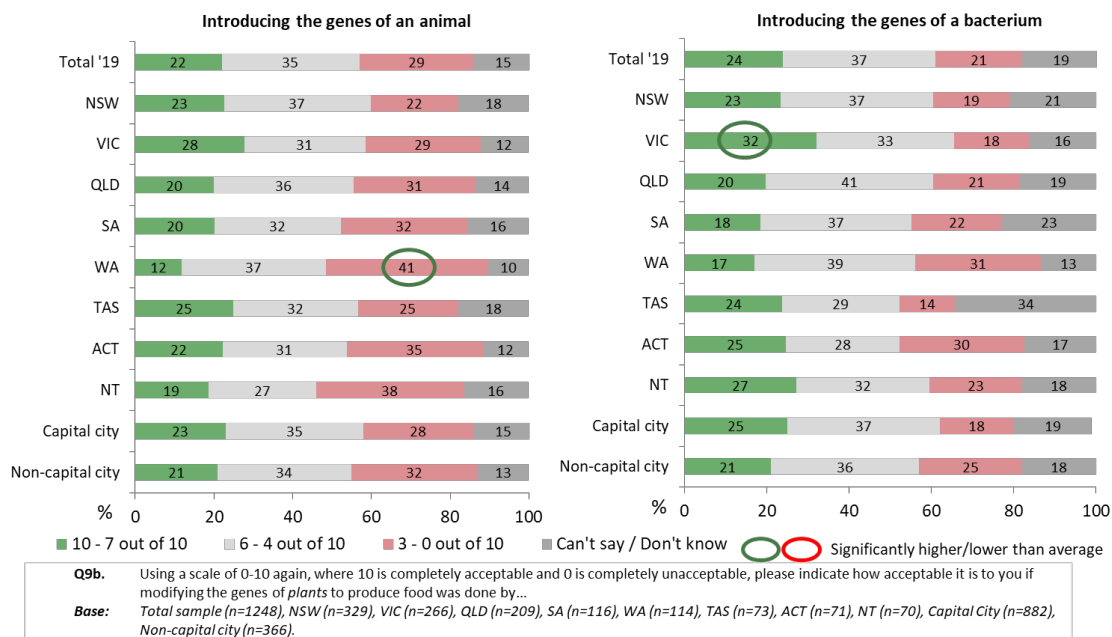
For instance, for switching on or switching off the genes within a plant the national average of 33% support and NSW and Victoria sat slightly above it at 35% and 36% respectively, and the other three major states sat just below it with Queensland on 29%, Western Australia on 28% and South Australia on 27%.

By comparison the ACT received 51% support and Tasmania received 47% support. The Northern Territory rated the lowest at 19% support.

Unlike previous years where there were no significant between capital cities and non-capital cities.

Figure 22: Attitudes to different types of modification by state/territory





Victorians were significantly more supportive of 'introducing the genes of a bacterium' than any other state, with a third (32%) finding this acceptable, whilst Western Australians were significantly more opposed to 'introducing the genes of an animal' than the national average (41% opposed versus 29% average).

Awareness of GM crops grown in states and territories

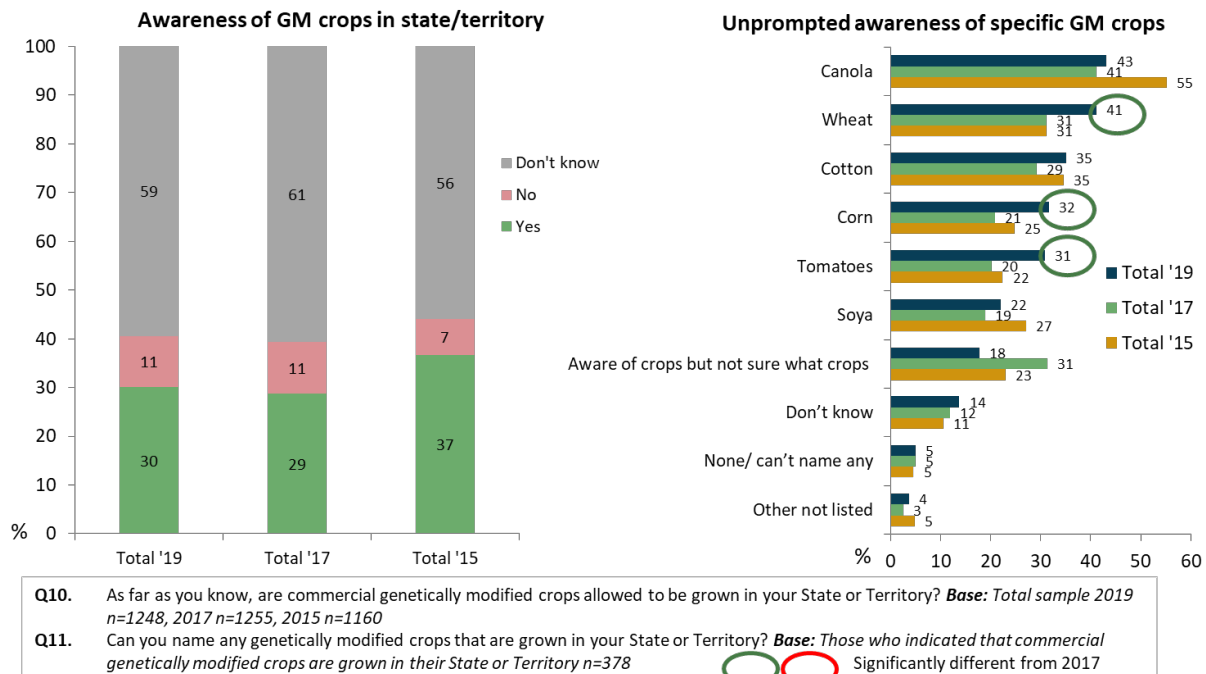
Awareness of whether GM crops were grown in a respondent's state/territory was generally not high, with an average of only 30% claiming to know. This is a similar figure to 2017 of 29%, which was a significant decline from 37% in 2015. This can best be explained by the general lack of media coverage of GM crops overall. The yes and no answers total 41% for the 2019 bar, 40% for 2017 and 44% in 2015 of Figure 23.

In addition to the decrease in those aware of commercial GM crops being grown in their state, there are significant numbers still stating incorrectly that GM wheat (41%), corn (32%) and tomatoes (31%) are being grown. These were significant increases over the 2017 figures (wheat 41% up from 31% in 2017, corn 32% up from 21% in 2017, and tomatoes 31% up from 20% in 2017).

Awareness of GM canola being grown (the most prevalent food crop which has traditionally received most of the media coverage) remains at a similar level to 2017, at 43%.

Overall this indicates that awareness of GM crops may be influenced by international and national media, as corn is widely grown as a GM crops overseas, but not grown commercially in Australia. This also shows that knowledge and awareness of GM issues can be shallow.

Figure 23: Awareness of GM crops being grown in respondents' states - by state/territory



State-based knowledge of whether GM crops were grown in respondents' states showed moderate to low accurate awareness, and very high *don't know* responses averaging 59%.

States have been boxed according to restrictions on growing, so QLD, NT and WA have no moratoria; NSW and VIC have moratoria but no active prohibitions; ACT has a moratorium in place (although no cotton or canola is grown); and TAS and SA have broad prohibitions in place.

Of interest, in those two states with broad prohibitions in place, South Australia and Tasmania, more people answer the question correctly in Tasmania than in South Australia. In Tasmania, 19% of respondents correctly answers No, while 13% incorrectly answered Yes, and in South Australia, 17% correctly answered No, while 26% incorrectly answered Yes.)

The high amount of 'don't know' responses, and the ability for respondents to get the answer as likely right as wrong indicates that many people might be making a best guess, based on a vague knowledge of GM crops being allowed or not allowed in their states or territories.

Figure 24: Awareness of GM crops grown in the state/territory - state/territory comparison

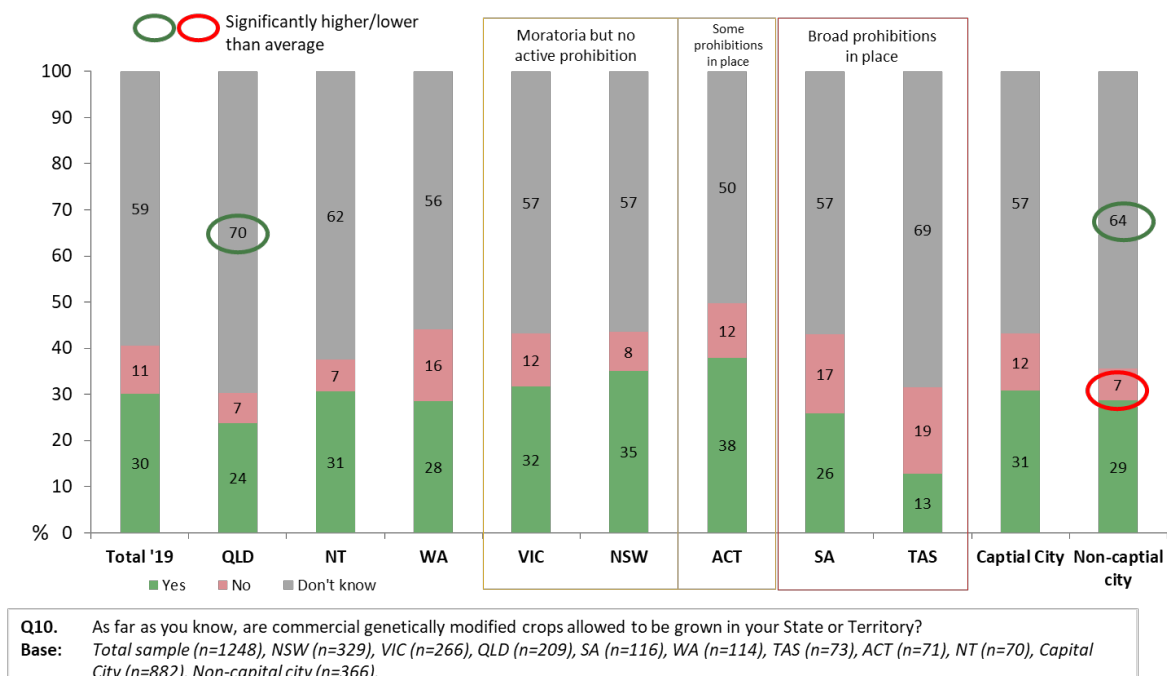
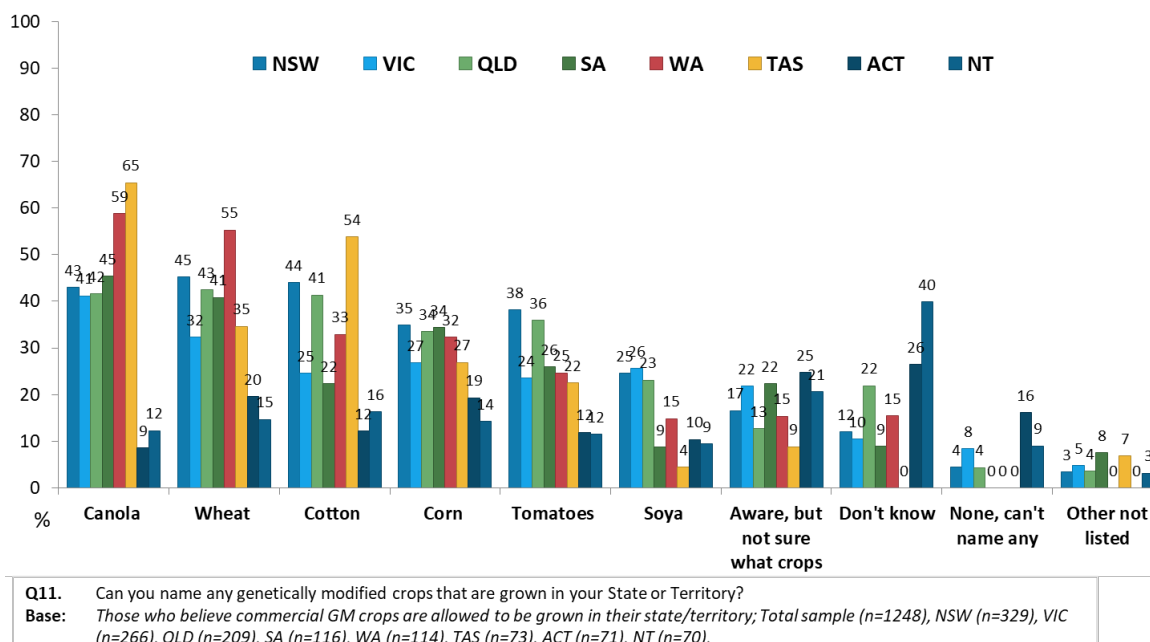


Figure 25: Awareness of specific GM crops grown in their state/territory



The stand-out figures for unprompted awareness were GM canola in Tasmania (65%) and GM Cotton in Tasmania (54%), even though both were incorrect in that GM canola and cotton, while growing in other states, is not grown in Tasmania. There has been a long-running clean-up of improperly

managed GM canola trials in Tasmania, and media attention to that may give Tasmanians the impression GM canola is grown there.

Western Australians had a generally high awareness of GM canola, being grown in their state (59%) but also a high incorrect stated awareness of GM wheat 55%. The higher incorrect awareness may be due to the removal of moratorium on GM in WA in recent years, with much media attention to it.

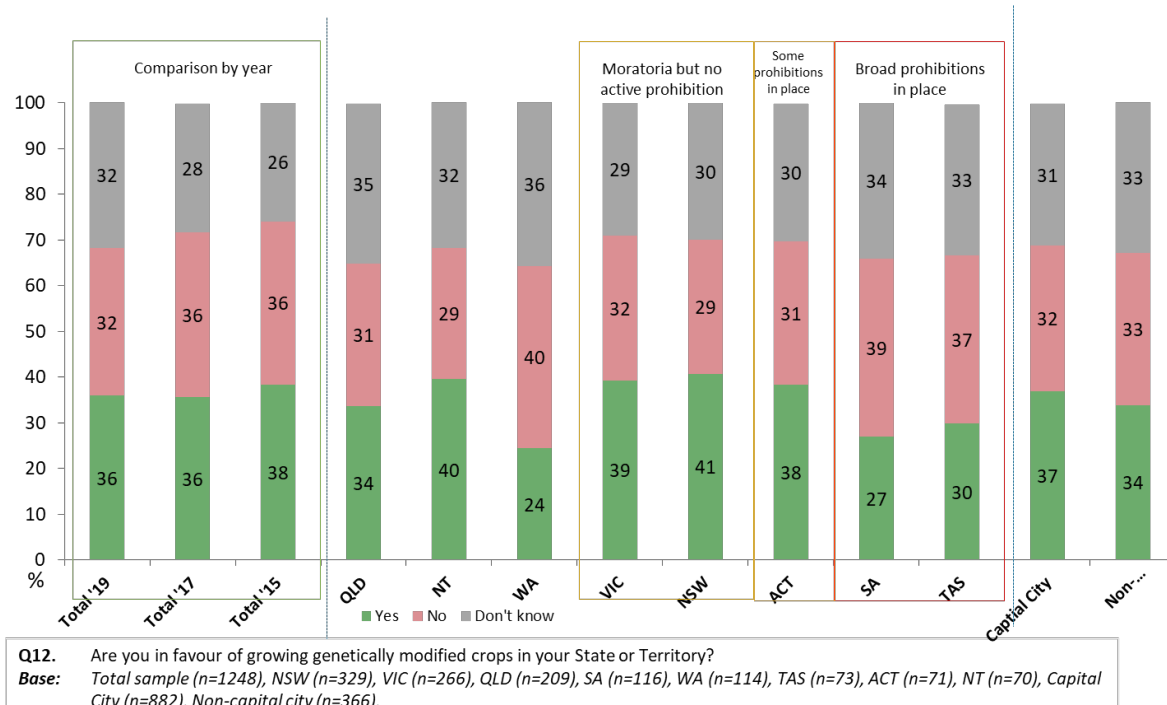
GM cotton was correctly stated by 44% of those from NSW and 41% of those from Queensland, but respondents from those two states also incorrectly named GM wheat, at a slightly higher level, with 45% from NSW and 43% from Queensland.

In general, the data indicates that knowledge of what crops are GM in general impacts beliefs as to whether that crop might be grown in a person's state or territory.

Support for growing GM crops in your state/territory

The support for growing GM crops overall was similar to previous years, with 36% in favour and 32% opposed, however we have seen a gradual significant increase in the proportion of 'don't know' responses from 26% in 2015 to 32% in 2019. The data also indicates a reduction in those who are opposed to growing GM crops, from 36% in 2017 to 32% in 2019. The highest support was in New South Wales, with 41% in favour of growing GM crops and the lower number against – 29%. This was comparable to the Northern Territory, at 40% in favour and 29% not in favour – but again it needs to be pointed out that the smaller jurisdictions are likely to have larger error rates due to the smaller proportional sample sizes used. The other states where more respondents were in favour than were against included Queensland (34% to 31%), Victoria (39% to 32%), ACT (38% to 31%). And those states where more people opposed growing GM crops in their state or territory than favoured it were Western Australia 24% in favour and 40% opposing), South Australia (27% in favour and 39% opposing) and Tasmania (30% in favour and 37% opposing).

Figure 26: In favour of growing GM crops in their state/territory - comparison by state/territory



While support for growing GM crops in a person's own state or territory has dropped over the last five years, going from 53% in 2012 to 38% in 2015 to 36% in 2017 and 2019, there is still a considerable number of people who are undecided with the *Don't know* response at 32%.

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.*

The key factors that would influence acceptance were:

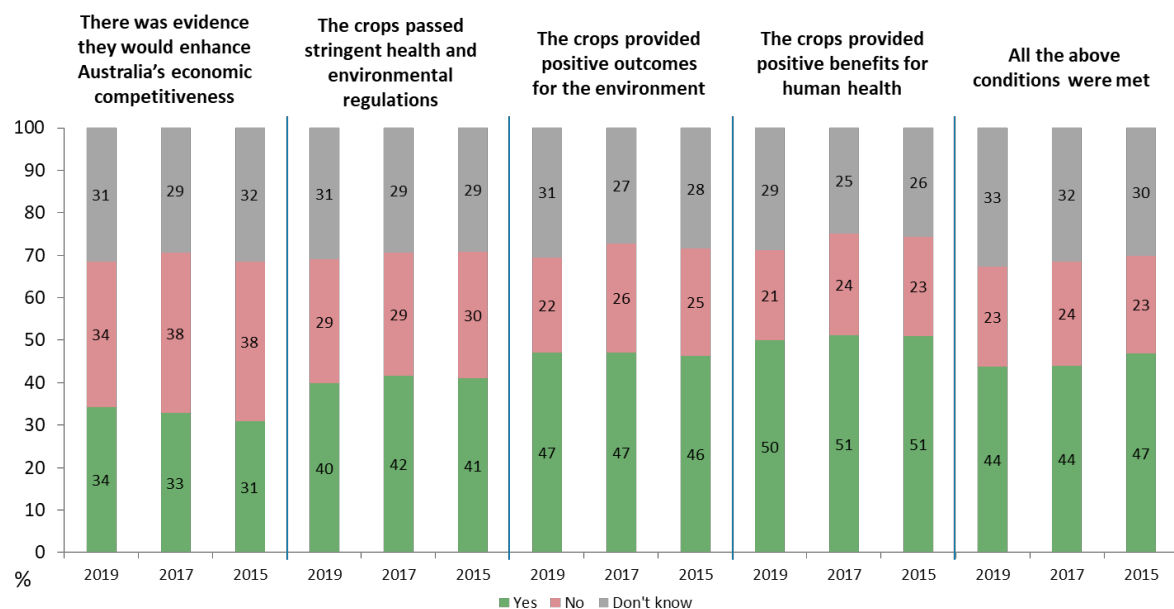
- if crops provided positive benefits for human health (50% of those opposed would change their position)
- if they passed stringent health regulations (40% would change their position)
- if they enhanced economic competitiveness (34% would change their position)
- if they provided positive outcomes for the environment (47% stated they would change their position).

If all the conditions were met, 44% would change their position—an interesting finding since it is lower than all of the responses except for improving economic competitiveness and if crops passed stringent regulations.

Of note is that people were not necessarily responding based on whether such regulations referred to did actually exist, but whether they had an understanding of, or perception of them existing. In the realms of public attitudes, perceptions become realities.

The data indicates that factors that would influence acceptance of GM crops in general do not necessarily translate into significant support among people for growing GM crops in their own state or territory.

Figure 27: Whether those opposed would be in favour if they knew the following existed



Q13. Would you be in favour of growing genetically modified crops in your State or Territory if...?
Base: Those who are not in favour of genetically modified crops growing in their State or Territory (n=421).

Public opinion on using GM technology to produce food

Using a series of attitudinal statements, respondents were placed in one of four categories.

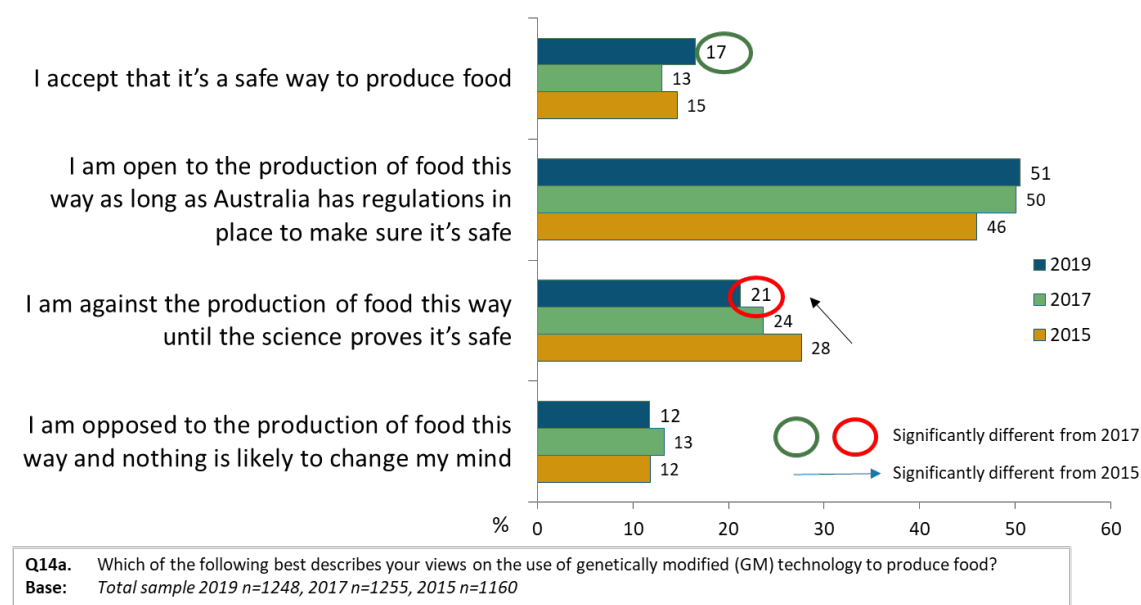
Half of the respondents (51%) agreed with the statement that they were open to the production of food this way as long as the regulations were in place to make sure it was safe, 17% accepted that it was a safe way to produce food, and 12% were also opposed to the production of food this way and nothing was likely to change their mind. The remaining 21% stated that they were against the production of food this way until the science proved it was safe.

These results show no significant change among those most opposed to using GM technology to produce food, but there was an increase in those most accepting of it being a safe way to produce food, rising to 17% from 13%.

There was also a continued drop in the number of people who were against the production of GM food until the science proved it was safe (28% in 2015, 24% in 2017, 21% in 2019).

Together about 70% of the population have conditional support for GM foods.

Figure 28: Attitudinal category in using GM technology to produce food



Reasons for being in favour of or against gene technology

Qualitative answers

When probed to respond why they were in favour of GM technologies to produce foods, those who accepted that GM technologies were a safe way to produce food (185 respondents) responded with a variety of statements including:

- *"I believe there is always better way of doing things. If it can produce better food, healthier, in good volume and can grow in hard condition to help the agricultural industry, then why not?"*
- *"Because it is well regulated by the government and can improve food production and quality. Government(s) is usually very responsible and safe in Australia thus it is unlikely that there is a lot of risk."*
- *"With the constant drought plants have to be modified to grow in these conditions, grow quicker, produce more and be insect tolerant."*

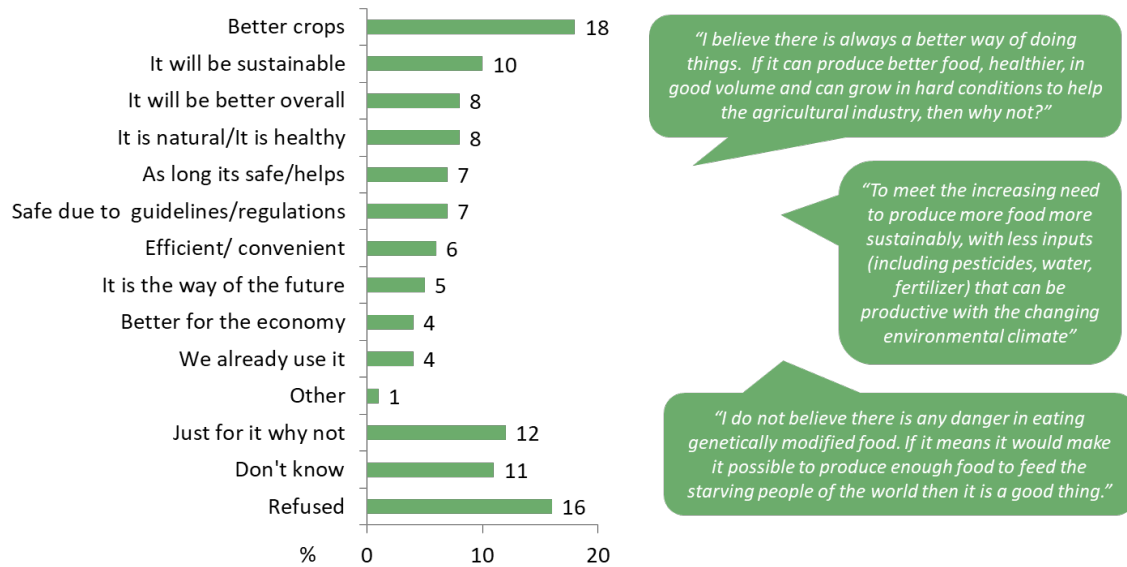
- *"I do not believe there is any danger in eating genetically modified food. If it means it would make it possible to produce enough food to feed the starving people of the world then it is a good thing."*
- *"To meet the increasing need to produce more food more sustainably, with less inputs (including pesticides, water, fertilizer) that can be productive with the changing environmental climate."*

And those who were most opposed to the use of GM technologies to produce food (143 respondents) stated that the reasons they were opposed to the production of food this way and nothing was likely to change their mind, included:

- *"Natural things shouldn't be modified. This will cause catastrophe in years to come with the modifications causing unknown adverse effects on the whole biological system. Humans are already showing symptoms and diseases from the existence of many GM foods and unnatural processed foods..."*
- *"Genetic modification is unnecessary, we don't always know the consequences if a genetic modification gets into the general population of a species, and most of the time genetic modification is about exploitation and profit rather than increasing production."*
- *"The long-term effects on human health and the environment is not known. Most studies are done by the industry and therefore can't be trusted. Studies typically involve testing on animals, which is neither ethical nor 100% transferable to humans. It is possible to feed the world without GMOs."*
- *"There are so many independent scientific studies that show they produce harmful effects on the animals that eat this food and, on the crops, grown this way. There is no evidence to suggest otherwise, except from Monsanto and their subsidiaries, Bayer etc."*

Among the most common reasons people gave for being in favour of GM foods included 'better crops' (18%), 'I am just for it, not sure why' (12%) and 'sustainability' (10%).

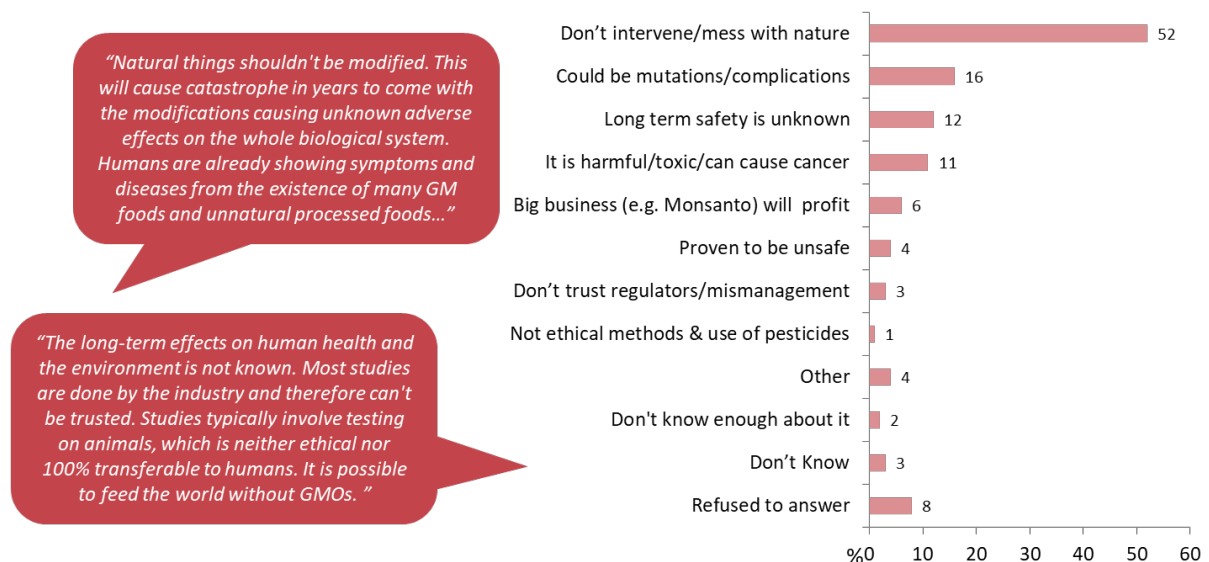
Figure 29: Why people are in favour of GM foods



Q14b. Why are you in favour of genetically modified (GM) technologies to produce food? **Base:** Those in favour n=206

At least half of those who were most opposed to using GM technologies to produce food mention 'not intervening with nature' (52%), while concerns include mutation/complication (16%), long term safety being unknown (12%) and the fact that it could be harmful/toxic/cause cancer (11%).

Figure 30: Why people are opposed to GM foods



Q14e. Why are you opposed to the use of genetically modified (GM) technologies to produce food? **Base:** Those opposed n=147

The value placed on the different objectives for GM plants for food

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

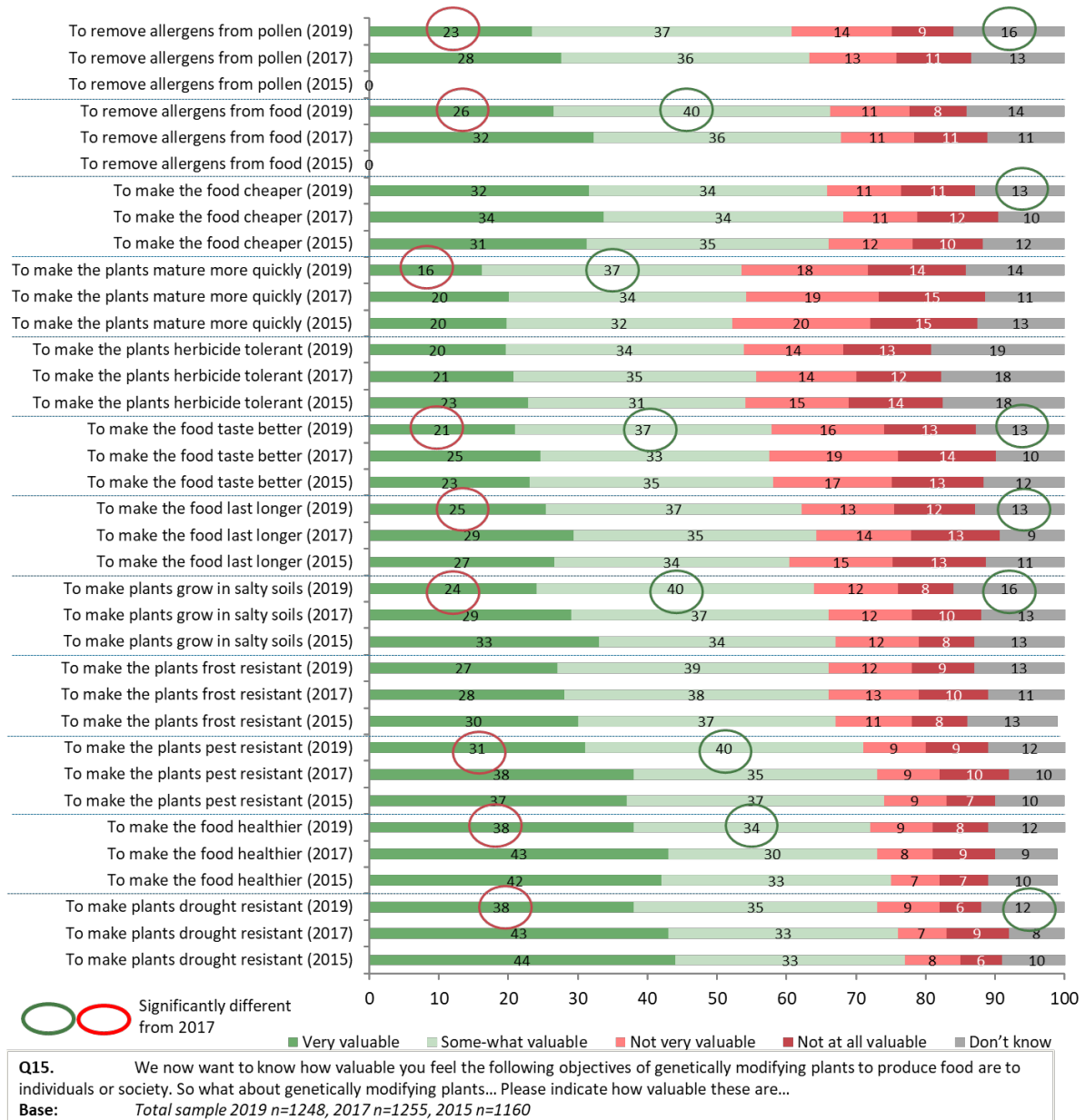
There was an overall drop in the values that people placed on the different objectives of genetically modifying plants and foods for particular outcomes. Those seen as very valuable were: drought resistance (38%); healthier (38%); pest-resistance (31%); frost resistance (27%); ability to grow in salty soils (24%); to make the food cheaper (32%); to make the food last longer (25%); to make the food taste better (21%); to make the plants herbicide tolerant (20%); and to make the plants mature more quickly (16%). While all of these responses represented a slight diminution of those who saw the attributes as very valuable, there was not a general corresponding increase in attitudes that these attributed were not valuable. Rather there was a general increase in the 'don't know' responses, and a slipping of values from very valuable to somewhat valuable. For instance, making plants healthier slipped from 43% seeing it as very valuable in 2017 to 38% in 2019, while those who felt it was somewhat valuable rose from 30% to 33%. The combined responses for not valuable and not at all valuable remained at 17% and those who did not know rose from 9% in 2017 to 12% in 2019.

Overall support for the objectives cited was very strong, with combined scores over 50% for the least supported outcome (53% valuable for making plants mature more quickly) and other rating well over 70%.

Drought resistance 73%, healthier 72%, pest resistant 71%. Lower value ratings, but still high overall were for making foods last longer 67%, making plants frost resistant 66%, removing allergens from food 66%, making food cheaper 66%, enabling plants to grow in salty soils 64%, removing allergens from pollen 60%, making food taste better 58%, making plants herbicide tolerant 54%, and making plants mature more quickly 53%.

These are important findings to compare with research and development outcomes from GM plants as they can indicate which plants are most likely to align with consumer needs or preferences, and which traits will not well meet those needs.

Figure 31: Attitudes to GM traits in plants



Combining the total value ratings of the GM traits gave the following rankings.

Table 8: Whether the objectives of genetically modifying plants to produce food is valuable

Objective	2015	2017	2019
To make plants drought resistant	77%	76%	73%
To make foods healthier	75%	73%	72%
To make plants pest resistant	74%	73%	71%
To make plants that can grow in salty soil	67%	66%	64%
To make foods cheaper	66%	68%	66%
To make foods last longer	61%	64%	62%
To make foods taste better	58%	58%	58%
To make plants herbicide tolerant	54%	56%	54%
To make plants mature more quickly	52%	54%	53%

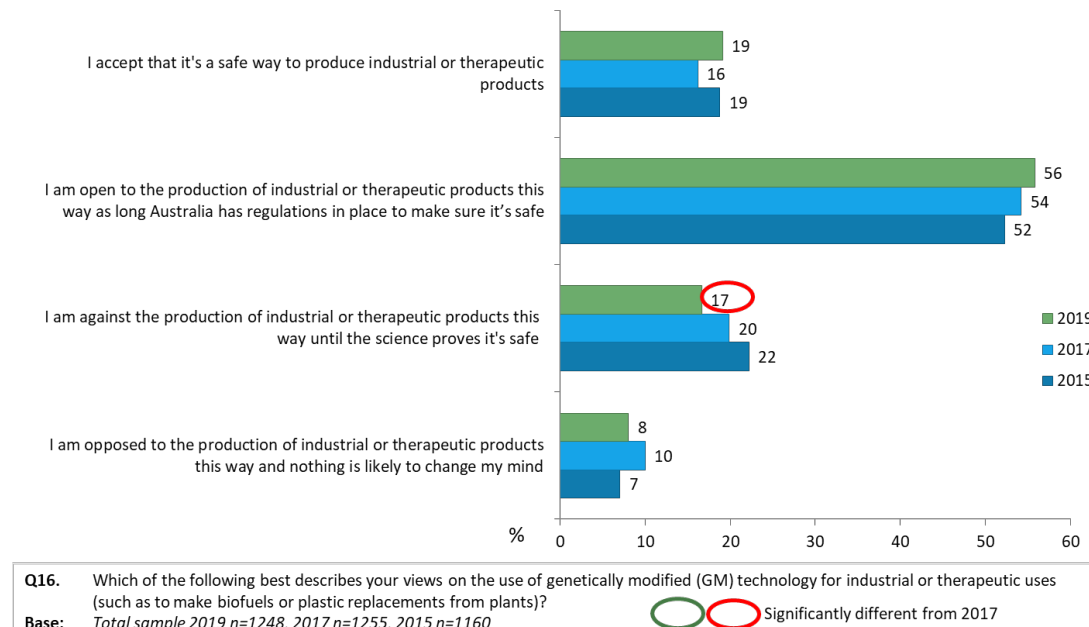
Attitudes to GM for industrial or therapeutic uses

Respondents were also asked about their attitudes to using GM for industrial or therapeutic purposes with examples cited as being to make biofuels or plastic replacements. Respondents were again placed in one of four categories, similar to those for GM foods: strongly for, as long as regulations make sure it's safe, not until science proves its safe, strongly against.

The results were a similar spread to those of food, but there were some significant differences in both the spread of attitudes and the changes over time. Firstly, three of the segments had near identical sizes, 17% or 19%, while those who wanted regulations in place to make sure it was safe was larger than the other three segments put together at 56%.

There has been a steady decline in those against the production of industry industrial or therapeutic products this way until the science proves its safe (22% in 2015, 20% in 2017 and 17% in 2019).

Figure 32: Attitudes to genetic modification for industrial or therapeutic uses



These findings are quite interesting, as there is generally a perception of higher support for non-food applications, and yet the results here are very close to the GM food findings.

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.

Information and trust

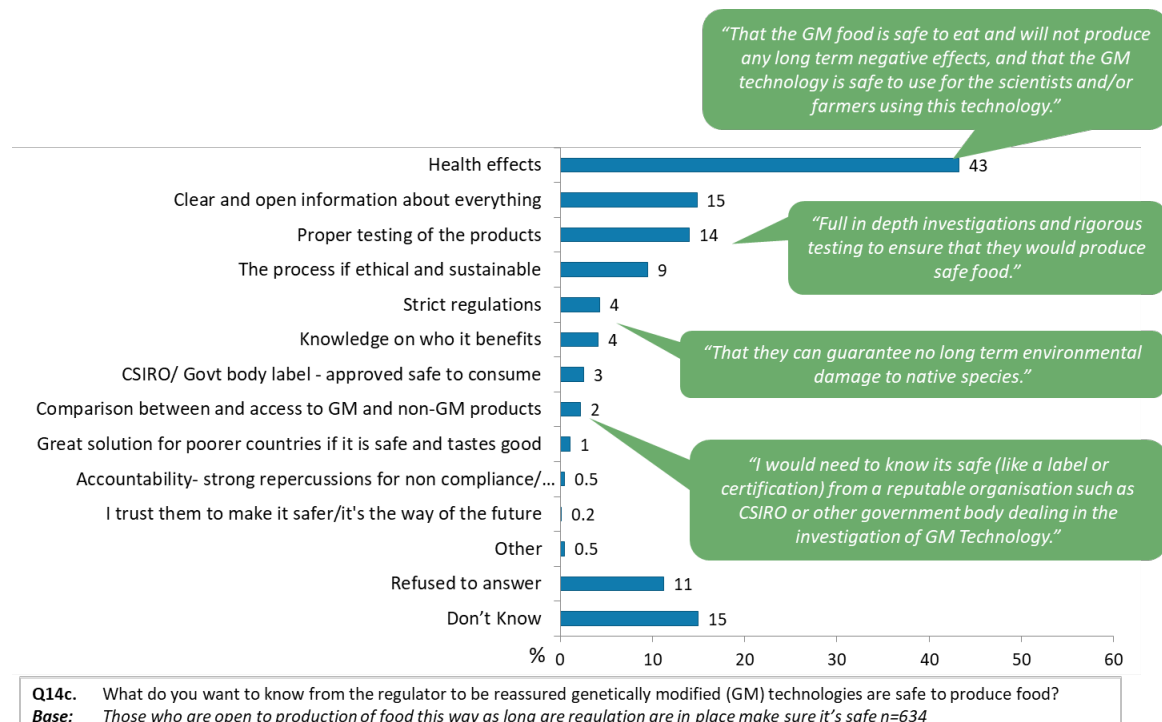
What people want to know to be assured GM crops and food are safe

Amongst those who are open to production of GM food as long as regulations are in place make sure it's safe, the key messages people wanted from the regulator were:

- that health tests showed GM foods were safe to consume (43%)
- clear and open information (15%)
- that there was proper testing of products (14%)
- that the process was ethical and sustainable (9%)
- that there were strict regulatory controls (4%).

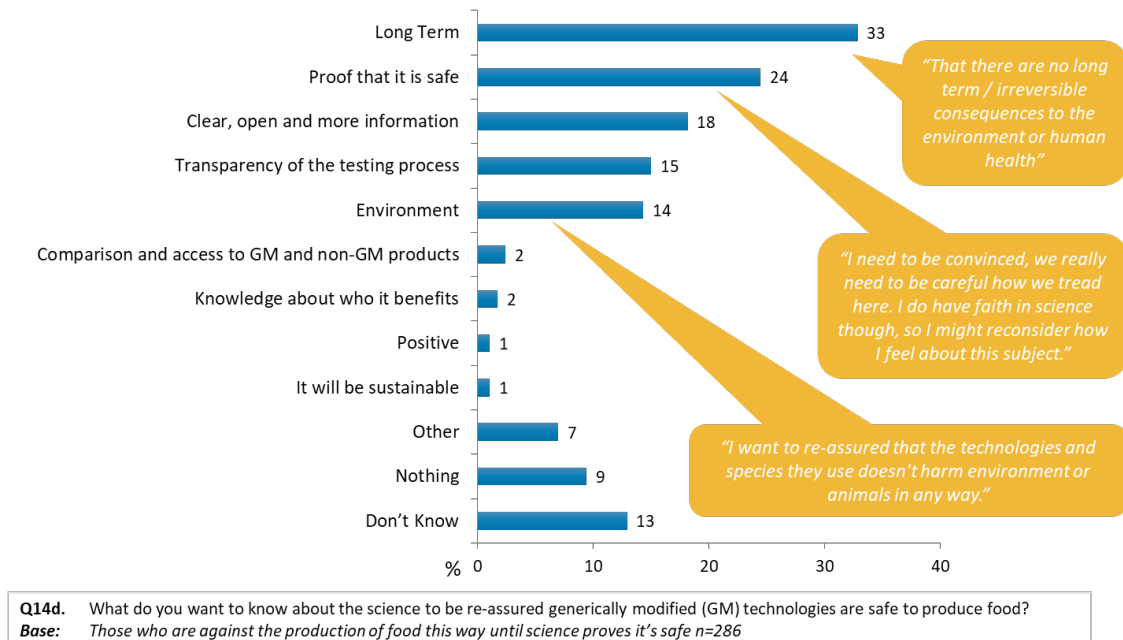
This finding suggests there is limited knowledge about the functions of the regulator and that increased awareness of the regulator's role and functions may have a significant impact on this section of the public.

Figure 33: What people want to hear from the Regulator



Respondents who indicated they were against the production of food this way until the science proved it was safe were asked what they wanted to know about the science to be re-assured gene technology is safe to produce food. Their main responses were no long-term effects on people or the environment (33%), proof that it was safe (24%), clear and open information (18%) and transparent of the testing process (15%). Respondents stressed the need to be convinced and re-assured of the safety of the technology.

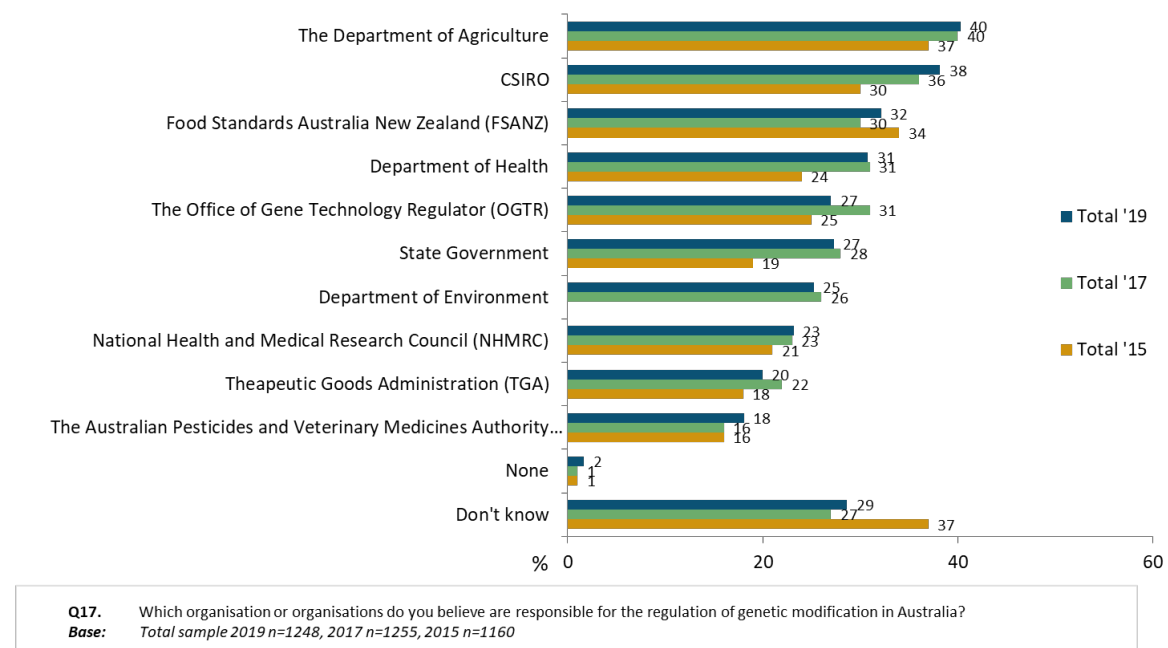
Figure 34: What people want to know from the Regulator



Awareness of organisations responsible for regulation of GM

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

Figure 35: Organisation/s they believe are responsible for the regulation of genetic modification in Australia



Despite having a list to choose from, there was low awareness of the organisations responsible for the regulation of GM in Australia, with a significant ‘don’t know’ response (29%).

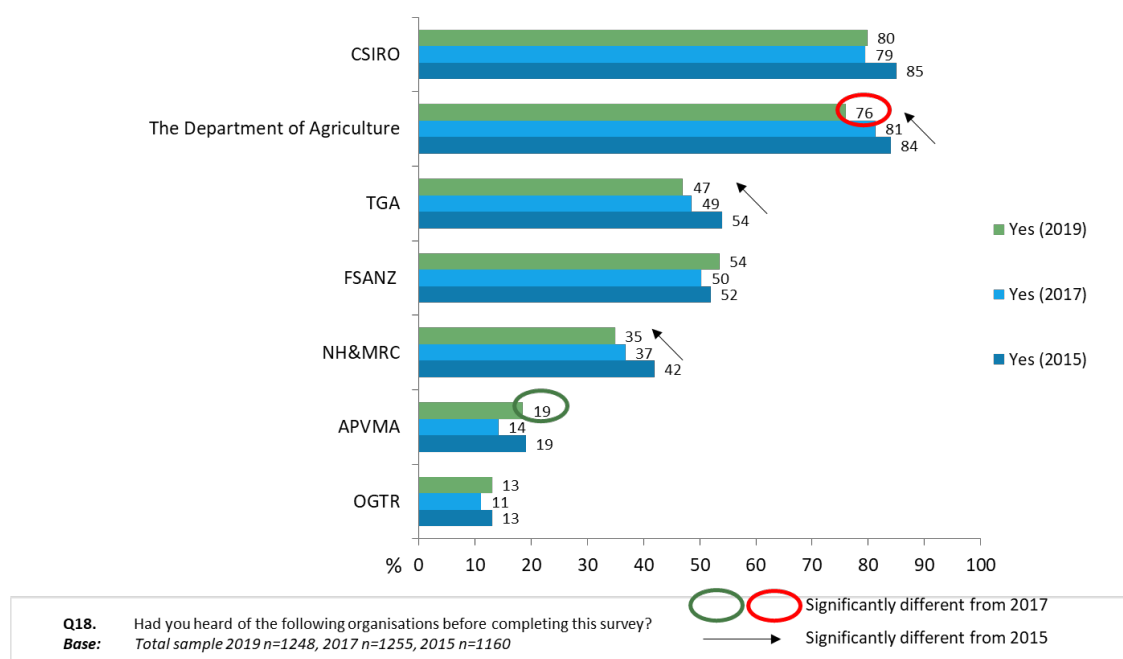
Those organisations that were most commonly believed to regulate GM were the Department of Agriculture (40%), CSIRO (38%), Food Standards Australia New Zealand (FSANZ) (32%), Department of Health (31%), the Office of the Gene Technology Regulator (OGTR) (27%), State governments (27%), the National Health and Medical Research Council (NHMRC) (23%), TGA (20%), and the Australian Pesticides and Veterinary Medicines Authority (APVMA) (18%).

Overall findings of awareness of the agencies that might be responsible for GM regulation were fairly similar to 2017, with a four percentage point drop for OGTR (31% to 27%), although this was not statistically significant.

These are moderate to good findings for the regulators (though it is worth noting that CSIRO—not a regulator—continues to rate near the highest) 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.

Respondents were then asked which organisation they had heard of before completing the survey and CSIRO was again the standout response at 80%, followed closely by the Department of Agriculture at 76%, and then a significant drop until FSANZ at 54%. Lowest recognition was for the OGTR which remains at a similar level to previous years.

Figure 36: Awareness of organisations



There was a poor correlation between agencies who respondents felt was responsible for GM regulation and awareness of them, with only the APVMA rating closely with 18% believing it responsible for GM regulation and 19% stating they had heard of it previously.

The majority of agencies received a higher awareness measure, compared to knowledge of whether they were responsible for GM regulation. The largest gap was between the CSIRO with a rating of 38% believing (incorrectly) that it was responsible for GM regulation and 80% having heard of it previously.

The OGTR stood out for having a higher response rate for being responsible for GM regulation compared to those who had heard of previously (27% to 13%).

Table 9: Comparison between who was thought responsible for regulation and prior awareness

	Responsible for GM regulation	Heard of previously
OGTR	27%	13%
APVMA	18%	19%
NHMRC	23%	35%
FSANZ	32%	54%
TGA	20%	47%
Dept of Agriculture	40%	76%
CSIRO	38%	80%

This does suggest that respondents were trying to be discerning about which agencies they indicated were responsible for GM regulation. It also reinforces that awareness of the OGTR and its role is not well known in the public.

Trust in what organisations say about gene technology

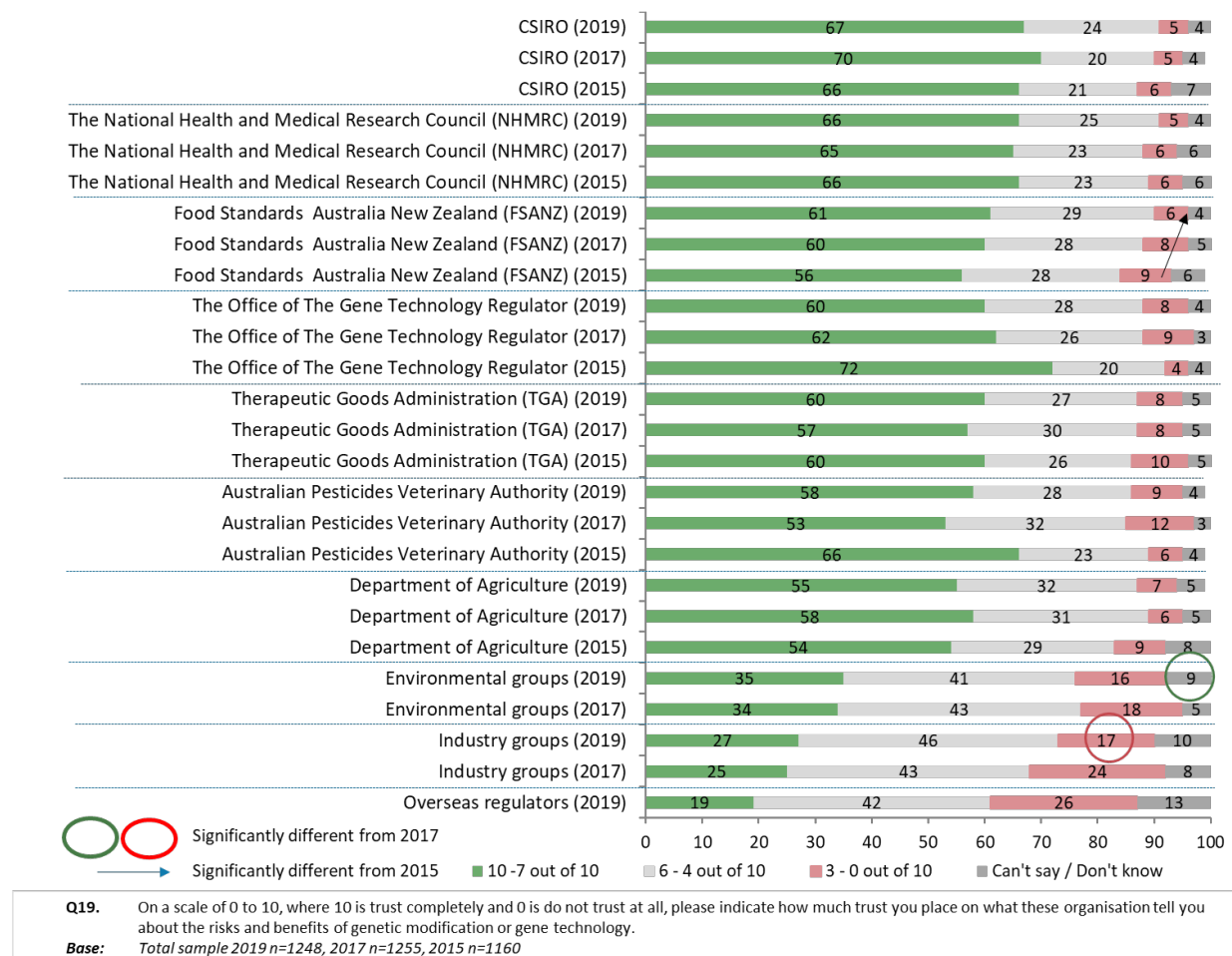
All the regulators polled received considerable levels of trust in relation to the information that they might produce on gene technology, with trust ratings between 55% and 67% for high trust. Low levels of trust were only between 5% and 8%.

Industry groups and environmental organisation groups rated much lower for trust though, at 27% and 35%, and also the highest levels of low trust (17% and 16%). That said, low trust has declined for industry groups since 2017 (from 24% to 17%).

A new question, asked about overseas regulators, also showed they have very low levels of trust, with only 19% of high trust and the most pronounced low trust rating of all organisations listed, at 26%.

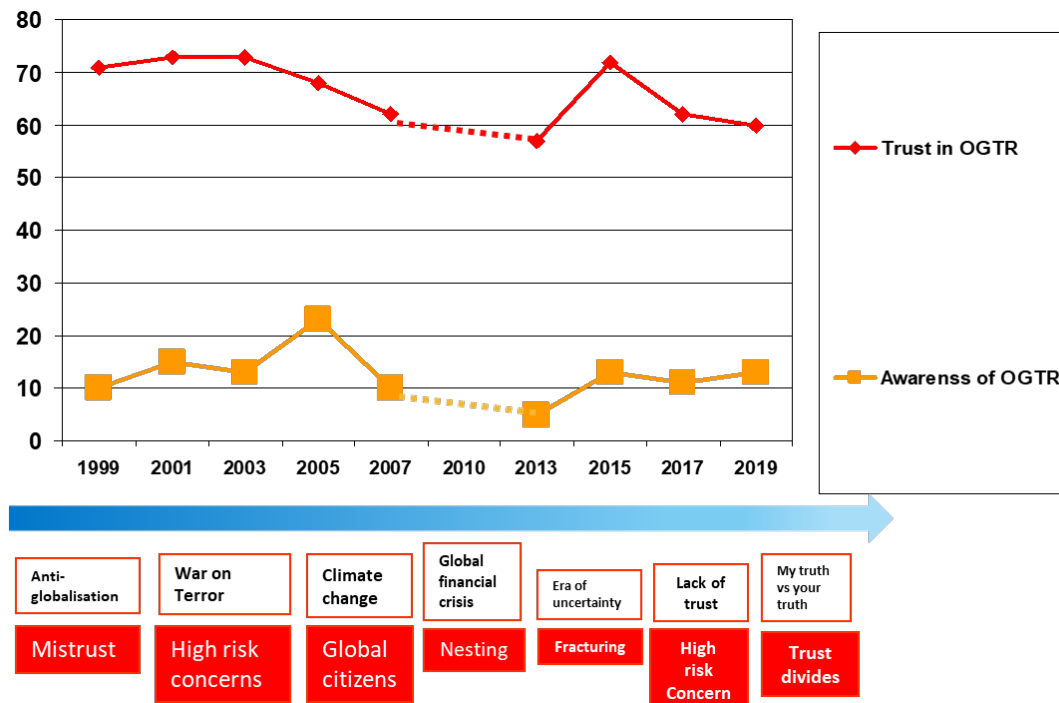
It should also be noted that this question does not necessarily reflect respondent's trust in these organisations per se, as the question specifically asked how much trust does the respondent place in what the organisations tell about the risks and benefits of gene technology.

Figure 37: Trust in what certain organisations say about GM and gene technology



When organisational trust was examined across the key groups by attitudes to GM foods, the group most reluctant to support GM technologies in food production had the lowest levels of trust in all groups, including in environmental groups, which indicates that trust is not conditional on aligning with a particular world view, but is just a constant low trust.

Figure 38: Awareness and trust in OGTR over 20 years



Tracking the trust in OGTR over the past 20 years reveals that awareness levels have been relatively steady for the past 4 years, however trust peaked in 2015 and has declined since, to a level similar to where it was 2007 (around 60%), before the last global financial crisis.

Attitudes and beliefs towards government involvement

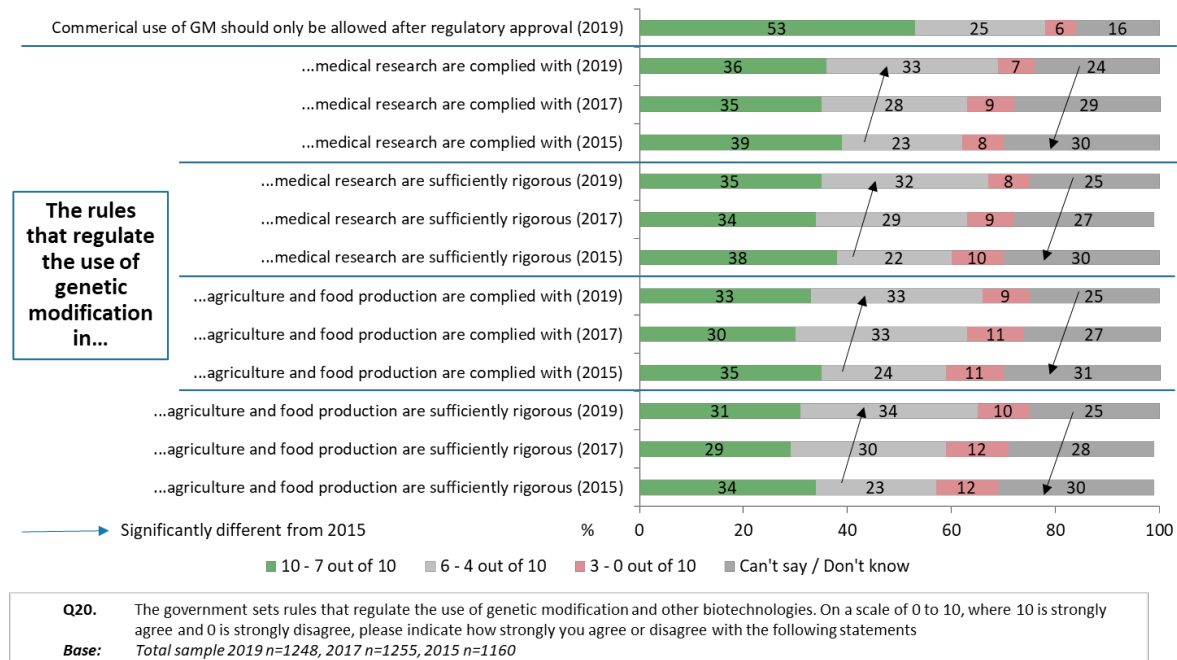
When asked about the rules and regulations relating to GM, and whether they were sufficiently rigorous and complied with, there was majority agreement but also a significant number of don't know responses, rating as high as 25%.

The proportion of 'don't knows' however is seeing a declining trend over time since 2015, whilst the proportion rating 'in the middle' was on the rise since 2015.

The new measure 'Commercial use of genetic modification and its products should only be allowed after regulatory approval' received strong support, with 53% in the top box.

Men were significantly more likely to believe the rules were sufficiently rigorous and complied with, except in medical research where there were no significant differences based on gender.

Figure 39: Attitudes and belief in government rules and regulation



Sources of information and trust in them

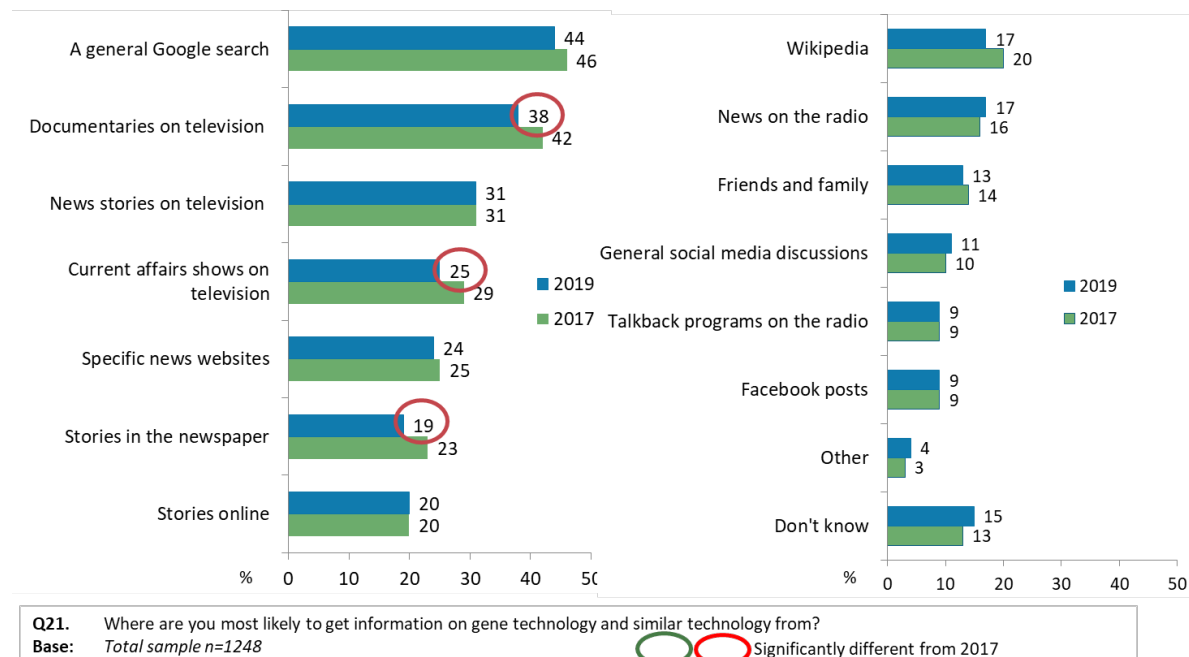
Survey respondents were asked where they were most likely to get information on gene technology and similar technology from, and multiple options were provided. The overall finding was that television and Google ruled information sources. A general Google search was stated by 44% of respondents, followed by documentaries on television (38%), news stories on television (31%) and current affairs shows on television (25%). This is similar to other surveys on sources of information on science issues, which tend to show that across the broad population, television is still the main source of information.

There were drops in key media sources. Documentaries on TV dropped significantly from 42% in 2017 to 38% in 2019, current affairs shows on television dropped significantly from 29% in 2017 to 25% in 2019, and stories in the newspaper dropped significantly from 23% to 19%. This may be the result of recent media attention on the topic of 'fake news' leading to scepticism of these channels typically associated with 'headlines' and 'being attention grabbing'

It should be pointed out, however, that a general Google search is an active form of seeking information on GMOs, while television tends to be a more passive form of seeking information, and in the absence of verifying if the responses align with people's actual information seeking habits, they should be understood as aspirational—that is, they are how people either feel they seek information, or how they would prefer to find information.

It was worth noting that despite concerns about social media as a source of information or misinformation on gene technology, it rated at 11% or less for respondents.

Figure 40: Sources of information



Comparing sources of information to their trust shows that information preferences and trust are not necessarily closely aligned. The highest rating for trust was television documentaries, with 18% rating them as very trustworthy. The next closest was friends and family, with 14% rating them as very trustworthy. Overall most media rated only between 6% and 11% trust, with current affairs shows on television rating the best of general media at 11%, and news on the radio, TV and newspapers all rating 8%. Talkback radio rated only 6% very trustworthy.

Wikipedia rated above all the mainstream news media, at 11%, but general social media discussions and Facebook posts rated the lowest at 5% and 4% respectively.

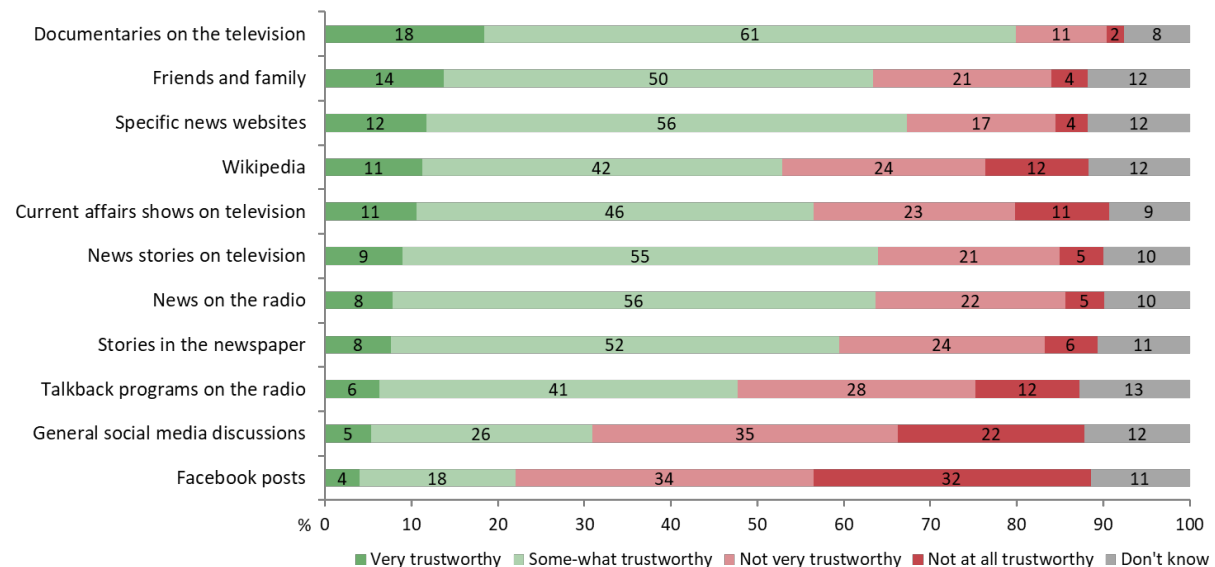
The most trusted medium for combined trust was for information from documentaries on television with 18% finding them very trustworthy and 61% finding them somewhat trustworthy (totalling 79%). This was followed by specific news websites (12% very trustworthy and 56% somewhat trustworthy, totalling 68%). The third most trustworthy source of information was news on the radio (8% very trustworthy and 56% somewhat trustworthy, totalling 64%), rating equally friends and family (14%) and 50% somewhat trustworthy, totalling 64% trust.

Social media scored the highest level of distrust with Facebook posts rating 32% not at all trustworthy and 34% somewhat trustworthy, totalling 66% (which was a notable improvement on the 2017 combined rating of 71% distrust). The second least trusted source of information was general social media discussions, with 22% rating them as not at all trustworthy and 35% rating them

not very trustworthy, totalling 57% distrust (again an improvement on the 2017 rating of 62% distrust).

Women were significantly more likely to place low trust in Facebook posts (58%, +4%).

Figure 41: Trust in sources of information



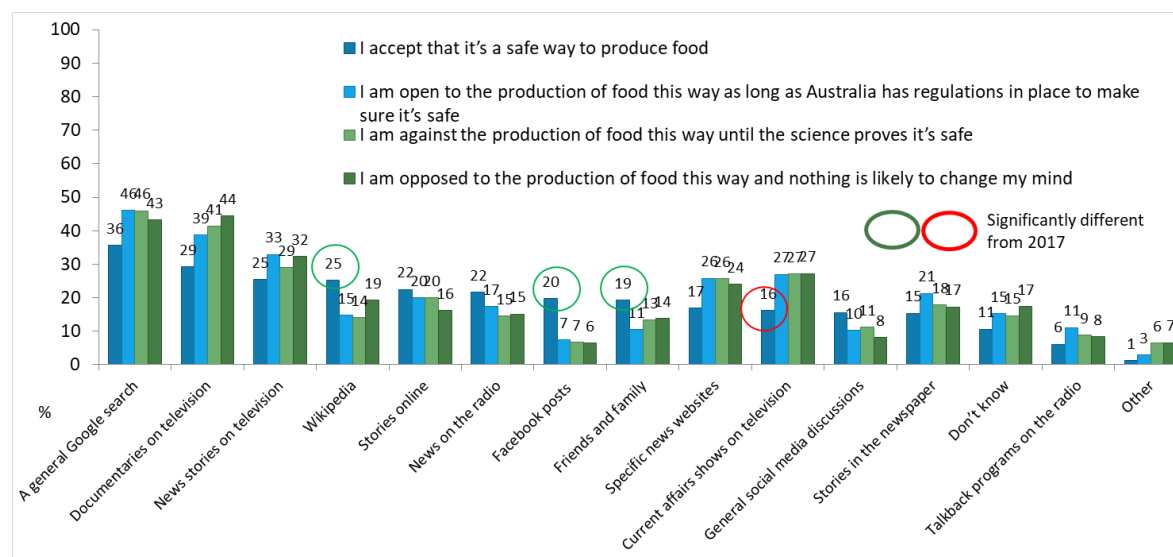
Q22. On a scale of 0 to 10, where 10 is trust completely and 0 is do not trust at all, please indicate how much trust you place on what these organisation tell you about the risks and benefits of genetic modification or gene technology.
Base: Total sample n=1248

When combined, the data on sources of information and trust in the source showed that no source of information was closely correlated with levels of trust. There tended to be low use and high trust (such as for news on the radio, friends and family or stories online), or they were high use with low trust (such as current affairs shows) or low use and low trust (such as general social media, talkback programs on radio and Facebook posts).

Table 10: Sources of information and trust in the source

	Likely source of info	Total trust
General Google search	44%	n/a
Documentaries on TV	38%	79%
News stories on TV	31%	60%
Current affairs shows on TV	25%	57%
Specific news websites	24%	68%
Stories in the newspaper	19%	60%
Stories online	20%	n/a
Wikipedia	17%	53%
News on the radio	17%	64%
Family and friends	13%	64%
General social media	11%	31%
Talkback programs on radio	9%	47%
Facebook posts	9%	22%

Figure 42: Sources of information - by attitudes to GM food segments



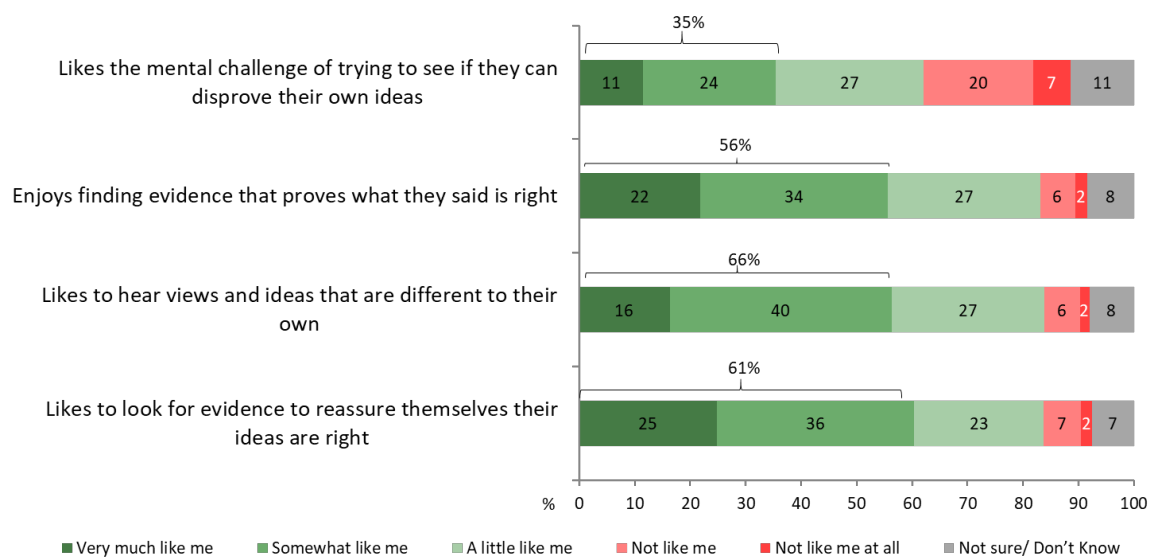
Q21. Where are you most likely to get information on gene technology and similar technology from?
Base: I accept that it's a safe way to produce food n=206, I am open to the production of food this way as long as Australia has regulations in place to make sure it's safe n=631, I am against the production of food this way until the science proves it's safe n=265, I am opposed to the production of food this way and nothing is likely to change my mind n=147

Attitudes towards information and ideas

At least half the total sample will agree that they enjoy finding evidence that proves that they are right (56%) or look for evidence to reassure themselves that their ideas are right (61%).

Whilst people don't mind hearing different ideas (56%), fewer are those who like the mental challenge of trying to see if they can disprove their own ideas (35%).

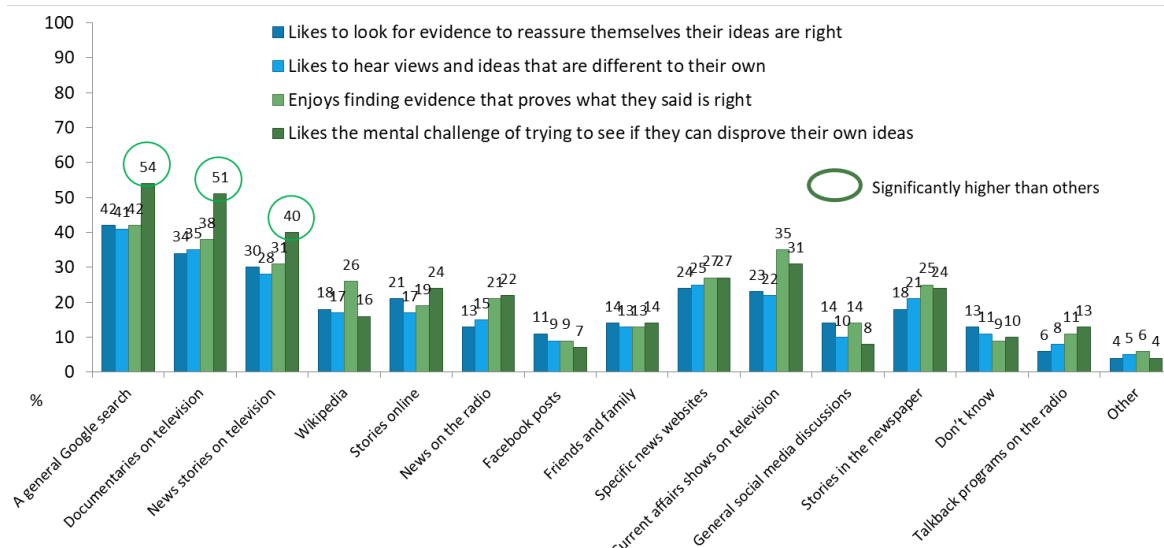
Figure 43: Attitudes and behaviours towards sources of information



Q22b. Please indicate how much each person described in the statements below is, or is not, like you?
Base: Total sample n=1248

Interestingly, those who 'like the mental challenge of seeing if they can disprove their own ideas' tend to use Google searches, news stories on TV and documentaries on TV more for information on gene technology.

Figure 44: Sources of information used - by attitudes towards information



Q21. Where are you most likely to get information on gene technology and similar technology from?
Base: Like to look for evidence and enjoy finding evidence, but not like to hear views & ideas n=299, Like to hear views & ideas but not like to look for evidence n=173, Like to look for evidence and like to hear views & ideas n=118, Like to look for evidence and enjoy finding evidence, and like to hear views & ideas n=300

These general attitudes towards information and facts may also influence views and acceptance of GM technologies generally. Those who 'like to hear views different to their own' are more accepting of GM for livestock uses (mean score of 6.39) and generally (mean score of 5.75), and those who like the mental challenge of disproving their own ideas are more accepting for medical uses and for vaccines (mean score of 7.45 and of 6.92 respectively).

Figure 45: Acceptance of GM technologies - by attitudes towards information

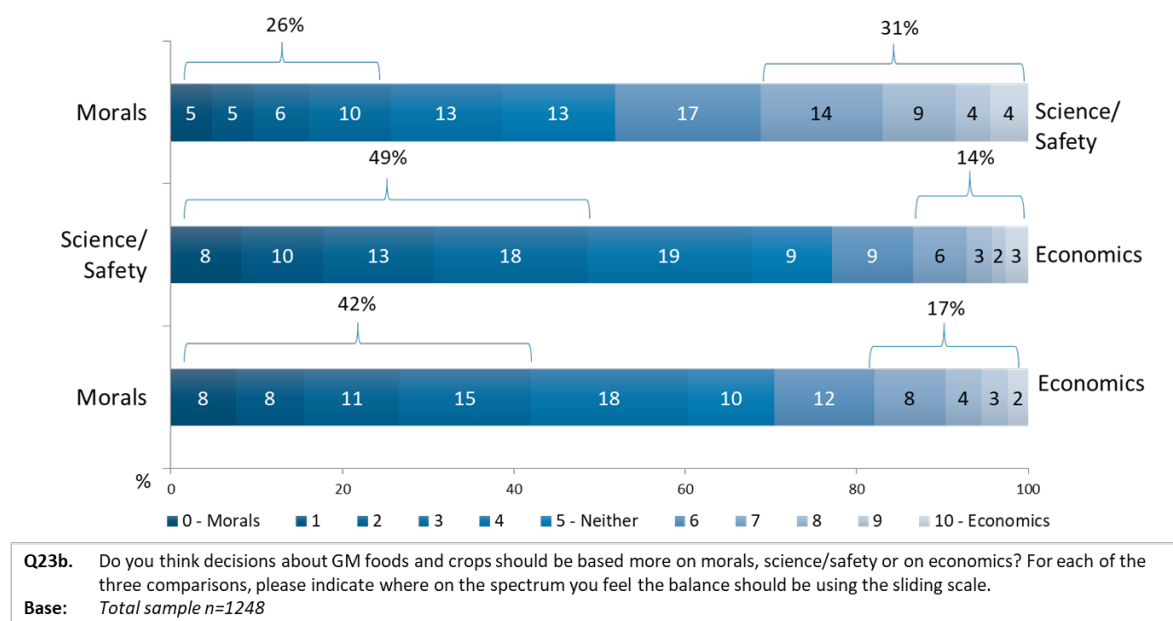
To what extent do you agree with the use of GM for each of the following? Mean Scores Shown	Likes to look for evidence to reassure themselves their ideas are right	Likes to hear views and ideas that are different to their own	Enjoys finding evidence that proves what they said is right	Likes the mental challenge of trying to see if they can disprove their own ideas
Generally	5.40	5.75	5.63	5.24
For use in foods and crops	5.40	5.63	5.26	4.71
For medical uses (such as producing insulin or vaccines)	7.04	7.13	7.20	7.45
For industrial uses (such as to make biofuels or plastic replacements from plants)	6.82	6.68	6.94	7.15
For other uses (such as modifying microbes to clean up the environment)]	6.84	6.86	6.76	7.14
For ornamental uses (such as to produce orange petunias or blue carnations)	5.59	5.75	5.41	4.83
[For livestock uses (such as modifying feed to reduce the amount of greenhouse gases/methane produced by animals)	5.72	6.39	5.67	5.69
Livestock uses (such as vaccines against diseases)	6.38	6.57	6.62	6.92

Q5. On a scale of 0 – 10, where 10 is completely supportive and 0 is completely against it please indicate how supportive you are for the following uses of genetic modification or gene technology.
Base: Like to look for evidence and enjoy finding evidence, but not like to hear views and ideas n=299, Like to hear views and ideas but not like to look for evidence n=173, Like to look for evidence and like to hear views and ideas n=118, Like to look for evidence and enjoy finding evidence, and like to hear views and ideas n=300

Main driver underpinning decisions about GM foods and crops

A new question asked in 2019 seeking to determine what respondents felt should drive decisions about GM foods and crops.

Figure 46: Attitudes towards how decisions about GM foods and crops should be made



Three scales were provided, one with a divide between morals and economics, one with a divide between science/safety and economics and one with a divide between morals and science/safety. Respondents were asked to state where on the spectrum of divides they felt the balance should be, using the spectrum as a sliding scale.

The results showed that Science/safety far outranked Economics (49% to 14%), and slightly outranked Morals (31% to 26%). Morals, in turn, outranked Economics (42% to 17%).

Support for GM sciences and technologies

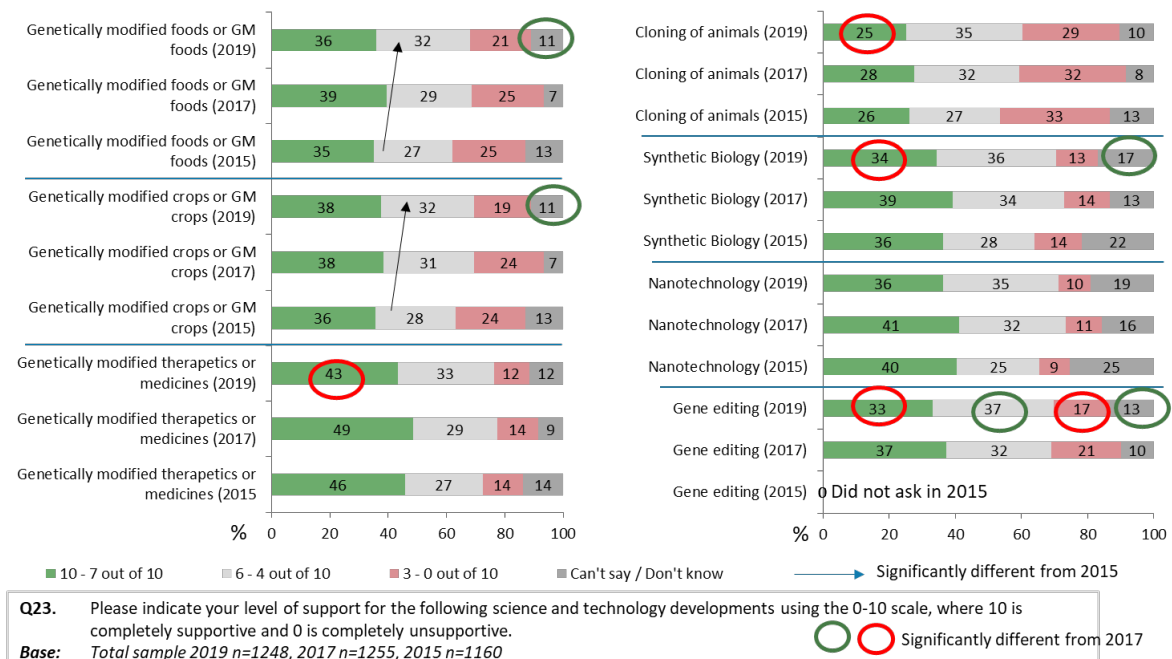
Towards the end of the survey respondents were asked to indicate their level of support for biotechnology sciences and technologies (Figure 47).

Tracking the results against those from 2015 and 2017 showed again that attitudes were more similar to 2015 than they were to 2017. There were also significant rises in don't know responses over 2017.

For GM foods, 43% were in the highest third of responses, rating high support for the technology and 21% had the least levels of support. Of interest, when a similar question had been asked earlier

in the study at Question 5 the spread of responses for GM foods was 35% in the highest range of support and 24% in the lowest.

Figure 47: Support for biotechnology sciences and technologies



The difference between the question relating to GM crops above was even more pronounced, rising from 35% high support in question 5 to 38% high support in question 23, with those who indicated least support dropping from 24% to 19%. This indicates that engaging with issues around GM foods and crops may lead to more support.

Other things to note were that there was a general drop in the highest levels of support for all applications mentioned, with only GM crops holding its own at 38% highest support. However, there was not a corresponding increase in the lowest levels of support, and they dropped as well. The growth was in the middle levels of support and the don't knows – which is a general characteristic of this year's survey.

Value 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). In

the 2012 study, the Department of Industry identified several values statements useful for defining values-based segments. These were used again in 2015, 2017 and 2019.

They include:

- Commercial use of genetic modification and its products should only be allowed after regulatory approval
- 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
- 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.

Of the four segments, the Disciples was the segment that responded most positively to gene technology in general. Although they were not necessarily more aware, claiming to 'have heard of but know little about' many of the technologies, they generally believe that they will 'improve our way of life in the future'. They were the segment most likely to be willing to eat GM related food, more accepting of modifying genes of plants and introducing new genes, and most likely to be in favour of growing GM crops in their state/territory.

Segment 1: The Disengaged/Lost 16%

	Male	Female	30 years or younger	31-50 years	51 years or older	NSW	VIC	QLD	ACT	TAS	NT	SA	WA
Avg.	50%	50%	27%	38%	35%	32%	25%	20%	2%	2%	1%	7%	10%
Seg.	52%	48%	31%	45%	24%	31%	21%	19%	2%	2%	2%	7%	15%

Demographic: This segment appears more likely to be aged 31- 50 years, although not significant

They are more likely to:

- Believe they know enough about biotechnology and gene editing that they could explain it to a friend
- Believe biotechnology, GMOs, cloning of animals and gene editing will make things worse in the future
- Rate their support of the use of gene technology generally as well as its use in foods and crops and for industrial uses, ornamental uses, and livestock uses all in the low 0-3 out of 10.
- Rate their support of the following statements in the higher 7-10 out of 10 category—*People shouldn't tamper with nature, scientific advances tend to benefit the rich*. Disagree that *'Technological change happens too fast for me to keep up with it'*
- Rate their willingness to eat 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, products from genetically modified animals in the lower 0-3 out of 10 category.
- They also rate their acceptance of modifying the genes of plants to produce food in the lower 0-3 out of 10 (Q9a).
- In terms of modifying the genes of plants to produce food, they consider unacceptable (lower 0- 3 out of 10) the following — 'Switching on' or 'switching off' the existing genes within a plant, Making a small change to an existing gene within a plant, as is done in gene editing, 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, Introducing the genes of a bacterium

Segment 2: The Sceptics 11%

	Male	Female	30 years or younger	31-50 years	51 years or older	NSW	VIC	QLD	ACT	TAS	NT	SA	WA
Avg.	50%	50%	27%	38%	35%	32%	25%	20%	2%	2%	1%	7%	10%
Seg.	53%	47%	45%	33%	22%	31%	30%	20%	2%	1%	1%	9%	7%

Demographic: This segment is more likely to be aged under 30, be Aboriginal or Torres Strait Islander and a landholder who derives most or part of their income from primary production (farming)

They are more likely to:

- Claim to know enough about gene editing and synthetic biology to be able to explain it to a friend but believe they will have no effect in the future
- Believe GMO, cloning of animals, gene editing will make things worse in the future, but believe synthetic biology will have no effect
- Rate their support of the use of gene technology generally as well as its use in foods and crops, and for medical and industrial uses in the low 0-3 out of 10
- Rate their support of the following statements in question six in the higher 7-10 out of 10 category — science and technology creates more problems than it solves, and people shouldn't tamper with nature. However more likely to disagree that not vaccinating children puts others at risk
- Rate their willingness to eat processed foods such as cakes or biscuits that contain only a small amount of genetically modified ingredients in the lower 0-3 out of 10 category
- Indicate they believe that most of the fresh fruit and vegetables grown in Australia are genetically modified. They also rate their acceptance of modifying the genes of plants to produce food in the lower 0-3 out of 10 (Q9a), similarly for introducing the genes of a plant of the same species
- In terms of modifying the genes of plants to produce food, they consider unacceptable (lower 0-3 out of 10) the following — Making a small change to an existing gene within a plant, as is done in gene editing, Introducing the genes of a plant of the same species, Introducing the genes of a plant of a different species
- They are not in favour of growing genetically modified crops in their state or territory. 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, if there was evidence they would enhance Australia's economic competitiveness, if the crops provided positive outcomes for the environment or if the crops provided positive benefits for human health

Segment 3: Uninformed supporters with provisos 28%

	Male	Female	30 years or younger	31-50 years	51 years or older	NSW	VIC	QLD	ACT	TAS	NT	SA	WA
Avg.	50%	50%	27%	38%	35%	32%	25%	20%	2%	2%	1%	7%	10%
Seg.	40%	60%	18%	37%	45%	28%	26%	23%	2%	2%	1%	6%	11%

Demographic: This segment is more likely to be female, aged 51 or older and be retired or pensioner, and more likely to not be a landholder.

They are more likely to:

- Have heard about GMOs, but know very little or nothing about it and have never heard about gene editing or synthetic biology
- Believe that cloning of animals will make things worse in the future
- Rate their support of the use of gene technology generally as well as its use in foods and crops, ornamental uses in the low 0-3 out of 10
- Rate their support of the following statements in question six in the lower 0-3 out of 10 category — *Science and technology creates more problems than it solves*, *Scientific advances tend to benefit the rich more than they benefit the poor*, however they rate the following statements in question six in the lower higher 7-10 out of 10 category — *People shouldn't tamper with nature* and *Not vaccinating children puts others at risk*
- Rate their willingness to eat food grown with the use of pesticides and genetically modified fruit and vegetables, and products from genetically modified animals as lower than average (in the 0-3 out of 10)
- Believe those Q8 statements are false — *Most of the fresh fruit and vegetables grown in Australia are genetically modified*, and *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 in the lower 3-10 out of 10 (Q9a)
- In terms of modifying the genes of plants to produce food, they consider less acceptable (lower 1-3 out of 10) the following, *Introducing the genes of a plant of a different species* and *introducing the genes of an animal*
- Say they know that commercial genetically modified crops are allowed to be grown in their state/territory and to name corn and tomatoes as examples. They are NOT in favour of growing genetically modified crops in their state or territory, however would be if the crops passed stringent health and environmental regulations and if the crops provided positive benefits for human health
- Were more likely to have heard of Department of Agriculture and Food Standards Australia New Zealand (FSANZ).

Segment 4: The Disciples 34%

	Male	Female	30 years or younger	31-50 years	51 years or older	NSW	VIC	QLD	ACT	TAS	NT	SA	WA
Avg.	50%	50%	27%	38%	35%	32%	25%	20%	2%	2%	1%	7%	10%
Seg.	52%	48%	26%	35%	39%	34%	23%	20%	2%	3%	1%	7%	11%

Demographic: This segment is more likely to live 'elsewhere in NSW' and speak only English at home

The Disciples are more likely to:

- Have heard of biotechnology and GMOs and gene editing, however know very little or nothing about it
- Believe biotechnology, GMOs, gene editing, cloning of animals and synthetic biology will improve our way of life in the future
- Rate their support of the use of gene technology generally, in foods/crops, for medical, industrial and for other uses such as modifying microbes to clean up the environment, as well as ornamental and livestock/vaccine related in the high 7-10 out of 10
- Rate their support of the following statements in question six in the lower 0-3 out of 10 category — *People shouldn't tamper with nature*, *Science and technology creates more problems than it solves* however they rate the following statements in question six in the lower higher 7-10 out of 10 category — *Scientific advances tend to benefit the rich more than they benefit the poor*, *Not vaccinating children puts others at risk*, *Commercial use of genetic modification and its products should only be allowed after regulatory approval*
- Rate their willingness to eat *organic food, food grown with the use of pesticides, genetically modified fruit and vegetables, and products from genetically modified animals, meat and other products from animals that have been fed with genetically modified stock feed, Processed foods such as cakes or biscuits that contain only a small amount of genetically modified ingredients, Processed foods such as bread or soy milk, that has been made from genetically modified crops* in the higher 7-10 out of 10 category
- They rate their acceptance of modifying the genes of plants to produce food in the higher 7-10 out of 10 (Q9a)
- In terms of modifying the genes of plants to produce food, they consider acceptable (higher 7-10 out of 10) introducing the genes of a plant of the same species, of a different plant species, of an animal or of a bacteria. They more likely do not know if GM is in their state
- They are mainly in favour of growing genetically modified crops in their state or territory. Those who are not also more likely to be in favour of growing GM crops in their state/territory, if the crops passed stringent health and environmental regulations, if there was evidence they would enhance Australia's economic competitiveness, if the crops

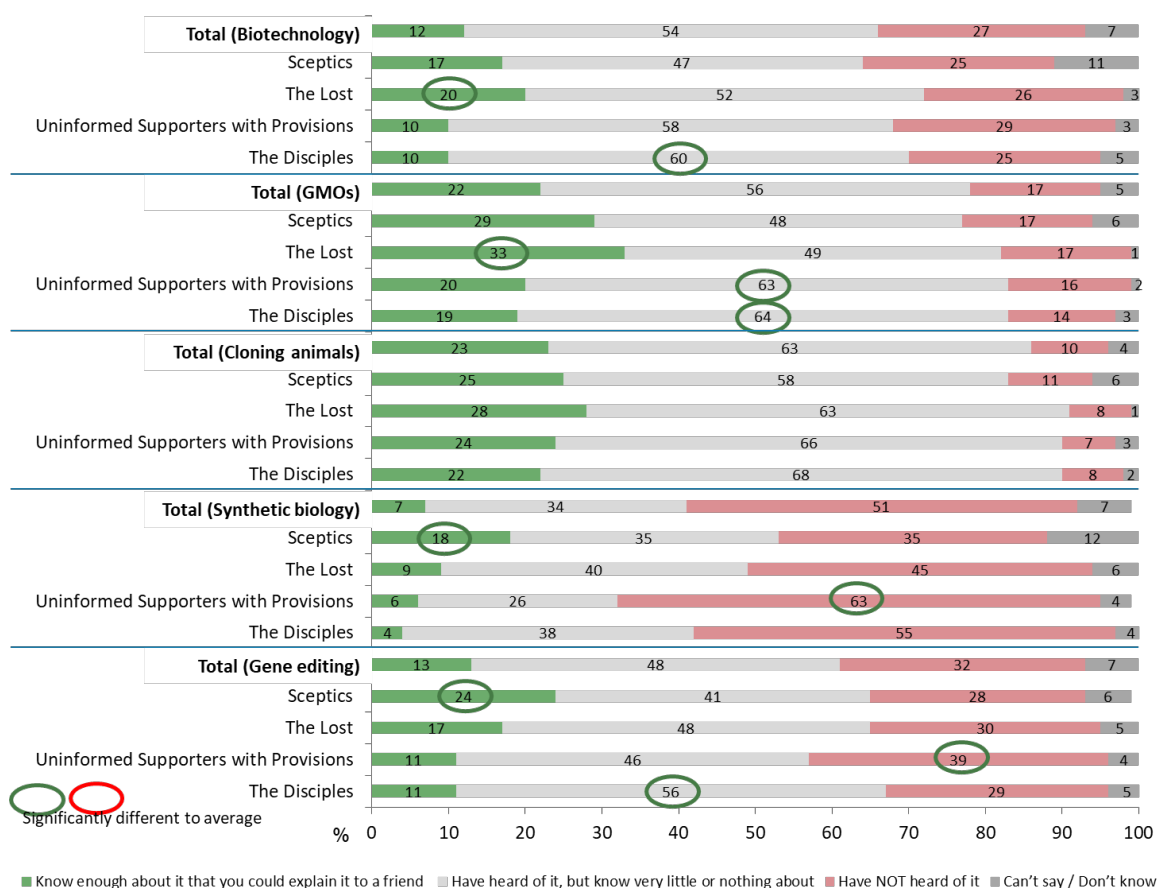
provided positive outcomes for the environment or if the crops provided positive benefits for human health

The 'Lost' are more likely to claim to be able to explain biotechnology and GMOs to a friend (20% and 33% respectively).

Meanwhile, the Sceptics are more likely to claim to be able to explain synthetic biology and gene editing to a friend (at 18% and 24% respectively), despite also believing that they will have no effect on improving lives. They may be the kind of people who suffer from 'thinking they know it all' but are definitely not in support of favour of GM to GM technologies.

The disciples gave more modest responses, claiming to 'have heard' of the technologies but knowing little about them. They, however, were the group much more positive in attitudes towards gene modification.

Figure 48: Awareness of terminology and understanding - by values segments

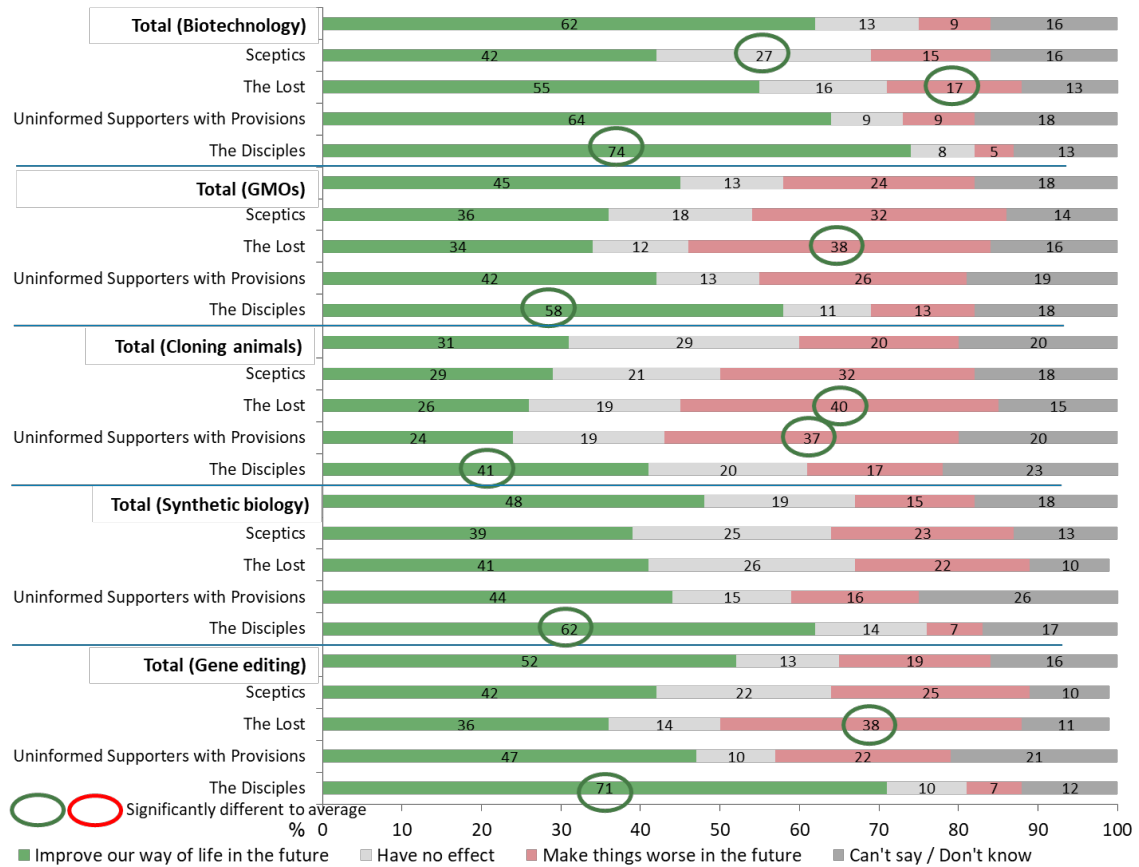


Q4a. For the following list of technologies could you please say whether... you have not heard of it, OR you have heard of it but know very little about or nothing about it, OR you know enough about it that you could explain it to a friend.

Base: Total sample n=1248, Sceptics n=165, The Lost n=199, Uninformed supporters with provisos n=338, Disciples n=391

The disciples are more likely to think the technologies will improve our way of life, than any other segments, across biotechnology, genetic modification, cloning, synthetic biology.

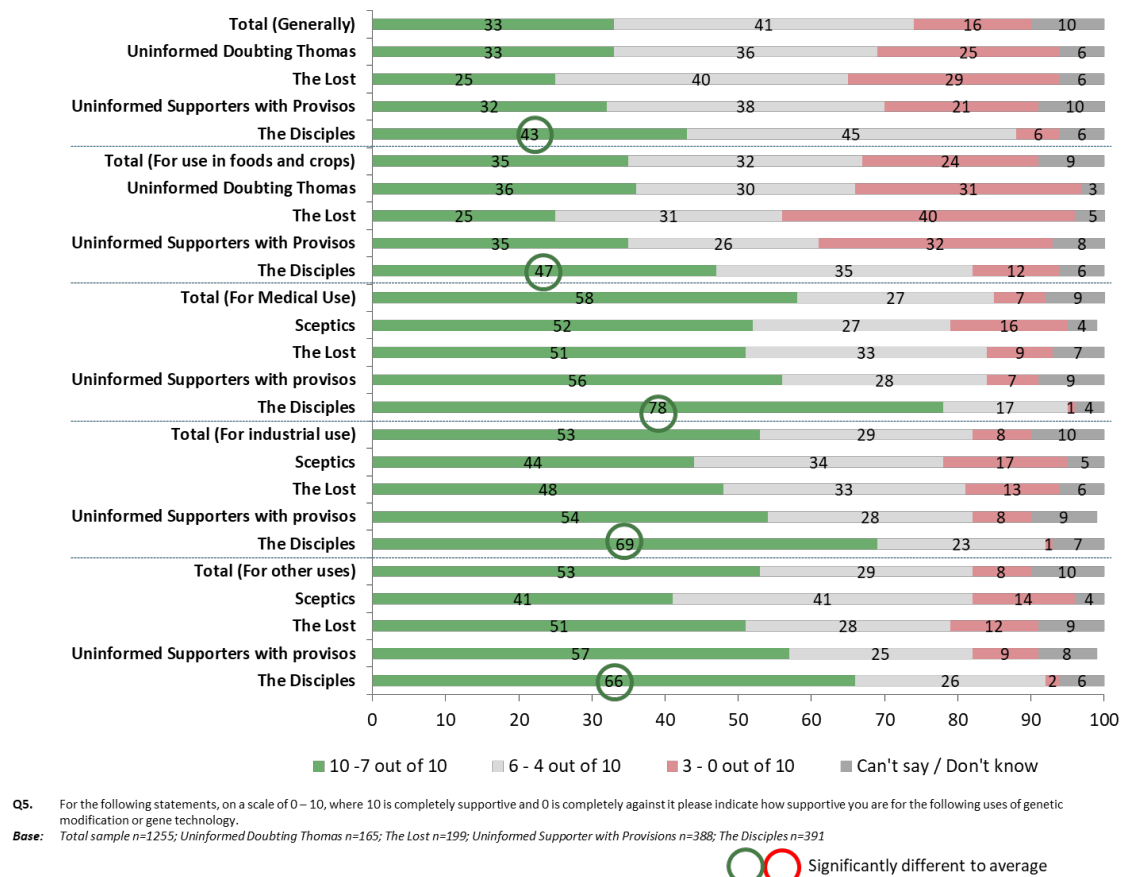
Figure 49: How technologies will impact our way of life - by values segments



Q4c. 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?

Base: Those who had heard of Biotechnology n=953, GMOs n=1028, cloning of animals n=1145

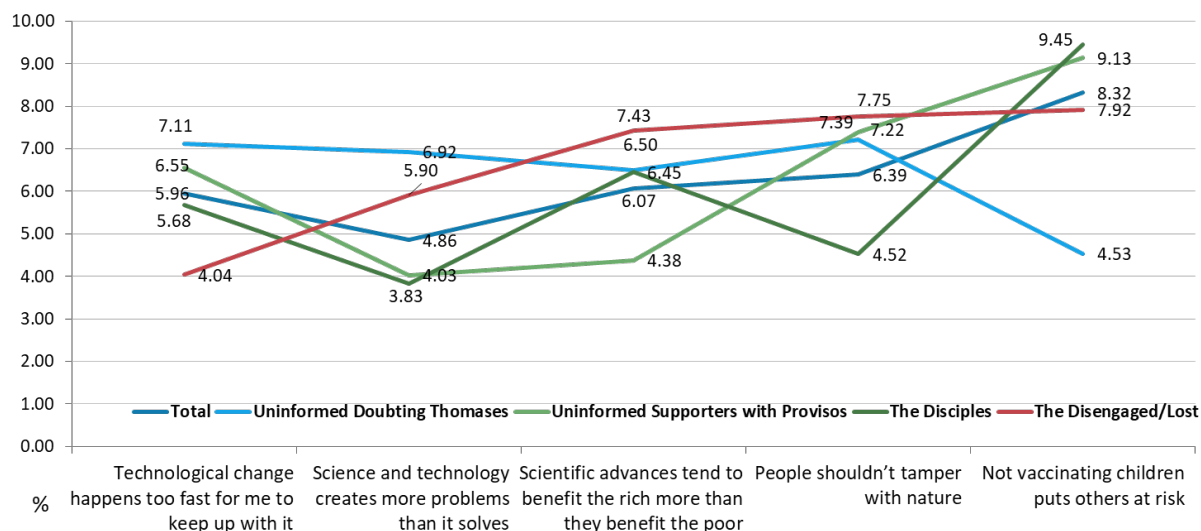
Figure 50: Support for uses of genetic modification or gene technology - by values segments



Looking at the mean scores for perceptions of scientific technology, the disciples are least likely to believe that people shouldn't tamper with nature (4.52 mean score) and most likely to agree that not vaccinating children puts others at risk (9.45 mean score), this was also the group most supportive of GM technology across the board.

Meanwhile, the Sceptics are more likely to agree that technological change is happening too fast to keep up with (7.11 mean score), that it creates more problems than it solves (6.92 mean score), and are the group least likely to see a problem with not vaccinating children (4.53).

Figure 51: Perceptions towards scientific technology - by value segments



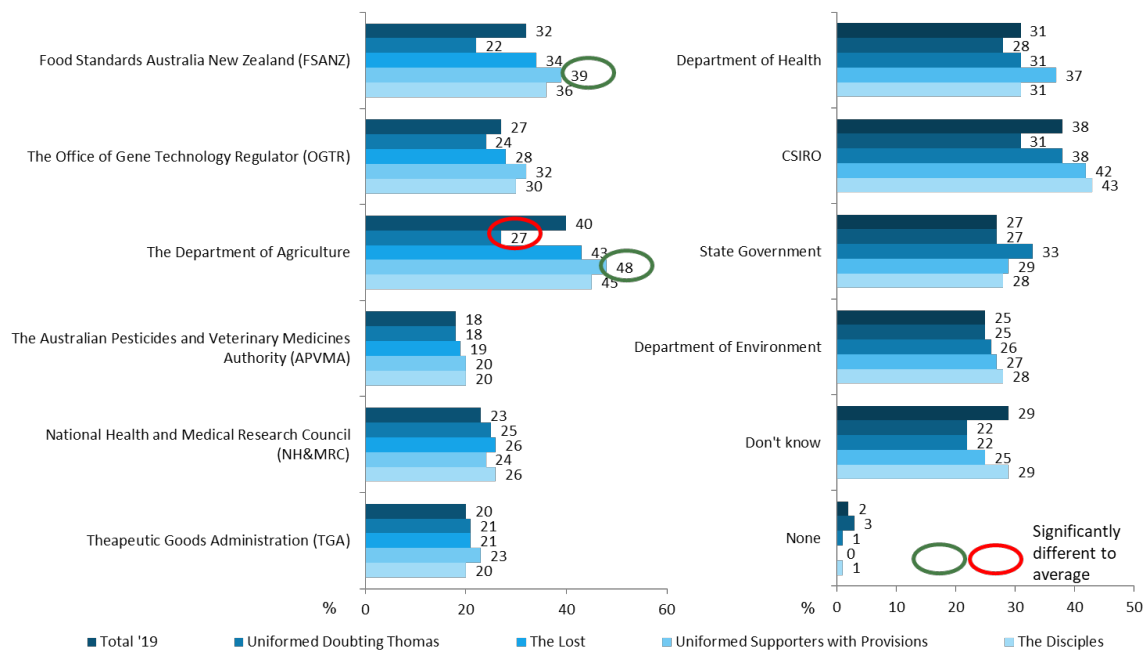
Q6a. On a scale of 0 – 10, where 10 is strongly agree and 0 is strongly disagree, please indicate how you agree or disagree with the following statements. Mean scores have been charted

Base: Total sample n=1248; Uninformed Doubting Thomas n=133; The Lost n=353; Uninformed Supporter with Provisions n=420; The Disciples n=194

The uninformed supporters with provisions were more aware of Food Standards Australia New Zealand and of the Department of Agriculture (39% and 48% respectively), whilst the Sceptics were least likely to have heard of the Department of Agriculture (27%).

Awareness of OGTR hovered around the average of 27% across the different value segments (ranging from 24% to 32%).

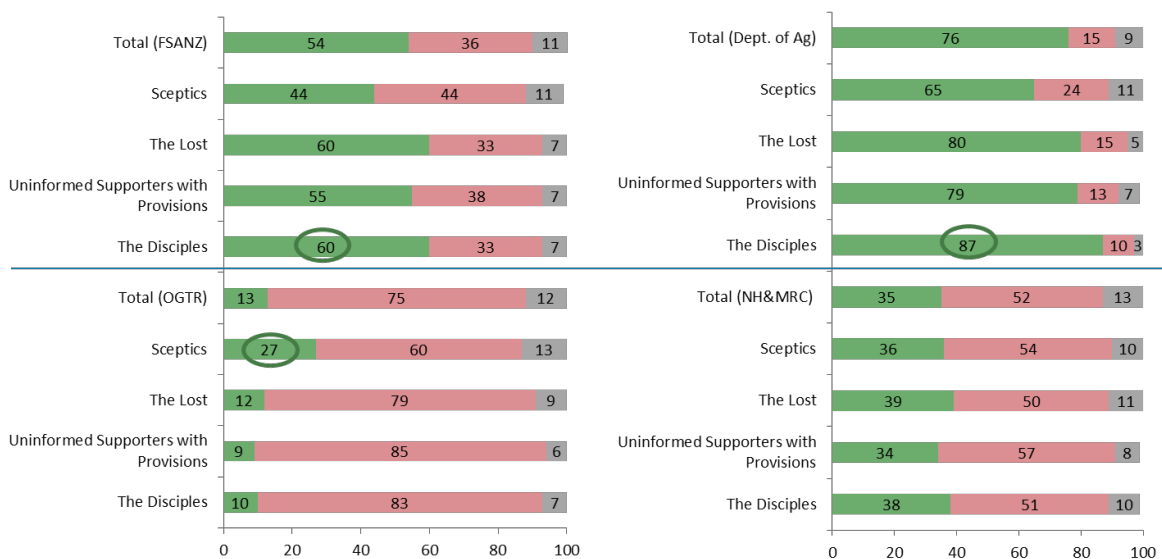
Figure 52: Awareness of organisations responsible for regulation of GM - by values segments

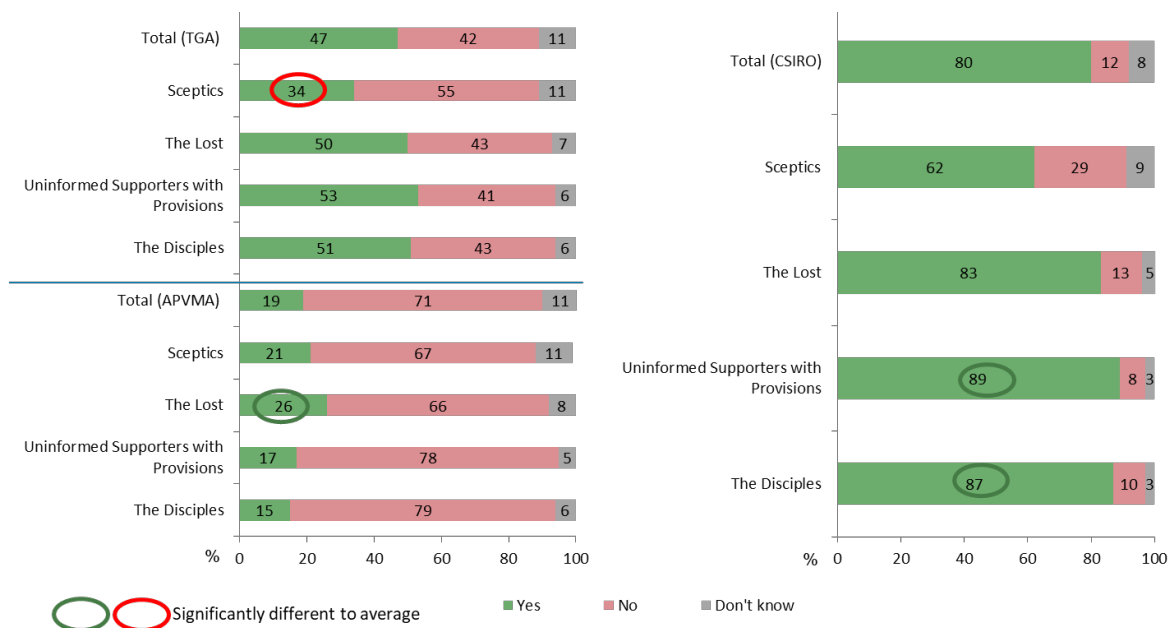


Q17. Which organisation or organisations do you believe are responsible for the regulation of genetic modification in Australia?
Base: Total sample n=1255; Uninformed Doubting Thomases n=165; The Lost n=199; Uninformed Supporter with Provisions n=388; The Disciples n=391

The Disciples are more likely to have heard of FSANZ, the Department of Agriculture and CSIRO before taking the survey, whilst the Sceptics were more likely to have heard of OGTR before taking the survey.

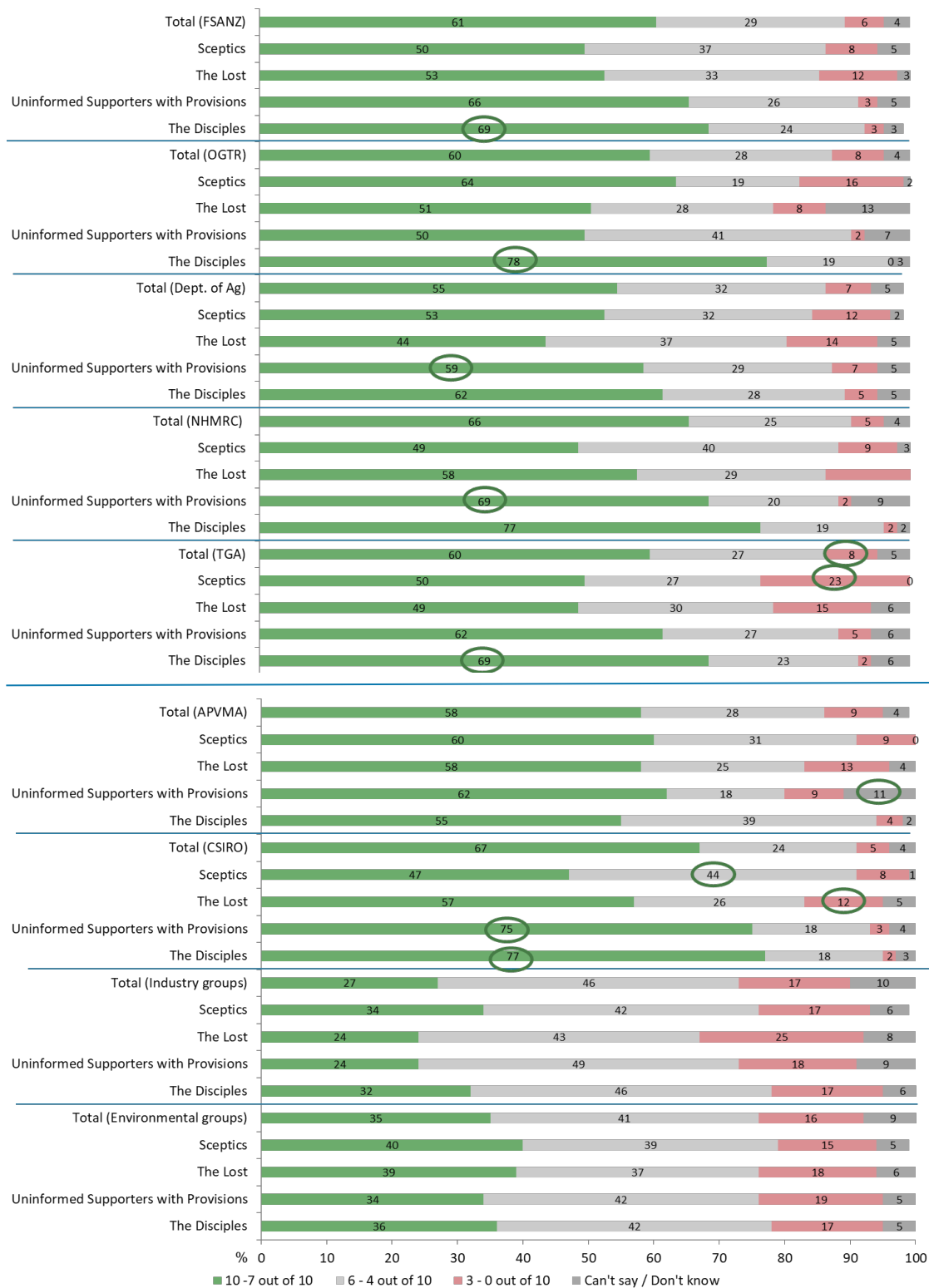
Figure 53: Familiarity with organisations responsible for gene technology in Australia - by values segments





The Disciples have more trust in what FSANZ, OGTR, NHMRC, TGA and CSIRO say than any other segment.

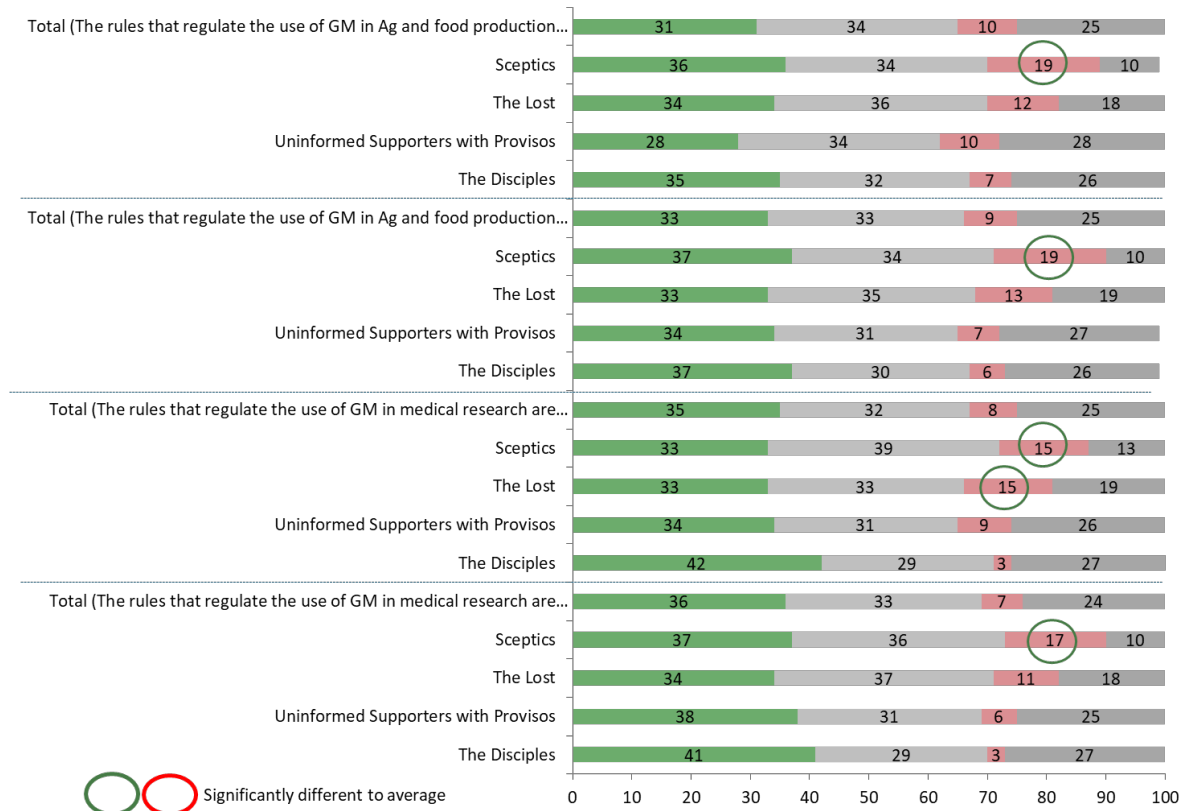
Figure 54: Trust in what organisations say about gene technology - by values segments



Q19. On a scale of 0 to 10, where 10 is trust completely and 0 is do not trust at all, please indicate how much trust you place on what these organisation tell you about the risks and benefits of genetic modification or gene technology.

Base: Total sample n=1255; Uninformed Doubting Thomas n=165; The Lost n=199; Uninformed Supporter with Provisions n=388; The Disciples n=391

Figure 55: GM rules and regulation and whether they are rigorous and complied with - by value segments



Q20. The government sets rules that regulate the use of genetic modification and other biotechnologies. On a scale of 0 to 10, where 10 is strongly agree and 0 is strongly disagree, please indicate how strongly you agree or disagree with the following statement

Base: Total sample n=1255; Uninformed Doubting Thomas n=165; The Lost n=199; Uninformed Supporter with Provisions n=388; The Disciples n=391

6. Conclusions

- Looking at the general trend, it is essentially unchanged over four years, with attitudes moving more to the middle, and an increase in those who don't know over 2015 (Figure 3).
- There has been very little change in attitudes to GM foods over the past two years, compared to the scale of change in previous studies, with slight increases of support for gene technology (Figure 2).
- Tracking data back over 20 years it is possible to see that the general rise and falls of support for different applications of gene technology tend to align with general paradigm changes, such as pro-environment support, or rises in risk concerns. (Figure 19)
- The current general mood in Australia is one of tolerating pessimism, which has seen a small rise in support for new technologies coupled with a drop in trust in most government agencies – reflecting global drops in trust.
- There was a drop of awareness of gene technologies and biotechnology, and continued high levels of wrongly stating what crops might be GM in Australia (Corn, Wheat and Tomatoes for example). This correlates with a general drop in coverage of GM issues in the media, and the relatively high don't know and not sure responses. (Figure 23)
- The data also indicates that knowledge and awareness of GM issues is generally 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.
- GMOs appear to be a low-level issue with most people, and they gather information on it as part of a general media diet, predominantly passively through watching TV. 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, and a diminishing of the impact of total media.
- Support or rejection of GM crops is still highly conditional, with only 13% of the population so against GM foods that they would never change their stance. Data also showed this group had low levels of trust, and more extreme attitudes to industrialisation of agriculture than other groups. (Figure 3)
- Data indicates that increasing a person's awareness of regulation and regulators of gene technology may have a small but positive impact upon their support for GM, but possibly more importantly it could have a significant impact on moving people into more positive conditional groups.
- There has been a gradual increase in those unsure about growing GM crops in their State or Territory to 32%. (Figure 26)

- 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.
- A stronger understanding of public values that drives attitudes, allows for an increased understanding of not just the diversity of public opinion, but how distinctly-framed messages can appeal to different segments of the public by aligning with their values.
- Amongst the key messages that will most resonate with the sections of the public receptive to messages about regulation is: Regulation Makes it Safe
- A deeper understanding of the segments of the public and their values and attitudes allows for an alignment of communication with different communication needs.
- The findings of this study counter the simplistic narratives favoured by politics and the media and lay a strong foundation for better engaging with the public, by better understanding the factors that influence people's attitudes towards GMOs, and through aligning discussions with these factors, can lead to a better level of engagement about how GMOs are regulated and used in this country.

7. Appendix 1 – Sample profile

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

Aboriginal or Torres Strait Islander origin	n=	%
Total Sample	1248	100
Yes	60	5
No	1188	95

Children under age of 10 living in household	n=	%
Total Sample	1248	100
Yes	317	25
No	931	75

Highest level of education	n=	%
Total Sample	1248	100
No formal schooling	6	0
Primary school	13	1
Some high school	77	6
Year 10/4th Form or equivalent	88	7
Year 11/5th Form or equivalent	33	3
Year 12/6th Form or equivalent	180	14
Technical school, commercial college or TAFE	343	27
University degree or diploma (undergraduate or postgraduate)	504	40
Other	4	0

Gender	n=	%
Total Sample	1248	100
Male	593	48
Female	655	52

Age	n=	%
Total Sample	1248	100
16 – 17 years old	1	0
18 – 20 years	44	4
21 – 30 years	240	19
31 – 40 years	279	22
41 – 50 years	207	17
51 – 60 years	180	14
61 – 70 years	226	18
71 – 75 years	71	6

Non-English language spoken at home	n=	%
Total Sample	1248	100
Yes	171	14
No	1077	86

Land ownership and farming	n=	%
Total Sample	1248	100
A landholder who derives most of my income from primary production (farming)	64	5
A landholder who derives some of my income from primary production (farming)	41	3
A landholder who undertakes hobby farming	39	3
None of the above	1104	88

Employment	n=	%
Total Sample	1248	100
Employed full time	448	36
Employed part time	248	20
Retired or Pensioner	253	20
Home duties	143	11
School or secondary student	7	1
TAFE or university student	47	4
Unemployed	83	7
Other	41	3
Prefer not to say	9	1

State of residence	n=	%
Total Sample	1248	100
Sydney	228	18
Elsewhere in New South Wales	101	8
Melbourne	186	15
Elsewhere in Victoria	80	6
Brisbane	141	11
Elsewhere in Queensland	68	5
Adelaide	74	6
Elsewhere in South Australia	42	3
Perth	81	6
Elsewhere in Western Australia	33	3
Hobart	51	4
Elsewhere in Tasmania	22	2
Canberra/ACT	71	6
Darwin	50	4
Elsewhere in Northern Territory	20	2

Sample sizes and margins of error for the 2019 sample are summarised below:

	Sample achieved	Margin of error (95% CI)
Total	1248	+/- 2.77%
NSW	329	+/- 5.40%
VIC	266	+/- 6.01%
QLD	209	+/- 6.78%
SA	116	+/- 9.10%
WA	114	+/- 9.18%
TAS	73	+/- 11.47%
Canberra/ACT	71	+/- 11.63%
NT	70	+/- 11.71%

8. References

- Akin, H., Rose, K., Scheufele, D., Simis-Wilkinson, M., Brossard, D., Xenos, M. & Corley, E. (2017), Mapping the Landscape of Public Attitudes on Synthetic Biology, *Bio Science*, Volume 67, Issue 3, pp. 290–300.
- Bauer, M.W., Allum, N., Miller, S. (2007) What can we learn from 25 years of PUS survey research? Liberating and expanding the agenda. *Public Understanding of Science* 16, 79-95.
- Biotechnology Australia. (2003). "Biotechnology Public Awareness Survey Final Report."
- Biotechnology Australia, (2005) Public Awareness Research 2005 Overview.
- Biotechnology Australia (2007) "Community Attitudes to Biotechnology. Report on overall perceptions of biotechnology and general applications."
- Bray, H. And Ankeny, R. (2017), Perceptions of genetically modified food are informed by more than just science, *The Conversation*, February 16.
- Cormick, C., (2007), Public Attitudes Towards GM Crops and Foods, *Agricultural Science*, Volume 21, No 2.
- Cormick, C., Romanach, L., and Craig, O. (2017), Searching for the Holy Grail: untangling the complexity of public attitudes towards agricultural biotechnology, *International Journal of Biotechnology*, 10.1504/IJBT.2017.10004752.
- Department of Industry, Innovation, Science, Research and Tertiary Education (2013), *Community attitudes towards emerging technology issues – Biotechnology*,
- Fernbach, P.M., Light, N., Scott, S., Inbar, Y.& Rozin, P. (2019) Extreme opponents of genetically modified foods know the least but think they know the most, *Nature Human Behaviour*, volume 3, pp. 251–256.
- Funk, C., and Kennedy, B., (2016), *The New Food Fights: U.S. Public Divides Over Food Science*, Pew Research Centre.
- Gaskell, G., Allum, N., Bauer, M., Durant, J., Allansdottir, A., Bonfadelli, H., et al. (2000). Biotechnology and the European public. *Nature Biotechnology*, 18(9), 935e938.
- Gaskell, G., Stares, S., Allansdottir, A., Allum, N., Corchero, C., Fishler, C., Hampel, J., Jackson, J., Kronberger, N., Mejlgaard, N., Revuelta, G., Schreiner, C., Torgersen, H., Wagner, W., (2006) *Europeans and Biotechnology in 2005: Patterns and Trends - Eurobarometer 64.3. A report to the European Commission's Directorate-General for Research.*

Hossain, F., Onyango, B., Schilling, B., Hallman, W., Adelaja, A. (2003) Product attributes, consumer benefits and public approval of genetic modified foods. *International Journal of Consumer Studies* 27, 353-365.

Kantar for the European Union, Special Eurobarometer - April 2019 “Food safety in the EU” Report.

Lyndhurst, B. (2009), An Evidence Review of Public Attitudes to Emerging Food Technologies, Social Science Unit, Food Standards Agency.

McPhetres, J., Rutjens, B., Weinstein, N., & Brisson, J. (2019), Modifying attitudes about modified foods: increased knowledge leads to more positive attitudes, *Journal of Environmental Psychology*, Volume 64, pp. 21-29.

van Mil, A., Hopkins, H. & Kinsella, S. (2017), Potential uses for genetic technologies: dialogue and engagement research conducted on behalf of the Royal Society, Royal Society.

Mohr, P., Harrison, A., Wilson, C., Baghurst, K. & Syrette, J. (2007), Attitudes, values and socio-demographic characteristics that predict acceptance of genetic engineering and applications of new technology in Australia, *Biotechnology Journal*, Volume 2, 1169-1178.

Qin, W., Brown, J.L. (2007) Public reactions to information about genetically engineered food: effects of information formats and male/female differences. *Public Understanding of Science* 16, 471-488.

Rollin, F., Kennedy, J. & Wills, J. (2011) Consumers and new food technologies, *Trends in Food Science & Technology*, V 22, Issue 2-3, pp 99 – 111.

Shew, A., Nalley, L., Snell, H., Nayga Jr, R. & Dixon, B. (2018) CRISPR versus GMOs: Public acceptance and valuation, *Global Food Security*, Volume 19, December, pp, 71-80.

Siegrist, M. (2000) The Influence of Trust and Perceptions of Risks and Benefits on the Acceptance of Gene Technology. *Risk Analysis* 20, 195-204.