Community attitudes to gene technology

October 2017

Prepared for	The Office of the Gene Technology Regulator
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Reference	J 2537

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1. Executive summary

The overall finding of the 2017 survey is that attitudes to GMOs have settled, mirroring very closely the results from the 2015 study, and not showing the degree of change seen between previous studies.

This does not mean that attitudes won't change rapidly if they are influenced by some external factors (for example, media coverage), but it does suggest that in the absence of such factors attitude changes will not be major.

There was little movement in awareness and understanding of GM issues and concerns.

Those strongly opposed to GMOs are about 13% of the population across different measures, and these respondents stood out as having more extreme attitudes to food and agriculture than any other group, as well as low overall trust.

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 differences in support for GMOs in medical (63%), industrial (55%), environmental (54%) and food and crops (38%).

Those who supported the growing of GM crops in their state or territory and those who were opposed to it were even at 36%, and with 28% unsure. The *don't know* or *unsure* ratings were high across most questions.

Segmenting the audience into four groups based on their support for GM foods, almost half the respondents were open to the production of GM food as long as regulations were in place to make sure it was safe. About a quarter were against the production of food this way until the science could prove it was safe.

While awareness of the Office of the Gene Technology Regulator (OGTR) has reduced slightly, 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, transparent testing, long-term effects and impacts on 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. The number one source stated was a general Google search. However looking at trust in information sources saw TV documentaries and friends and family ranked the highest, followed by Wikipedia. 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.
- As has repeatedly been shown in previous studies, people have different attitudes towards different genetic modifications, and there is more support for modifications that are perceived to be less radical.
- Awareness of whether GM crops were grown in a respondent's state was generally not high, varying between 14% and 35% correctly stating whether or not GM crops were grown in their state.
- Those organisations thought to be regulators of GM were the Department of Agriculture and Water Resources (40%), CSIRO (36%), the Office of the Gene Technology Regulator (31%), the Department of Health (31%), Food Standards Australia New Zealand (30%), state governments (28%), the National Health and Medical Research Council (23%), the Therapeutic Goods Administration (22%), and the Australian Pesticides and Veterinary Medicines Authority (16%).
- When asked about the rules and regulations relating to GM and whether they were sufficiently rigorous and complied with, there was majority agreement but also a significant number of *don't know* responses (28% *don't know* for both rules and regulations being sufficiently rigorous, and for being complied with).
- Most respondents (71%) felt that biotechnology would improve our way of life in the future, while only 46% felt that GMOs would improve our way of life in the future.
- Although only 43% of people had any awareness or knowledge of synthetic biology, there was significant support for it (once given a definition) with 62% of respondents stating they felt it would improve our way of life in the future.
- More than half the respondents (56%) stated they were aware of gene editing and 57% thought it might improve our way of life in the future, but 17% thought it might make things worse. Gene editing received quite high acceptance (42%) relative to other techniques, when asked about *making a small change to an existing gene within a plant, as is done in gene editing.*

The findings of this study lay a strong foundation for better engaging with the public. They provide a clear understanding of the factors that influence people's attitudes towards GMOs and how, by aligning communications with these factors, OGTR should be able to achieve a better level of engagement in how GMOs are regulated and used in this country.

Contents

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.

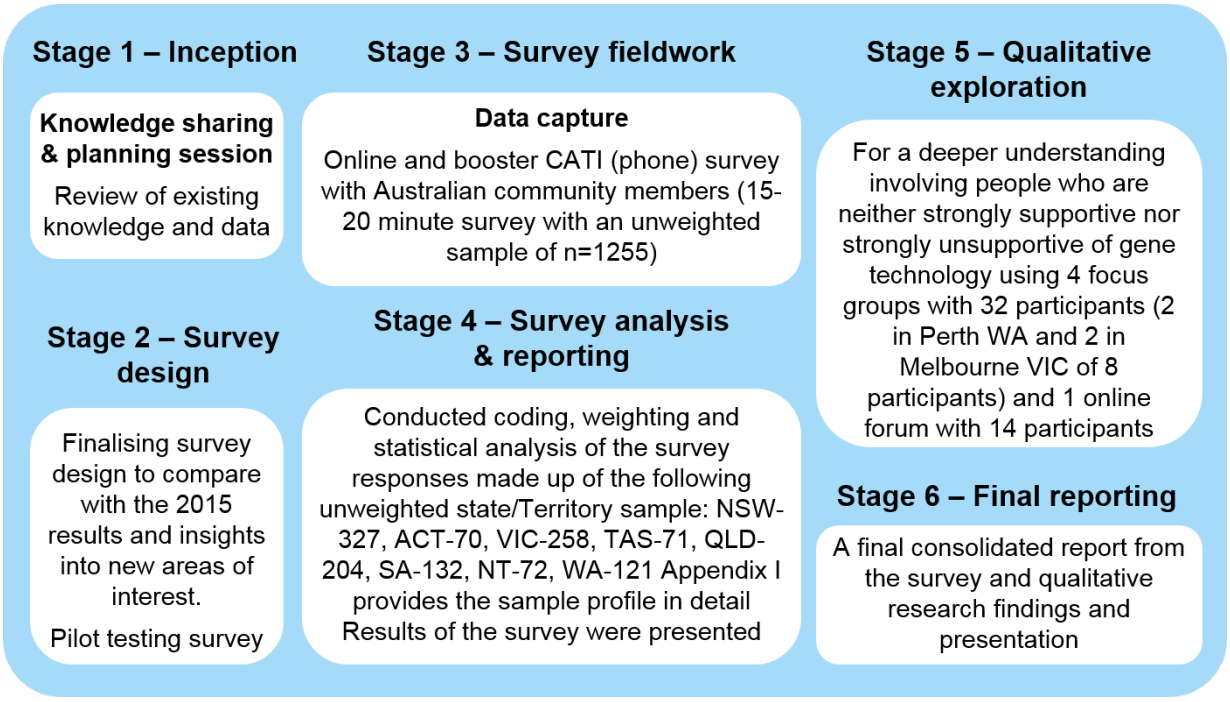
Objectives

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

The 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.

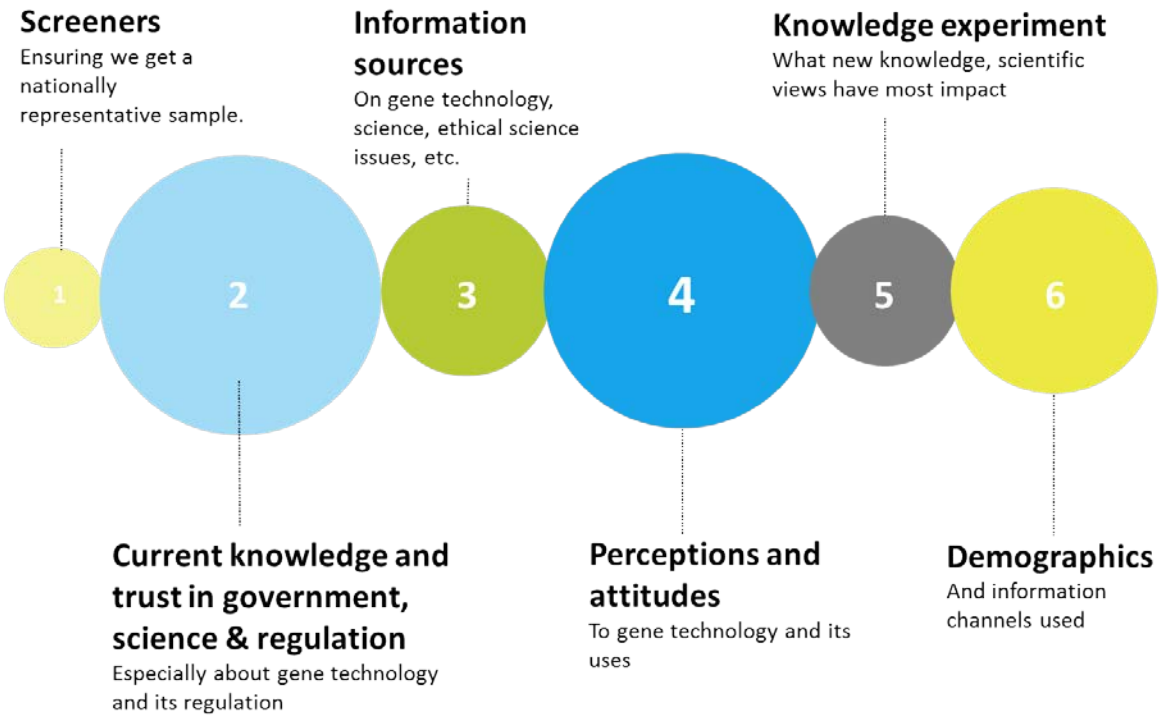
Survey methodology was agreed upon, replicating the survey methodologies of previous years and eliminating the impact of externalities.

Instinct and Reason undertook a literature review to update from the review undertaken in 2015 and to inform the 2017 survey and qualitative research.

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 15 minute survey was completed in June 2017 using an online survey and with booster CATI (phone) interviews to ensure a nationally representative sample of 1255 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 50:50 with 622 males and 633 females and represented a similar age profile to that of the 2015 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-327, ACT-70, VIC-258, TAS-71, QLD-204, SA-132, NT-72 and WA-121. Appendix I provide 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 and significant differences are marked in the graphs and tables by a red circle.

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 – Qualitative exploration

Following review of the survey results, qualitative research was undertaken to gain a deeper understanding of why people responded in the way they did and what influences their attitudes towards gene technology.

The qualitative research was also undertaken in June 2017 involving a mix of adult Australians (by gender and age) who were neither strongly supportive nor strongly unsupportive of gene technology and comprised:

- four focus groups – two in Perth WA and two in Melbourne VIC with eight participants in each representing a total of 32 participants; and
- one online forum of 14 participants.

The qualitative research explored:

- Why people believed that certain crops were grown in their State, noting that cotton and canola are the only GMOs being grown in Australia and there are no GM fruit or vegetables grown or marketed in Australia
- The values that people say cause them to be against GM crops, including identifying if there is any difference in attitudes towards an organism created using gene editing and one achieved through a naturally occurring mutation, and any reasons behind differences in acceptance levels of different gene technologies
- Awareness and trust in the OGTR and other key groups, including environmental groups specifically and whether it is the whole sector or just a few prominent organisations.
- Where people obtain information from on GMOs and their level of trust in those sources, for example, does a source become trusted just because it is used a lot and what makes a source more trusted?

The key findings from the qualitative research have been incorporated into relevant sections of the report.

Stage 6 – 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 decrease in awareness of the key terms of biotechnology and genetic modification. Those who have heard of an application but know little about it are still the majority, except for synthetic biology and gene editing which both recorded very high *Have NOT heard of it* responses**.**

Understanding of the term biotechnology dropped a further two percentage points to 17%, however awareness of the term increased by 5%. When looked at together, understanding and awareness was 77% in 2017 compared with 74% in 2015. This is still a fall from 2012's high of 84%.

A clear majority of respondents felt that biotechnology would improve our way of life in the future (71%), which was up from both 2015 (69%) and 2012 (64%). There was also large support for synthetic biology, with 62% (up from 59% in 2015) stating they felt it would improve our way of life in the future. It is interesting to compare this to awareness of synthetic biology which was much lower, at only 43%. In addition, more than half of respondents (57%) indicated they thought gene editing would improve our way of life in the future.

Belief that GMOs and cloning of animals would improve our way of life in the future, however, remained static at 46% and 32% respectively, following drops from 2012.

Just over one quarter of respondents (26%) felt that GMOs would make things worse in the future, and a similar proportion felt that cloning of animals would make our life worse in the future.

The data shows that 13% are completely against gene technology and 10% are completely in favour of it. 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 31–50 being the least supportive.

Looking at the data by gender confirmed the general trend that males were more supportive of GM foods than females, with the exception of meat from animals fed GM stock feed and GM fruits and vegetables, where both had low support. Interestingly, males rated lower on support for GM fruit and vegetables (23% for males and 26% for females) although the difference was minimal.

Attitudes by states and territories

GM crops

Awareness of whether GM crops were grown in a respondent's state was generally not high, with only 29% indicating they were aware. This was a significant decline from 37% in 2015 and 44% in 2012, mirrored by significant increases in those who did not know from 49% in 2012 to 61% in 2017. This can best be explained by the general lack of media coverage of GM crops overall.

In addition to the decrease in those aware of commercial GM crops being grown in their state, there were substantial numbers still stating incorrectly that GM wheat (31%), corn (21%) and tomatoes (20%) were being grown.

Western Australia had the highest awareness of GM crops being commercially grown in that state (35%), while the Australian Capital Territory and the Northern Territory had the lowest awareness (both 18%). *Don't know* responses were 61% nationally and highest in the Australian Capital Territory (75%), Northern Territory (67%), Queensland (66%) and Tasmania (66%).

There was little overall movement in those in favour of growing GM crops in their states, with 36% in favour and 36% opposed. The highest support was in the Northern Territory with 49% support, and the lowest levels of support were in Victoria (30%) and Western Australia (34%).

While support for growing GM crops in a person's own state or territory has dropped over the last five years from 53% in 2012, 38% in 2015 to down to 36% in 2017, there was still a considerable number of people undecided with the *Don't know* response at 28%.

The key factors that would influence acceptance were if crops provided positive benefits for human health (51% of those opposed would change their position). If crops provided positive outcomes for the environment, 47% stated they would change their position. Passing stringent health regulations would lead to 42% changing their position, and if they enhanced economic competitiveness then 33% would change their position.

GM foods

The ACT showed the highest support for GM foods of all kinds, including willingness to consume products from GM animals (44% ranking it 7 to 10 on a Likert scale, +15% from sample average) but also the highest level of low support (37%. +4% from sample average). The ACT was the most strongly polarised of the states/territories. Across the other states, the highest levels of willingness to consumer products from GM animals were in South Australia (36% in the highest ranking, +7% from sample average), Tasmania (34%, +5%), and NSW (33%, +4%). Those rating the lowest level of willingness to consume products from GM animals were Victoria (36% in the 0 to 3 ranking, +3%), Queensland (36%, +3%) and Tasmania (35%, +2%).

Those states showing the highest levels of willingness to consume products from animals fed GM stock feed were the ACT (48% ranking it 7 to 10 on a Likert scale, +14% from sample average), NSW (39%, +5%), and Queensland (37%, +3%). Victoria was the least willing (35% giving a low 0 to 3 ranking of support, +4%), followed by Tasmania (34%, +3%), ans Queensland (33%, +2%).

The ACT was most willing to consume GM fruits and vegetables (46% giving it a 7 to 10 level of support, +12% from sample average). Other states high ratings were NSW (39%, +5%), NT (38%, +4%), Queensland (37%, +3%) and South Australia (37%, +3%). Those with low support were Western Australia (36%, +6%), Tasmania (35%, +5%), and Victoria (35%, +5%).

Beliefs about GM foods

Using a series of attitudinal statements, respondents were placed in one of four categories related to attitudes to GM food. Half the respondents 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. Thirteen per cent of respondents accepted that it was a safe way to produce food and 13% were opposed to the production of food this way and nothing was likely to change their mind. The remaining 24% stated that they were against the production of food this way until the science proved it was safe.

When the 13% 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, were very high users of Google for information, and generally had a position on most questions that was quite extreme compared to other groups.

The results show little change since 2015 among those most opposed to using GM technology to produce food, and those most accepting of it being a safe way to produce food. There was a slight movement in the other categories, with a drift away from those stating they were against the production of food this way until the science proved it was safe, towards those who were open to the production of food this way as long as the regulations were in place to make sure it was safe.

There was little change in the value placed on the different purposes of GM plants and food. Those objectives that rated most valuable were: drought resistance and healthier food (both 43%); pest-resistance (38%); to make the food cheaper (34%); ability to grow in salty soils and to make the food last longer (both 29%); frost resistance (28%); to make the food taste better (25%); to make plants herbicide tolerant (21%); and to make plants mature more quickly (20%).

There was also moderate to strong support for the value of removing allergens from food (68%) and removing allergens from pollen (64%). This was asked for the first time in 2017.

Awareness of organisations responsible for regulation of GM

Despite having a list to choose from, there was low awareness of organisations responsible for the regulation of GM in Australia, with a high *don't know* response of 27%. Those organisations most commonly believed to regulate GM were the Department of Agriculture and Water Resources (40%), CSIRO (36%), the Office of the Gene Technology Regulator (31%), the Department of Health (31%), Food Standards Australia New Zealand (30%), state governments (28%), the National Health and

Medical Research Council (23%), TGA (22%), and the Australian Pesticides and Veterinary Medicines Authority (16%).

Overall findings of awareness of the agencies that might be responsible for GM regulation were fairly similar to 2015, with increases for OGTR (from 25% to 31%), the Department of Health (from 24% to 31%), state governments (from 19% to 28%) and CSIRO (from 30% to 36%).

There was also a slight downward trend of awareness for other organisations—the largest being for the National Health and Medical Research Council (42% in 2015 down to 37% in 2017), TGA (54% down to 49%) and CSIRO (85% down to 79%).

There was a poor correlation between answers to who respondents felt were responsible for GM regulation and whether they had heard of it previously, with only the APVMA rating closely with 16% for being responsible for GM regulation and 14% stating they had heard of it previously.

The majority of agencies rated much higher for general awareness compared to being responsible for GM regulation. The largest gap was for CSIRO which 36% believed (incorrectly) was responsible for GM regulation but 79% having heard of it previously.

The OGTR stood out for having a higher response rate to being responsible for GM regulation compared to those who had heard of it previously (31% to 11%), probably because of its name.

Trust in what organisations say about gene technology

All the regulators and other organisations received quite high levels of trust from respondents on the information they might tell them about the risks and benefits of genetic modification or gene technology (spread between 53% and 70%). Industry groups and environmental organisations rated much lower for trust though, at 25% and 34%.

Movements in trust were mixed with rises for FSANZ (49% in 2012 to 56% in 2015 to 60% in 2017) and the Department of Agriculture and Water Resources (50% to 54% to 58%). The OGTR saw a fall in 2017 (61% to 72% to 62%) as did the NHMRC (62% to 66% to 65%) and the TGA (49% to 60% to 57%).

APVMA and CSIRO were only tested over the last two polls, and the CSIRO's trust increased from 66% to 70% and the APVMA decreased from 66% to 53%.

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.

That the rules regulating the uses of GM in agriculture and food production were sufficiently rigorous was agreed to by 29% on the top cohort on a Likert scale, and 42% were less sure (and 28%

did not know). That the rules regulating the uses of GM in medical research were sufficiently rigorous was agreed to by 34%, and 38% were less sure (27% didn't know).

Sources of information and trust in them

Google and television were the most cited as sources of information on GM. A general Google search was cited by 46% of respondents, followed by documentaries on television (42%), news stories on television (31%) and current affairs shows on television (29%). 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.

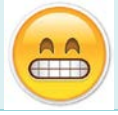
Comparing sources of information to their trust shows that information preferences and trust are not necessarily aligned. Overall there was little difference in trust of information sources, with TV documentaries, friends and family and Wikipedia rating 10% or more as trustworthy. There was a greater difference in lack of trust with social media and Facebook rating very poorly.

The most trusted medium for information was documentaries on television which 16% rated as very trustworthy and 64% as somewhat trustworthy (totalling 80%). This was followed by specific news websites (8% very trustworthy and 60% somewhat trustworthy, totalling 68%). The third most trustworthy source of information was news on the radio (6% very trustworthy and 58% somewhat trustworthy, totalling 64%).

Segmentation

In the 2012 study, the Department of Industry identified several values statements useful for defining values-based segments. These were used again in 2015 and 2017. A cluster analysis of responses to a series of statements produced four distinct attitudinal groups. Two of the segments (Segments 1 and 2) were less positive toward science and technology, while two segments (3 and 4) were more positive.

Segment profiles by gender, age and attitude

	Total	Uninformed Doubting Thomas	The Disengaged/ Lost	Uninformed Supporters with Provisos	The Disciples
					
Male	**50%**	55%	33%	53%	49%
Female	**50%**	45%	67%	47%	51%
16 - 30	**27%**	44%	21%	18%	30%
31 - 35	**38%**	37%	50%	31%	36%
51 - 75	**35%**	19%	28%	52%	34%
Support for GM food and crops	**10%**	8%	4%	14%	11%
Support for medical uses of GM	**24%**	8%	15%	31%	31%
Agree people should not tamper with nature	**13%**	32%	20%	1%	15%
Believe most fresh fruits and vegetables are GM	**23%**	38%	21%	21%	18%
Believe S&T create more problems than they solve	**26%**	65%	36%	12%	15%
Have heard of OGTR before	**11%**	22%	14%	9%	7%
Trust OGTR	**62%**	53%	43%	77%	72%
Most likely Google for information	**46%**	43%	47%	49%	53%

Qualitative findings

The qualitative research, conducted through focus groups and an online forum, found that knowledge and perceptions of what GM crops are grown in Australia (and specifically in people's own state or territory) is in most cases based on hearsay and guesses. There is a general assumption that the volume and range of GM crops is more prevalent than is the actual situation.

While some participants in the qualitative research knew or felt they knew that cotton and canola are the only GMOs being grown in Australia, and that there is no GM fruit or vegetables grown or marketed in Australia, most were surprised.

The reasons people think there are more GM crops grown than actually are include:

- They have heard stories and reports on GM crops in the media, movies and documentaries at different times and don't necessarily pay attention to or discriminate between whether it relates to something local and international (often assuming if it is occurring overseas it is happening or will happen here eventually).
- Seeing and reading information online and again not necessarily paying attention to or discriminating between whether it relates to something local or international.

- Assuming that seeing a range of foods with different traits is the result of the foods having been genetically modified (e.g. larger or smaller in size, seedless, less tasty etc), and
- They believe they have seen mentions of GM ingredients on the labels of food they buy.

Participants in the qualitative research were also asked if they thought most foods they bought (whether fresh or processed) were from, or have ingredients from GM crops. They were also asked if their perceptions on what is from, or has ingredients from GM crops, was influenced by it being fresh produce, processed food, certain types of processed food or if it was produced or packaged in Australia or in any particular countries overseas.

The findings were that the people largely over-estimated what foods might be GM, with a higher belief that processed foods would be GM. The reasons given included reports in the media, mentions in movies and documentaries, and also not discriminating between stories relating to Australia and overseas countries.

4. Literature review

GM crops have now been grown commercially for more than 20 years, and despite the rapid adoption of GM crops in many developed and developing countries, attitudinal surveys still tend to show that the public holds concerns about this technology (Legge & Durant, 2010; Cormick, 2007; Department of Innovation 2013, Funk and Rainie, 2015).

Despite two decades of scientific research finding no harm to people or the environment from GMOs, numerous public attitude studies indicate many people are still concerned enough to push for GMOs to be banned. However, at the same time there is strong support for GMOs that have the potential to cure disease. These seemingly conflicting views indicate that public attitudes are not based on the science, and so concentrating on explaining the science does little to address public concerns.

Over the past twenty years methods of surveying public attitudes has become increasingly sophisticated, and can provide deeper insights in not just what the public think about the technology, but why. Early studies concentrated on knowledge as a driver of attitudes (Bauer, Allum et al, 2007), but this was soon overtaken by personal risk-benefit perceptions and trust (Lyndhurst, 2009; Biotechnology Australia, 2005; Gaskell et al., 2006; Hossain et al., 2003).

Multi-dimensional studies tend to show there is no one easily obtainable figure for public support or rejection of GM foods. Studies such as the ANU's study of beliefs and attitudes towards science, while on the face of it seeking simple percentages of support for eating GM foods (46.6% support and 39.6% opposed), does seek to show there is some nuance by comparing the findings with other technologies such as fracking and nuclear power, and also comparing Australian findings to those from the US (Lambert, 2017).

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).

Findings that there are higher levels of acceptance of some GM products compared to others has also been reported by Lusk et al (2004a), suggesting that GM products such as oil were more acceptable than GM meat. Other studies show that gene technology in animal production is less acceptable to the general public than it is in plant production (Department of Innovation, 2013).

In relation to values based choices, research in USA has shown that as people move towards healthy eating, they are more likely to be concerned about GM foods, basing their decisions on general food values (Funk and Kennedy, 2016). Surveys in EU countries have shown a wider diversity of findings, possibly due to the breadth of cultural and political differences across countries.

More recently, broad attitudes to complex new technologies have been shown to be generally not about the technology itself, but about how well the technology aligns with a person's world-view or values. For instance the Genetic Literacy Project in the USA found that US attitudes towards GMOs

are quite strongly influenced by education and gender, whereas attitudes to other contentious sciences such as climate change are driven more by political and religious views (Funk and Rainie, 2015).

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.

As Moon and Balasubramanian (2004) have pointed out, “the influence of cognitive factors in this area remains relatively unexplored, particularly in terms of how they can facilitate widespread acceptance of, and shape attitudes and risk perceptions about agro-biotechnology”.

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.

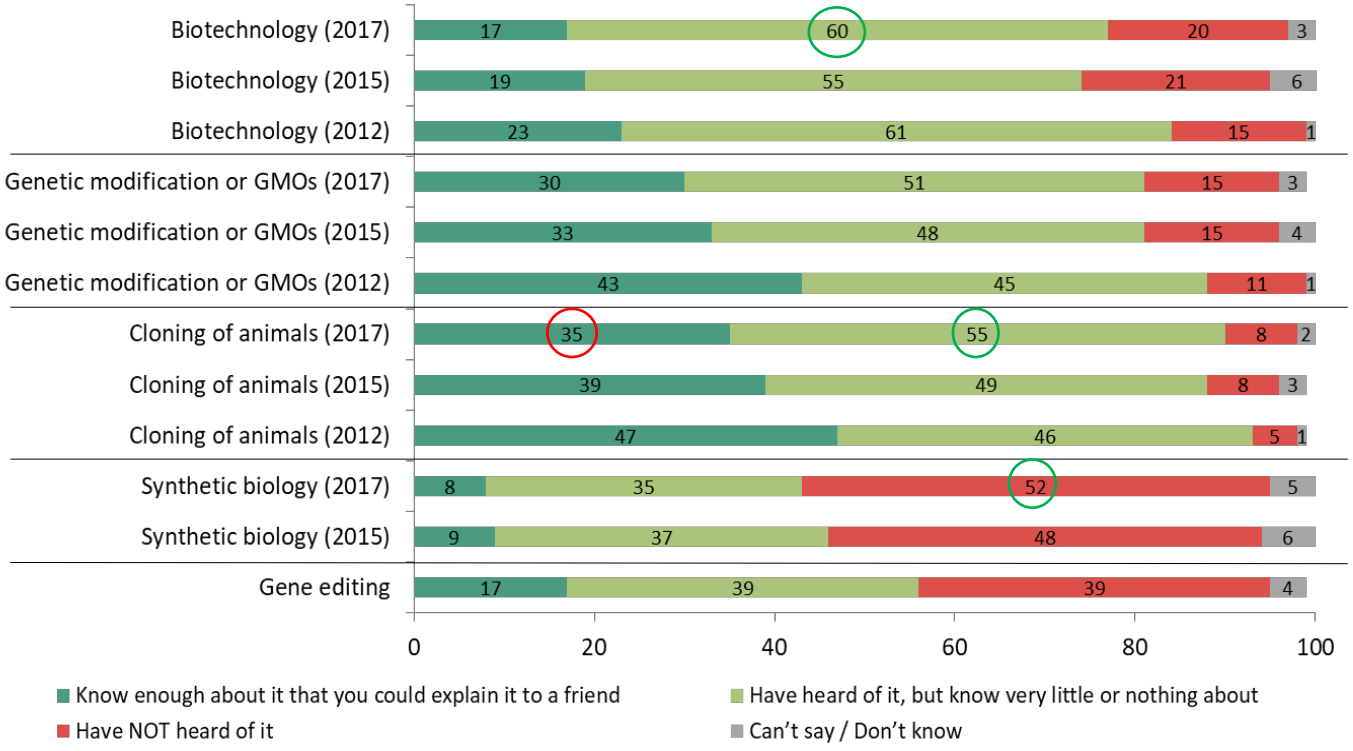
5. Key findings

Awareness and understanding of biotechnologies

The overall finding of the 2017 survey is that attitudes to GMOs have changed little from the 2015 study, suggesting that attitudes may have settled.

There has been little movement in awareness of the key terms of biotechnology and genetic modification. Those who have heard of an application but know little about it are still the majority, except for synthetic biology and gene editing, which recorded very high *Have NOT heard of it* responses.

Figure 1: Awareness and understanding of biotechnologies



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=1255*

Significant increase from 2015 Significant decrease from 2015

Understanding of the term biotechnology dropped a further two percentage points to 17%, however general awareness of the term increased by 5%.

When looked at together, understanding and awareness was 77% in 2017 compared with 74% in 2015. This is still a fall from 2012's high of 84%.

Those who said they had not heard of biotechnology remained fairly static at 20% (down from 21% in 2015, but a significant rise over 15% in 2012). Fewer than two out of ten respondents said they knew enough about biotechnology to be able to explain it to a friend.

While awareness of the term genetic modification or GMOs was much higher, it showed a continued downward trend with the number of those who felt they could explain it to a friend dropping from 43% in 2012, to 33% in 2015 and 30% in 2017. There was a comparable rise in those who said they had heard of it but knew very little or nothing about it (45% in 2012, 48% in 2015, and 51% in 2017).

This same trend was seen for the cloning of animals, with only 35% in 2017 saying that they knew enough about it to explain it to a friend (47% in 2012 and 39% in 2015).

Awareness of synthetic biology remained low, with only 8% stating that they could explain it to a friend and with another 35% stating that they had heard of it but knew very little about it. Those who had never heard of it rose from 48% in 2015 to 52% in 2017.

Gene editing, a relatively new application, rated better than synthetic biology with 17% of respondents stating that they could explain it to a friend, 39% stating that they had heard of it but knew little or nothing about it, and another 39% stating that they had never heard of it.

There were few differences (no significant differences) in awareness by gender, as shown in the table below.

Table 1: Awareness of GMOs

	Total	Males	Females
Have NOT heard of it	15%	16%	15%
Have heard of it, but know very little or nothing about	51%	49%	54%
Know enough about it that you could explain it to a friend	30%	32%	28%
Can't say / Don't know	3%	3%	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	Definition provided in 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.
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.

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

A clear majority of respondents felt that biotechnology would improve our way of life in the future (71%) which was up from both 2015 (69%) and 2012 (64%).

There was large support for synthetic biology, with 62% (up from 59% in 2015) stating they felt it would improve our way of life in the future. It is interesting to compare this to awareness of synthetic biology, which was much lower, at only 42%.

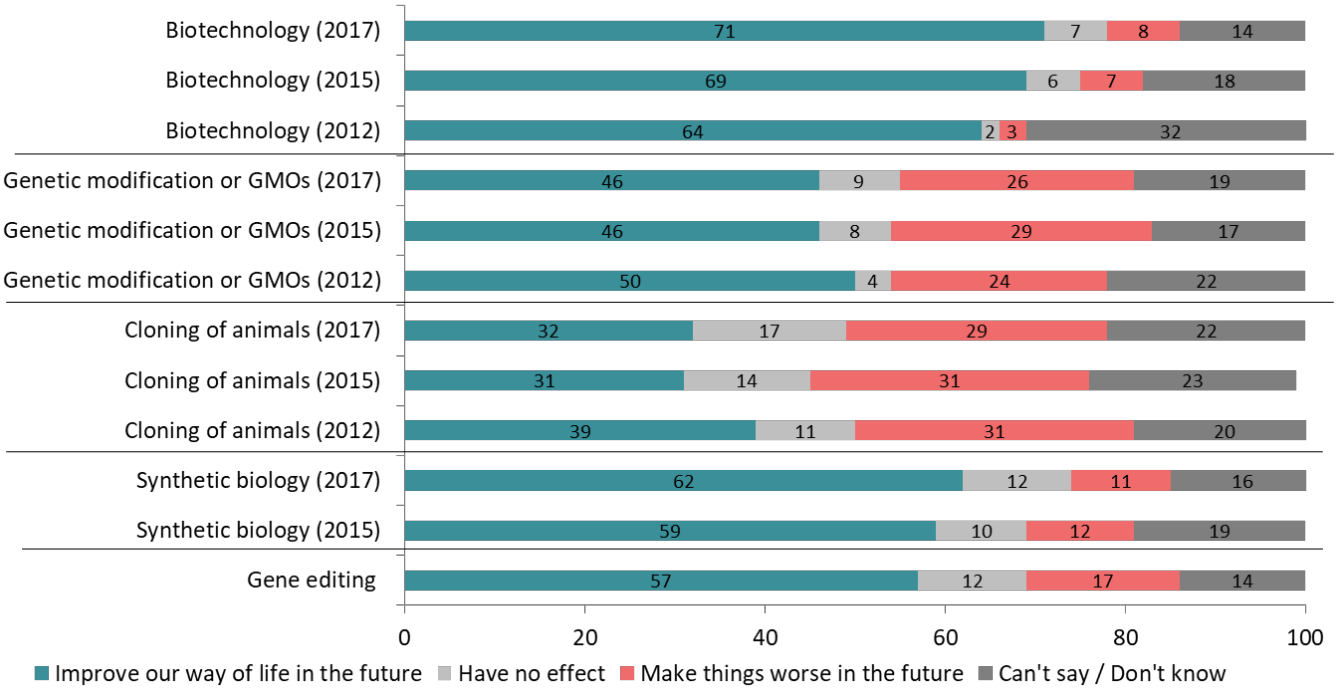
Gene editing also had more than half (57%) indicating it would improve our way of life in the future.

Belief that GMOs and cloning of animals would improve our way of life in the future, however, remained static at 46% and 32% respectively, following drops from 2012.

Almost one quarter felt that GMOs would make things worse in the future, and a similar proportion felt that cloning of animals would make our life worse in the future.

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. Males (46%, +5%) and people aged 16–30 years (46%, +7%) were significantly more likely to believe the GMOs would improve our way of life in the future.

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



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?

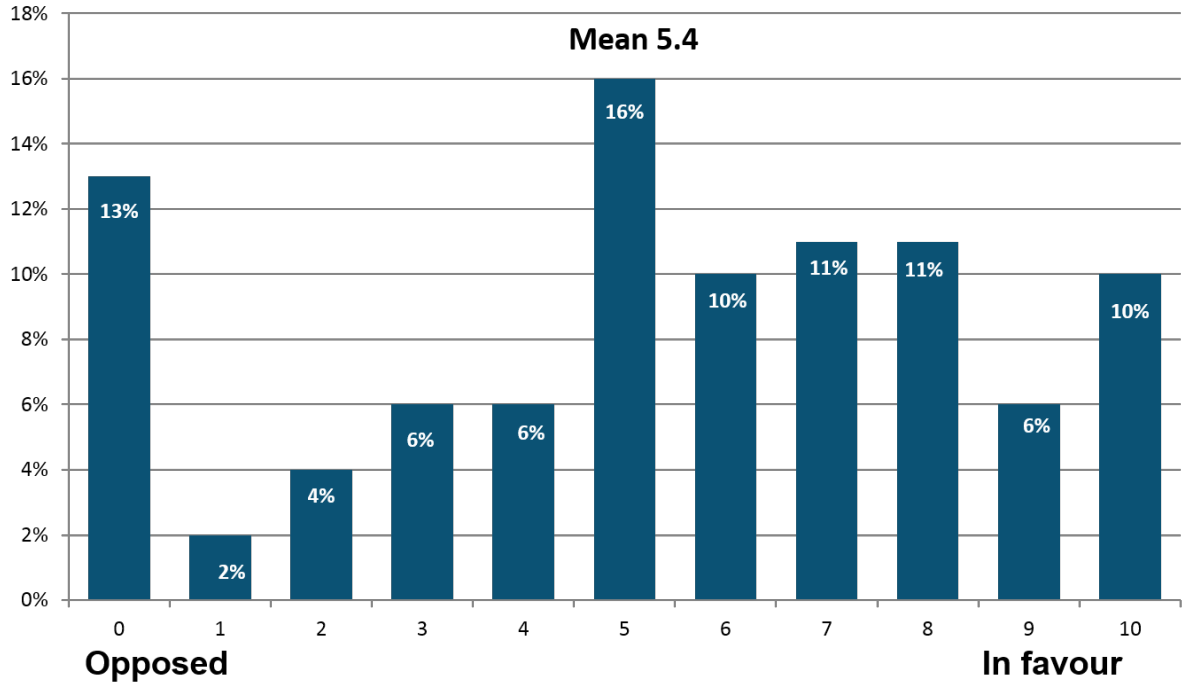
Base: *Total sample n=1255*

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 and 10% 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.

Figure 3: Support for gene technology in food and crops



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 n=1255*

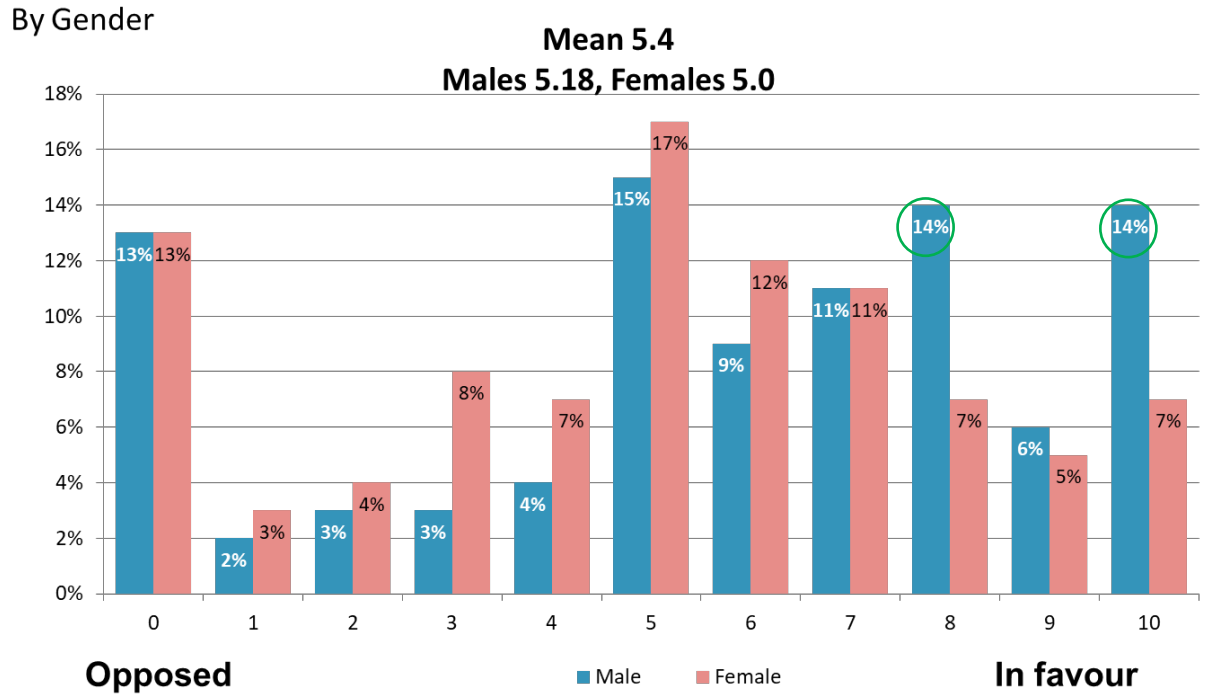
While levels of support for GMOs showed nuances across different applications, the mean level of support for GMOs in food and crops was 5.4, which is a slight increase from 2015's rating of 4.84, but a drop from the 2012 figure of 6.

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 (excluding the *can't say/ don't know* responses), representing those most in support, those in the middle and those with the least support.

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. Men were more likely to show high levels of support for gene technology generally (38%, +13%), for use in food and crops (38%, +8%), and for industrial use (55%, +4%). Green circle marker

Support for gene technology appears to decrease with age. Those in the 31-54 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 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.

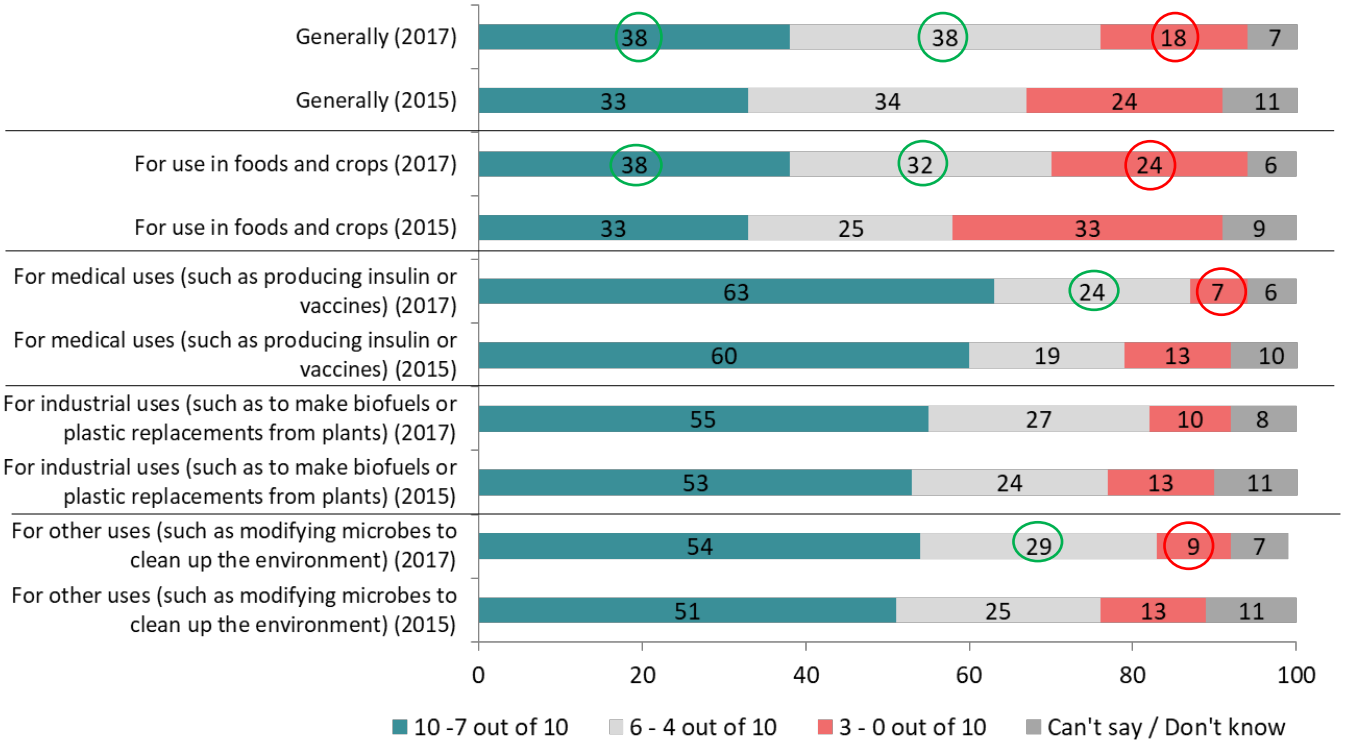
Base: *Total sample n=1255*

Significantly higher

One of the few differences between 2015 and 2017 was in the general level of support for GMOs and gene technology which slightly increased from 33% in the highest cohort of support to 38%. Those most opposed to GMOs and gene technology dropped from 24% to 18%. There was a similar direction of support for the use of GMOs in food and crops, with highest support rising from 33% to 38%, and those most against dropping from 33% to 24%.

Other responses tended to be more static, with relatively high support indicated for medical, industrial and environmental uses, 63%, 55% and 54% respectively. The largest gain was for environmental uses, with those most in favour rising from 51% to 54%, and those most opposed dropping from 13% to 9%.

Figure 5: Levels of support for GMOs and gene technology



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.

Base: *Total sample n=1255*

Significant increase from 2015 Significant decrease from 2015

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

The eight statements were:

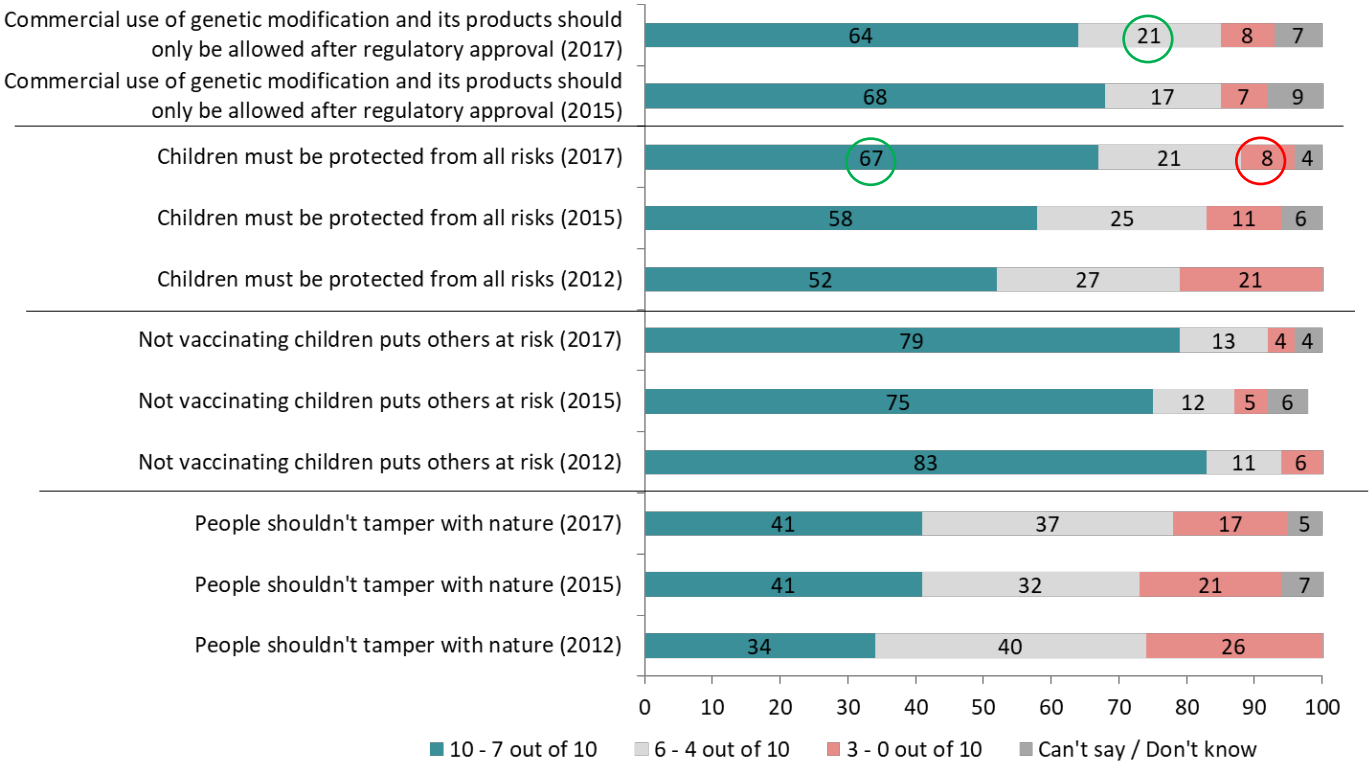
- Commercial use of genetic modification and its products should only be allowed after regulatory approval
- Children must be protected from all risks
- Not vaccinating children puts others at risk
- People shouldn't tamper with nature
- Scientific advances tend to benefit the rich more than they benefit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

Those statements that received the highest levels of support were *not vaccinating children puts others at risk* (79% of respondents ranking the highest level of support, up from 75% in 2015), and *commercial use of genetic modification and its products should only be allowed after regulatory approval* (64% of respondents ranking in the highest level of support, down from 68% in 2015). The next highest ranked support was for the statements *children must be protected from all risks* (67%, up significantly from the 2015 ranking of 58% and perhaps a reflection of general rises in risk concerns) and *technological change happens too fast for me to keep up with* (45% ranked in the highest level of support).

By contrast, those statements with the lowest support were *we rely too much on science and not enough on faith* (24% ranked the highest levels of support) and *science and technology creates more problems than it solves* (22% ranked the highest levels of support). There was also a significant drop among those who did not support the statement *we rely too much on science and not enough on faith (*dropping from 43% to 38% from 2015 to 2017), and *science and technology creates more problems than it solves* dropping from 37% to 29%.

Other statements received more evenly distributed responses, as outlined in the figure below (continued over page).

Figure 6: Attitudes towards science and technology

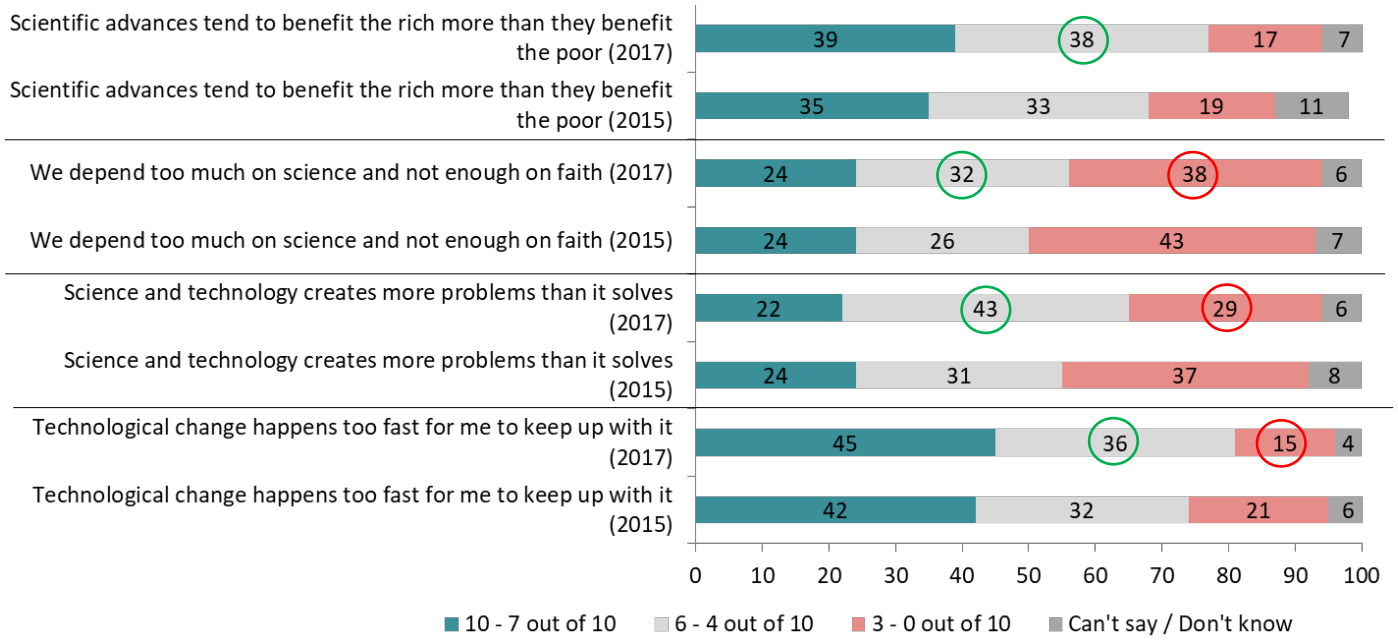


Q6 and Q24 combined. On a scale of 0 – 10, where 10 is strongly agree and 0 is strongly disagree, please indicate how you agree or disagree with the following statements.

Base: *Total sample n=1255*

Significant increase from 2015 Significant decrease from 2015

Figure 6 (continued): Attitudes towards science and technology



Q6 and Q24 combined. 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.

Base: *Total sample n=1255*

Significant increase from 2015 Significant decrease from 2015

Attitudes and beliefs

Confidence in food and the influence of GM on food consumption

To obtain more nuances from responses to supporting 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, in 2017 we saw several GM applications receive higher levels of support than for food produced with pesticides and preservatives.

This is an interesting finding. There is data showing how people's concern about buying foods containing preservatives and pesticides is not reflected in actual shopping data—the finding being in general that people's stated shopping preferences do not correlate strongly with actual shopping practices. If this is 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 3 – Ranking of Willingness to eat GM foods compared with those produced using pesticides and preservatives

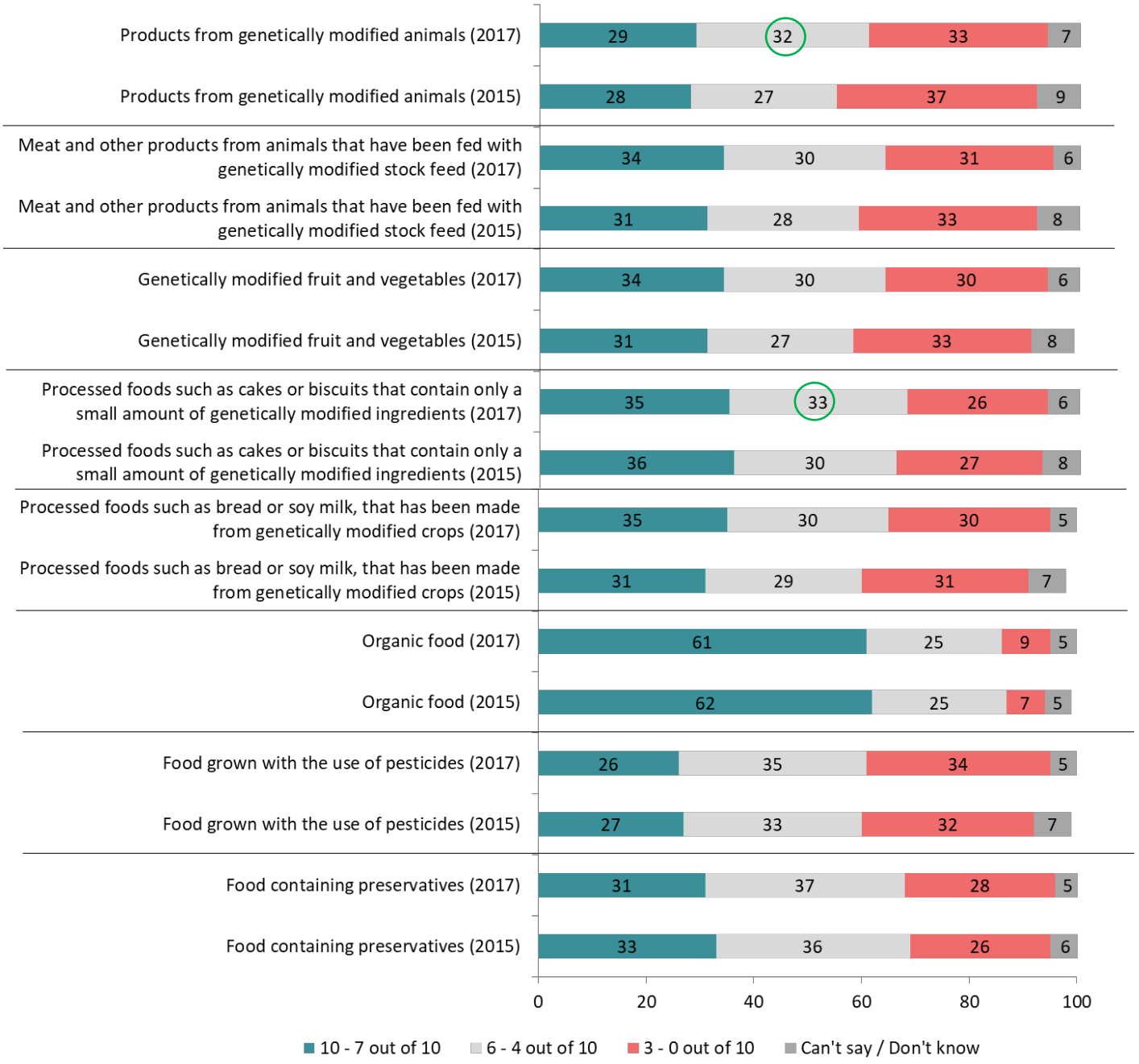
Processed foods such as cakes and biscuits that contain only a small amount of GM ingredients	35%
Processed foods such as bread and soymilk that has been made from GM crops	35%
Genetically modified fruit and vegetables	34%
Meat and other products from animals that have been fed GM stock feed	34%
Food containing preservatives	31%
Products from GM animals	29%
Food grown with the use of pesticides	26%

Table 4 – Ranking in the lack of Willingness to eat GM foods compared with those produced using pesticides and preservatives

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

Interestingly, 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 animals and meat and other products from animals that had been fed GM stock feed. The least concern (or lowest percentage of respondents not willing to consume) was for pesticides and preservatives, and processed foods such as cakes and biscuits that contained only a small amount of GM ingredients. This is shown in the following figure.

Figure 7: Willingness to eat GM food



Q7. Now we'd like you to think about food. On a scale of 0-10 where 10 is extremely willing and 0 is extremely unwilling, please indicate how willing you would be to eat the following

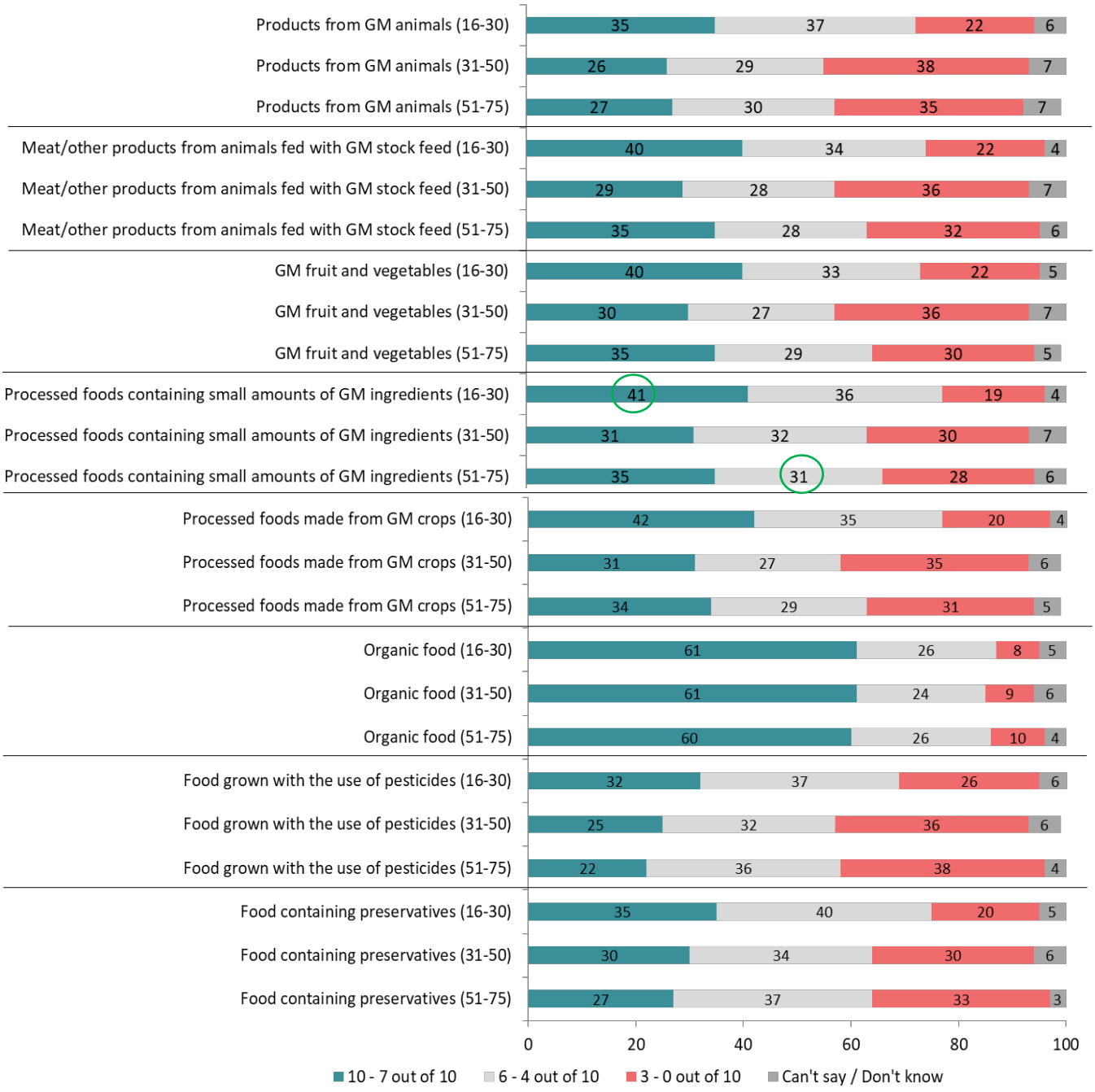
Base: *Total sample n=1255*

◯ Significant increase from 2015

Men and younger people were more likely to be prepared to eat genetically modified foods and those grown with pesticides and containing preservatives. Women and older people were less likely to be prepared to eat genetically modified foods, those grown with pesticides and those containing preservatives, but were more prepared to eat organic foods.

Data across age groups (clustered into three age cohorts, 16–30, 31–50 and 51–75), showed a general trend of younger people being more willing to consume GM foods of all kinds, and those aged 31–50 were less willing. Younger people were also more willing to eat food grown with pesticides or containing preservatives, while attitudes to organic food were static across all ages.

Figure 8: Willingness to eat GM food by age



Q7. Now we'd like you to think about food. On a scale of 0-10 where 10 is extremely willing and 0 is extremely unwilling, please indicate how willing you would be to eat the following

Base: *Total sample n=1255; 16-30 n=299, 31-50 n=488; 51-75 n=468*

Significant increase from 2015

Looking at the food rankings over three years shows some significant movements from 2012 and confirms the general flattening of movements since 2015. The greatest variation being a 4 percentage point rise for processed foods such as bread and soymilk that has been made from GM crops rising from 31% in 2015 to 35% in 2017.

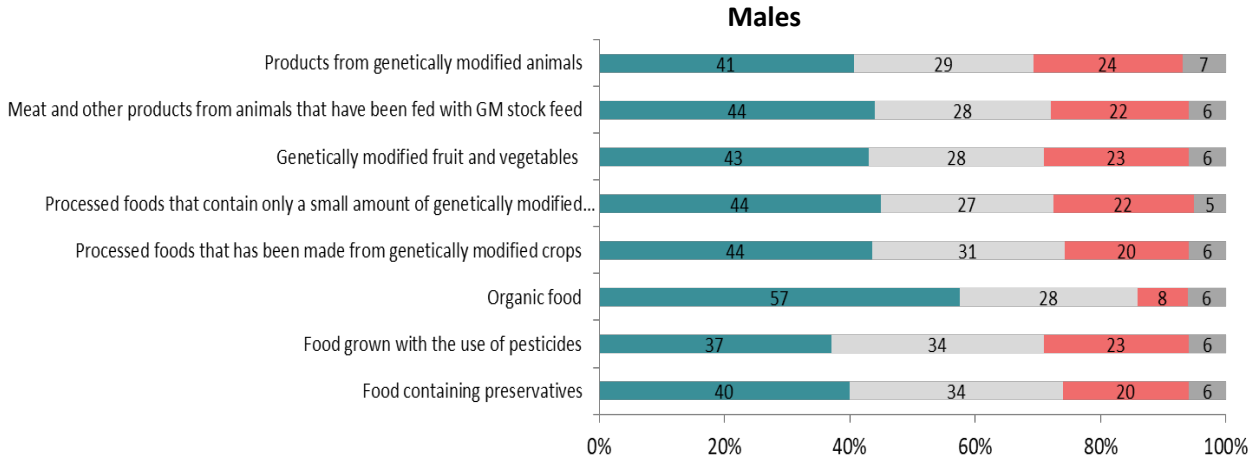
Table 5 – Ranking of Willingness to eat GM in foods between 2012 and 2015 and 2017

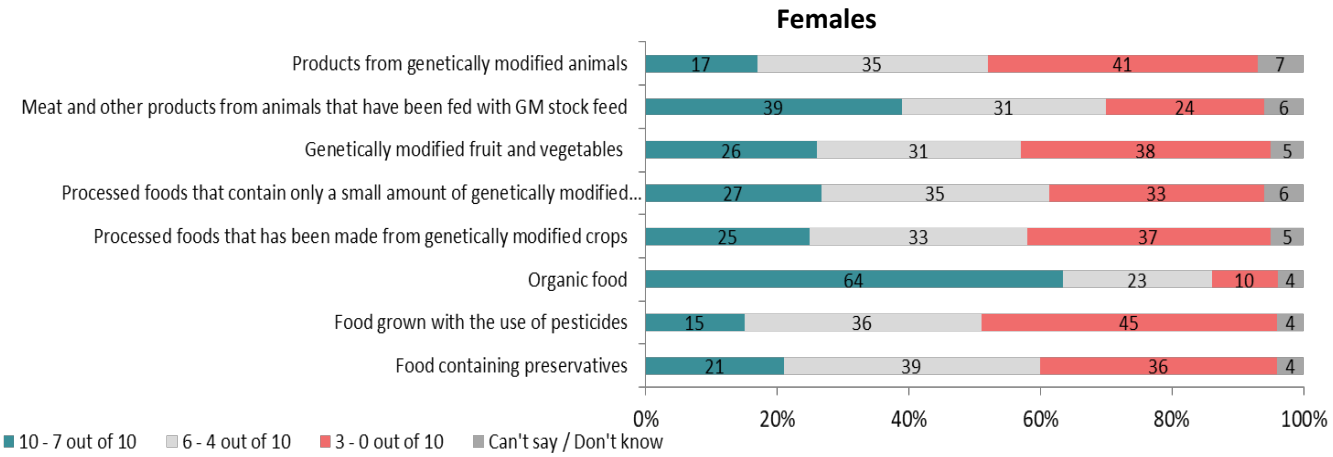
	2012	2015	2017
Processed foods such as cakes and biscuits that contain only a small amount of GM ingredients	33%	36%	35%
Food containing preservatives	28%	33%	31%
Meat and other products from animals that have been fed GM stock feed	39%	31%	34%
Genetically modified fruit and vegetables	38%	31%	34%
Processed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

Women's highest concern was for the use of pesticides in foods (45%) which outranked all GM food concerns. The use of preservatives in food, however, rated similar to other GM food concerns.

Figure 9: Willingness to eat GM food by gender



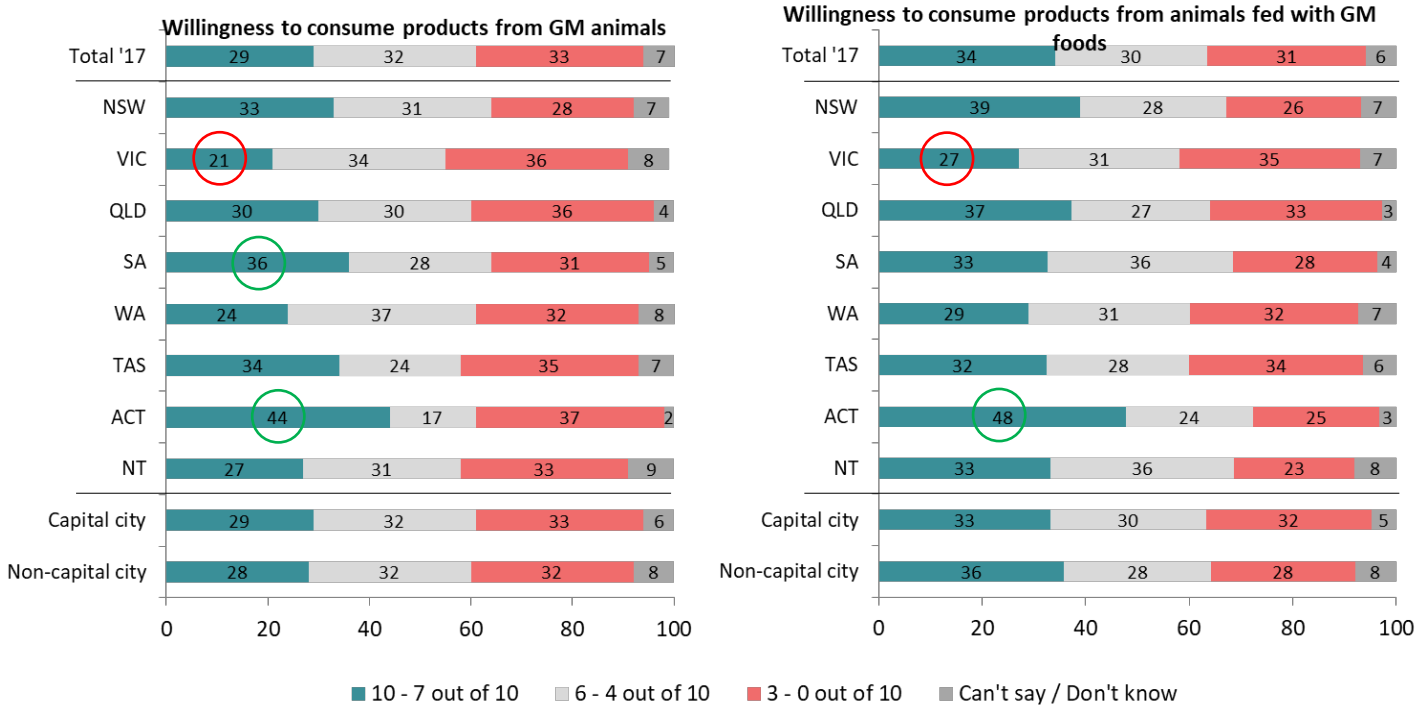


Q7. Now we'd like you to think about food. On a scale of 0-10 where 10 is extremely willing and 0 is extremely unwilling, please indicate how willing you would be to eat the following

Base: *Total sample n=1255; Male n=605; Female n-650*

Trends across the larger states showed that willingness to consume products from GM animals and animals fed GM foods was very mixed, with many states ranking highly in both willingness and reluctance. There was also little difference between capital and non-capital city ratings.

Figure 10: Willingness to eat products from GM animals – by state and territory



Q7. Now we'd like you to think about food. On a scale of 0-10 where 10 is extremely willing and 0 is extremely unwilling, please indicate how willing you would be to eat the following

Base: *Total sample (n=1255), NSW (n=327), VIC (n=258), QLD (n=204), SA (n=132), WA (n=121), TAS (n=71), ACT (n=70), NT (n=72), Capital City (n=904), Non-capital city (n=351).*

Significanty above average Significantly below average

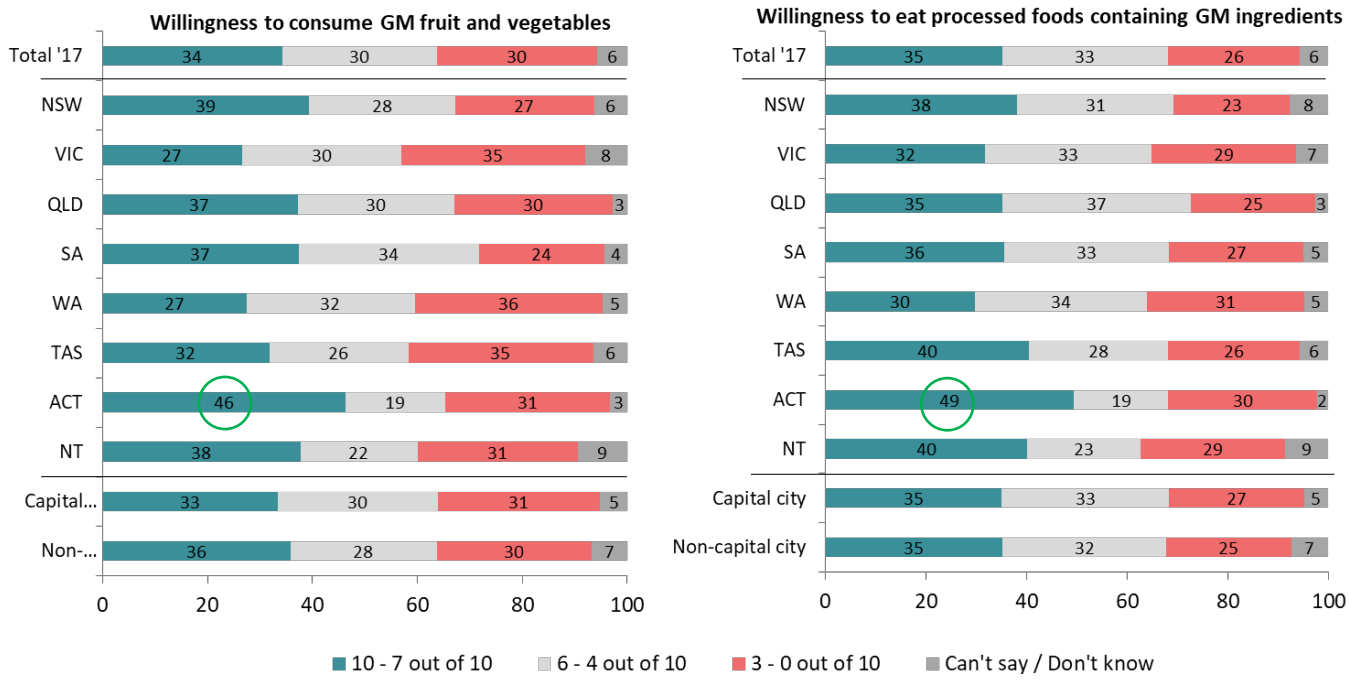
The highest levels of willingness to consume products from GM animals were from the ACT (44%), South Australia (36%), Tasmania (34%) and NSW (33%). Those states least willing to eat products from GM animals were the ACT (37%) were Victoria (36%), Queensland (36%) and Tasmania (35%).

Willingness to consume products from animals fed GM stock feed was comparable. Those states most willing were the ACT (48%), NSW (39%) and Queensland (37%): those least willing were Victoria (35%), Tasmania (34%) and Queensland (33%).

The data shows that it is possible for a state to have both very high willingness and very low willingness in a GM application, rating highly on both scales. However across all applications, NSW, Queensland and South Australia tended to show greater willingness than Victoria and Western Australia.

Looking at willingness to consume GM fruits and vegetables and willingness to consume processed food containing GM ingredients, the ACT had the highest levels of willingness at 46% and 49% respectively. Other states with high willingness in GM fruits and vegetables were NSW (39%), NT (38%), Queensland (37%) and South Australia (37%): those with least confidence were Western Australia (36%), Tasmania (35%), and Victoria (35%). Those states with the highest willingness to consume processed foods containing GM ingredients were ACT (49%), Tasmania (40%), NT (40%) and New South Wales (38%): those with the least willingness were Western Australia (31%), the ACT (30%) and Victoria (29%).

Figure 11: Willingness to eat products – by state and territory



Q7. Now we'd like you to think about food. On a scale of 0-10 where 10 is extremely willing and 0 is extremely unwilling, please indicate how willing you would be to eat the following

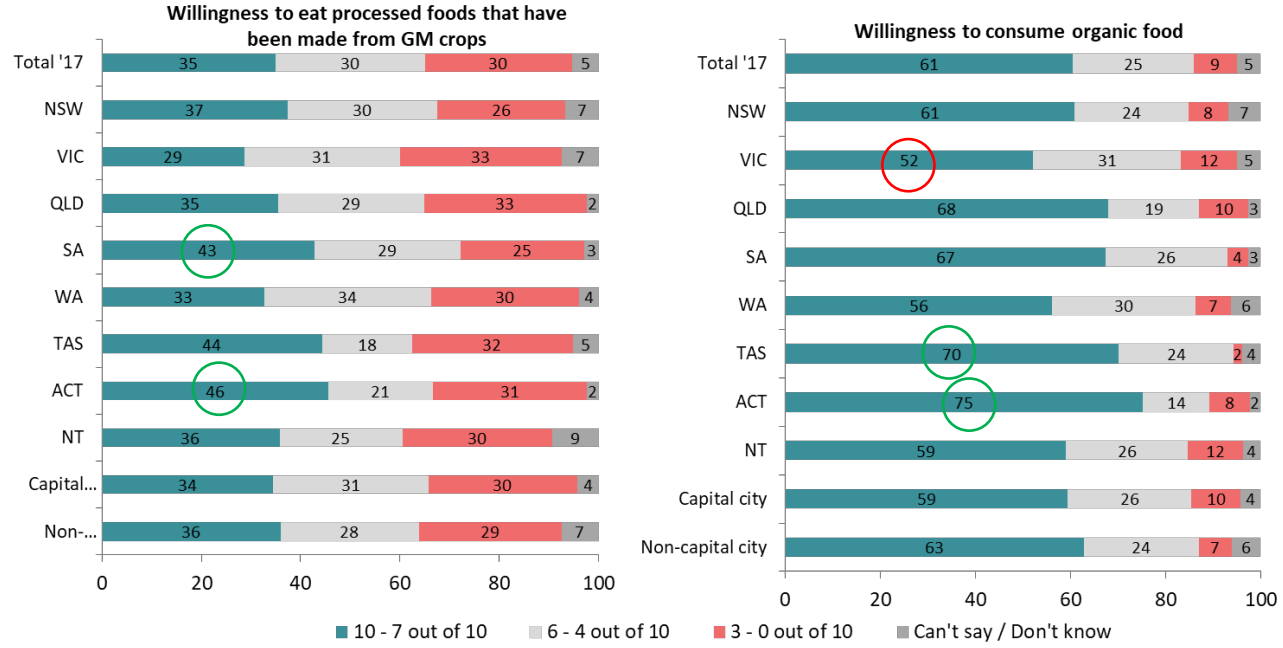
Base: *Total sample (n=1255), NSW (n=327), VIC (n=258), QLD (n=204), SA (n=132), WA (n=121), TAS (n=71), ACT (n=70), NT (n=72), Capital City (n=904), Non-capital city (n=351).*

○ Significantly higher than sample average

Those states with the highest levels of willingness to consume processed foods made from GM crops were again ACT (46%), followed by Tasmania (44%) and South Australia (43%), while those least willing were Victoria (33%), Queensland (33%) and Tasmania (31%).

Willingness to consume organic foods was high across all states and territories, with the highest being ACT (75%), Tasmania (70%), Queensland (68%) and South Australia (67%). As in all the data there was very little difference between capital city and non-capital city areas.

Figure 12: Willingness to eat products – by state and territory



Q7. Now we'd like you to think about food. On a scale of 0-10 where 10 is extremely willing and 0 is extremely unwilling, please indicate how willing you would be to eat the following

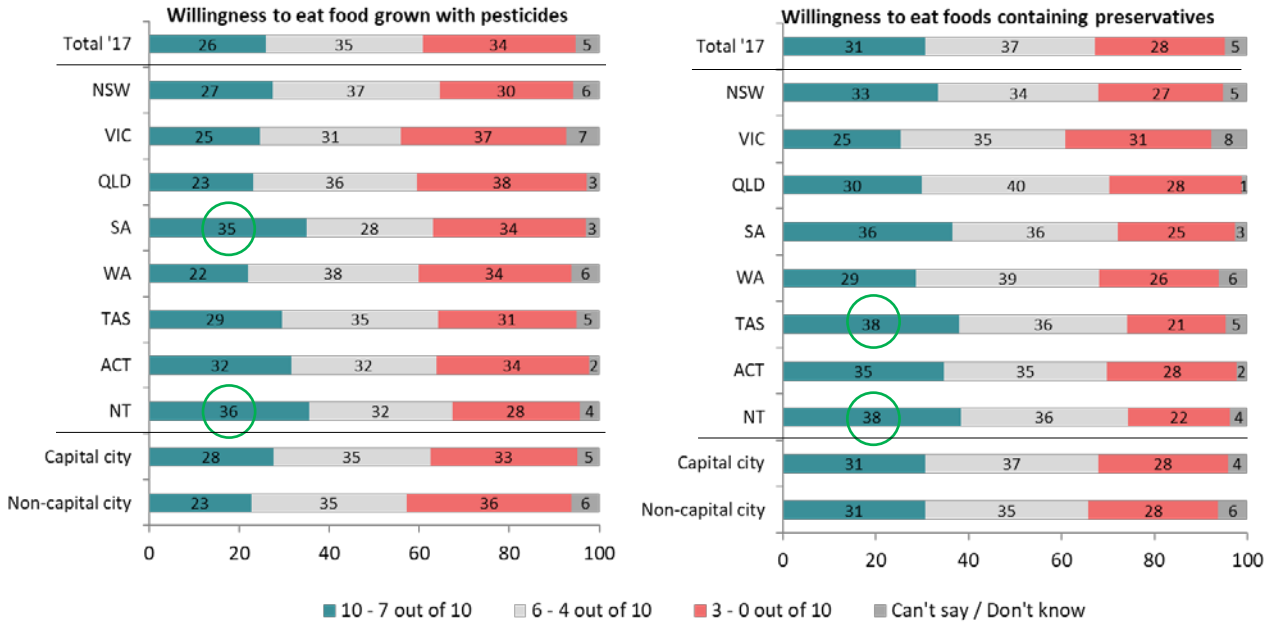
Base: *Total sample (n=1255), NSW (n=327), VIC (n=258), QLD (n=204), SA (n=132), WA (n=121), TAS (n=71), ACT (n=70), NT (n=72), Capital City (n=904), Non-capital city (n=351).*

Significanty higher than average Significantly lower than average

Those states with the greatest willingness to consume foods grown with pesticides were the Northern Territory (36%), South Australia (35%) and the ACT (32%), while those least willing were Queensland (38%), Victoria (37%) and Western Australia and South Australia (34%).

By comparison those states with most willing to consume foods containing preservatives were Tasmania (38%), the Northern Territory (38%) and South Australia (36%), and those least willing were Victoria (31%), Queensland (31%) and the ACT (31%).

Figure 13: Willingness to eat GM products– by state and territory



Q7. Now we'd like you to think about food. On a scale of 0-10 where 10 is extremely willing and 0 is extremely unwilling, please indicate how willing you would be to eat the following...

Base: *Total sample (n=1255), NSW (n=327), VIC (n=258), QLD (n=204), SA (n=132), WA (n=121), TAS (n=71), ACT (n=70), NT (n=72), Capital City (n=904), Non-capital city (n=351).*

Significanty higher than average Significantly lower than average

Genetic modification in Australia

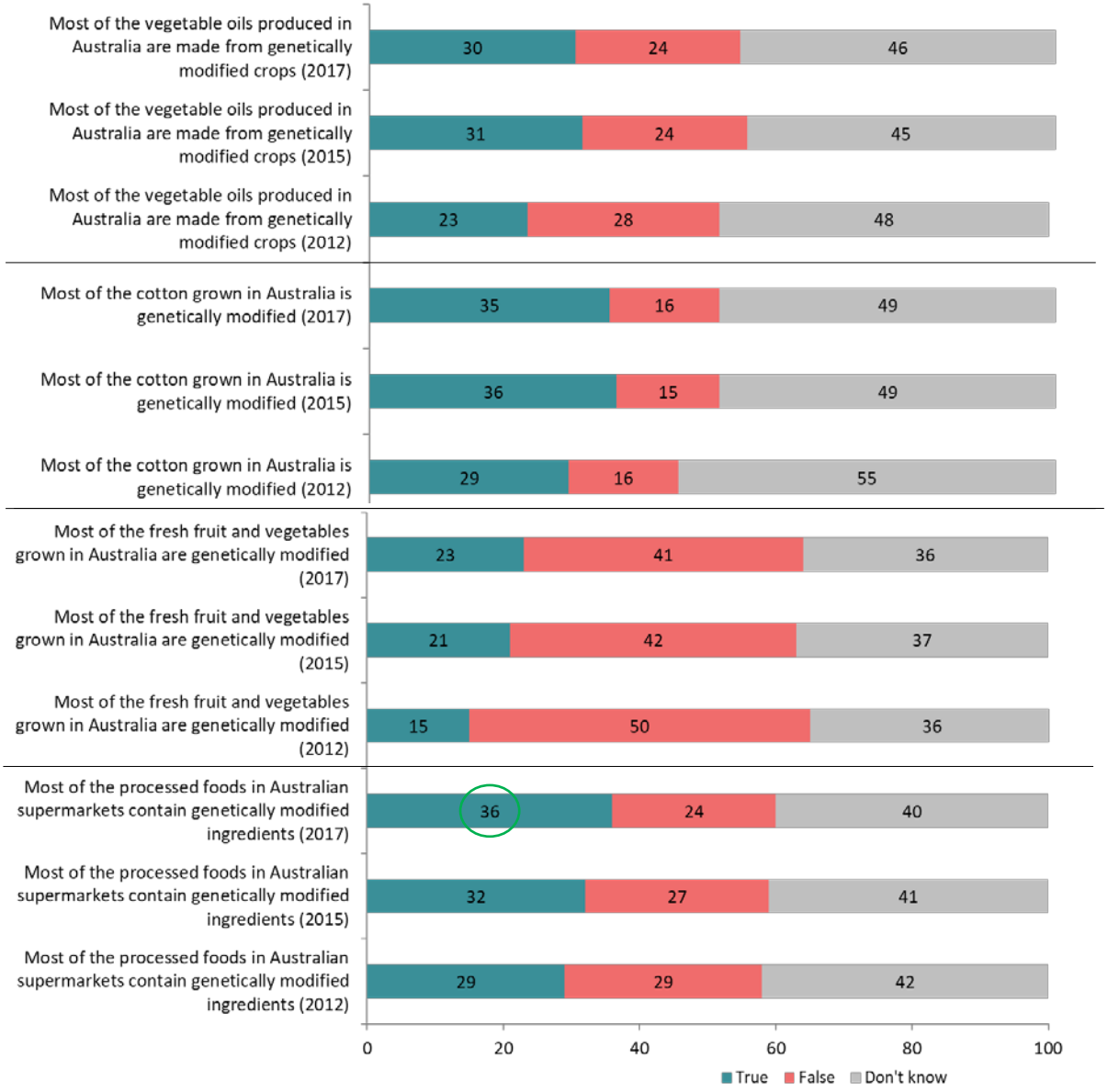
Beliefs about what foods were genetically modified in Australia were little changed from 2015. In general, knowledge about GM foods was poor, with *Don't Know* always being close to 50%. There was a minor increase in those who incorrectly felt most fruit and vegetables grown in Australia were GM (from 21% to 23%) and a larger increase in those who felt most processed foods in Australian supermarkets contained GM ingredients (from 32% to 36%).

Also, more people believed (incorrectly) that most of the processed foods in Australian supermarkets contained GM ingredients (36%) compared to 24% who correctly stated that this was false. Younger people were significantly more likely to believe this.

The percentage of people who correctly stated that most of the fruits and vegetable grown in Australia are not genetically modified was 41% (similar to 2015). Twenty one per cent of respondents incorrectly believed that most fruit and vegetables grown in Australia was GM (up from 15% in 2012).

Thirty five per cent correctly stated that most of the cotton grown in Australia is genetically modified (up from 29% in 2012). Thirty per cent incorrectly believed that most of the vegetable oils produced in Australia were made from GM crops, more than the 24% who said they were not.

Figure 14: Attitudes towards genetic modification in Australia



Q8. Please say whether you think each of the following statements is true or false.

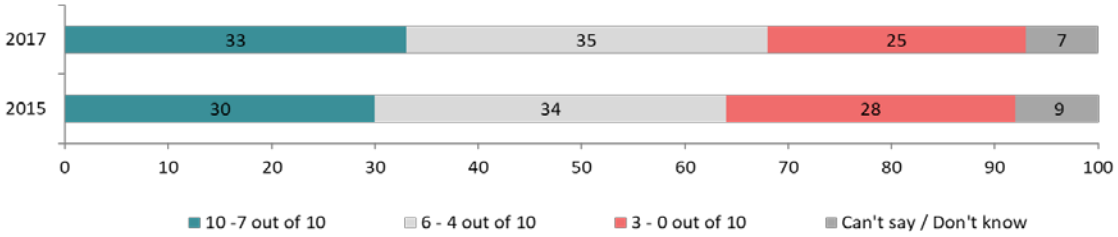
Base: *Total sample n=1255*

◯ Significantly higher than 2015

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 were less sure and were hedging their bets and a quarter clearly believed it was not acceptable. Only 7% indicated *don't know*. Males were significantly more likely to find this acceptable (33%, +10%).

Figure 15: How acceptable it is to modify the genes of plants to produce food



Q9a. Please indicate how acceptable modifying the genes of *plants* to produces food is to you, where 10 is completely acceptable and 0 is completely unacceptable.

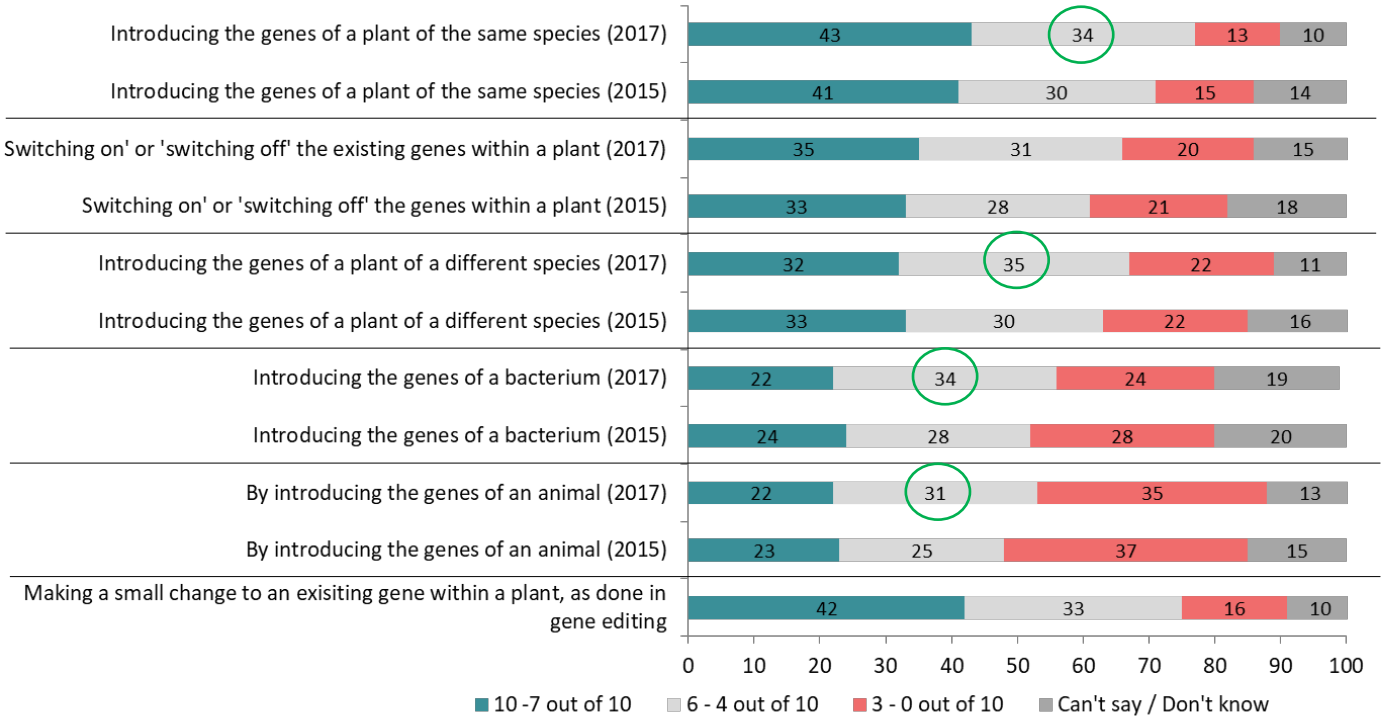
Base: *Total sample n=1255*

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. Those living in non-capital city areas were less likely to accept introducing the genes of an animal and introducing the genes of a bacterium.

Women were less likely to accept any or to indicate don't know/can't, while men were much more likely to indicate acceptance. Those in the 51-75 age group were less likely to accept the technology compared to those in the 16-30 age group.

Figure 16: Attitudes to GM in food production



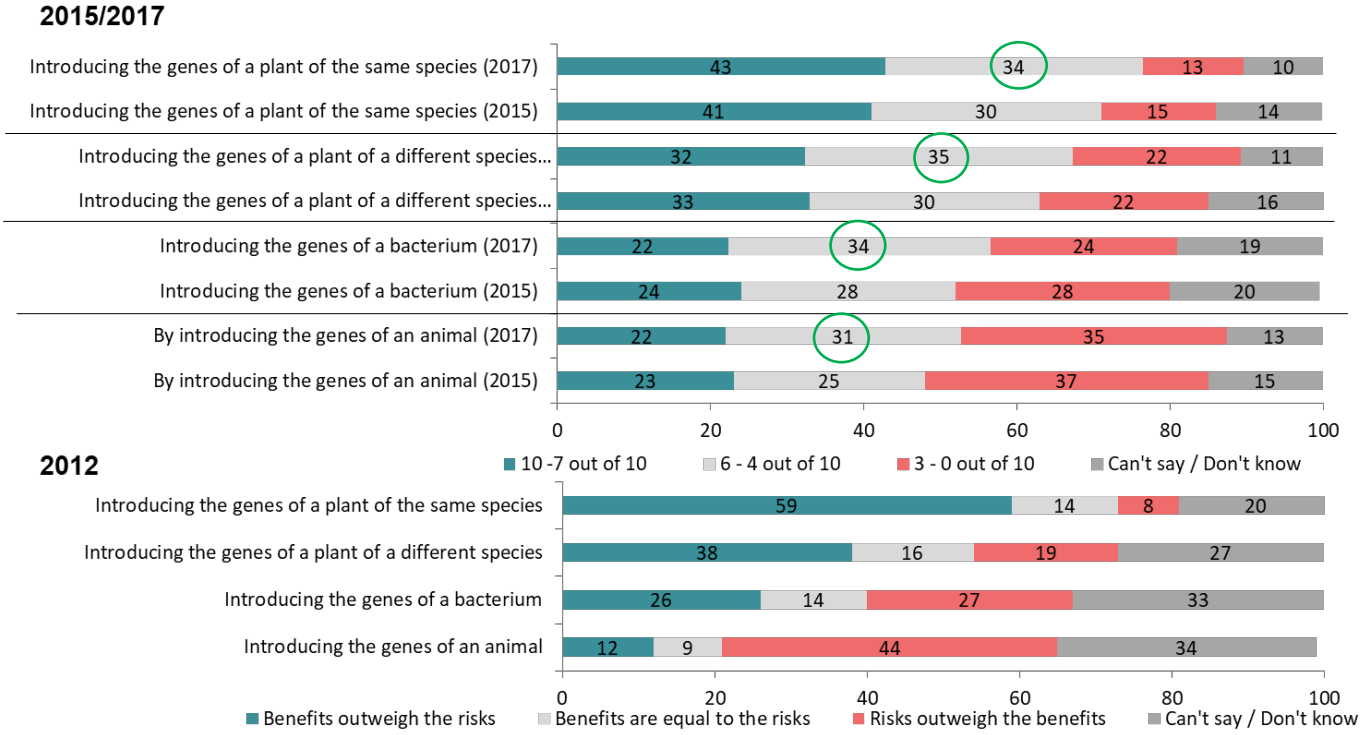
Q9b. Using a scale of 0-10 again, where 10 is completely acceptable and 0 is completely unacceptable, please indicate how acceptable it is to you if modifying the genes of *plants* to produce food was done by…

Base: *Total sample n=1255*

Significantly higher than sample average

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 (43%)* and *Making small changes to the existing genes within a plant, as is done in gene editing* (42%).

Figure 17: Attitudes to different types of genetic modification



Q9b. Using a scale of 0-10 again, where 10 is completely acceptable and 0 is completely unacceptable, please indicate how acceptable it is to you if modifying the genes of *plants* to produce food was done by…

Base: *Total sample 2017 (n=1255)*

◯ Significantly higher than 2015

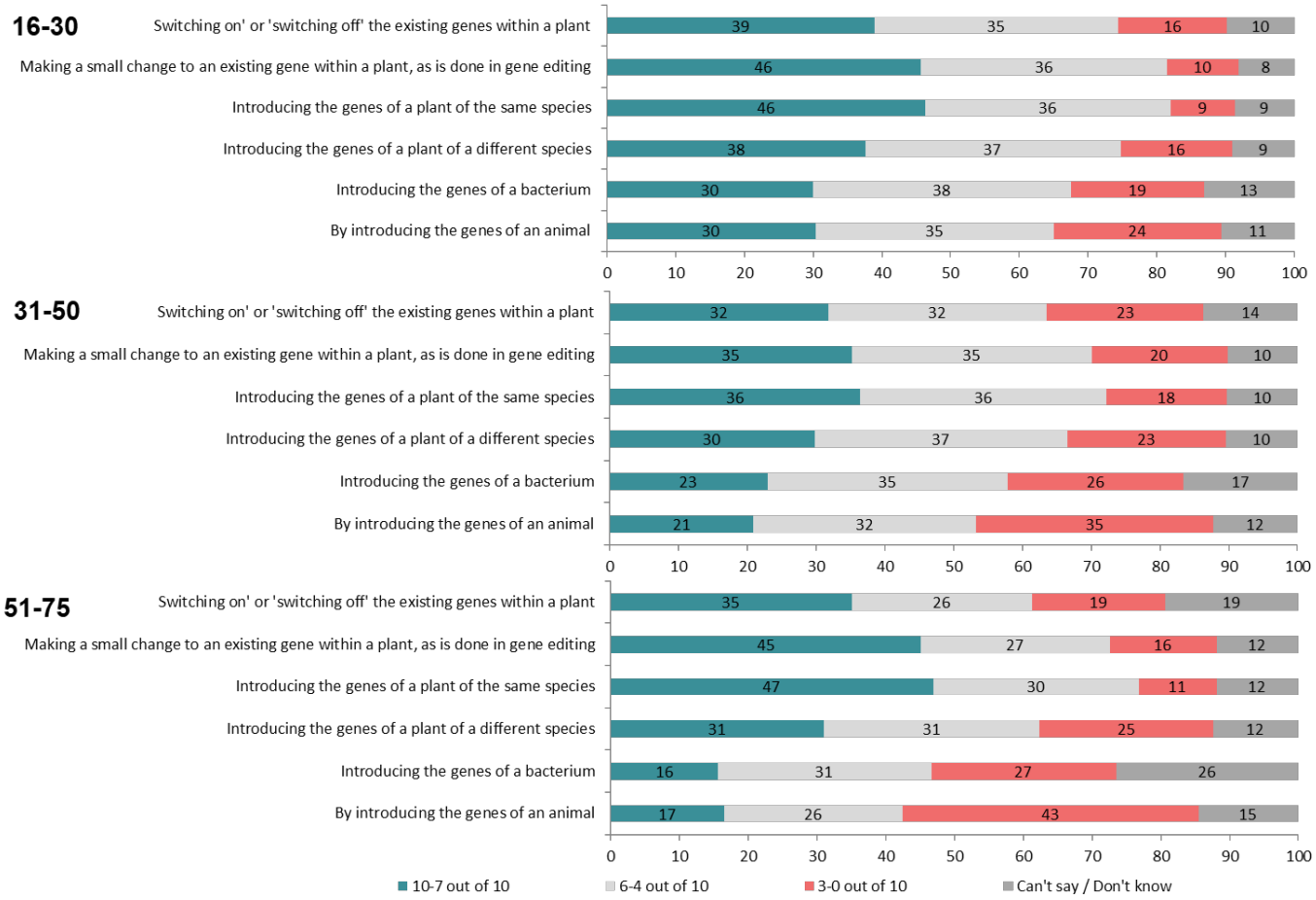
Support for introducing the genes of a bacterium or an animal stayed low at 22% for both. Interestingly however, fewer people found the idea of introducing the genes of a bacterium as unacceptable (24%) than found the idea of introducing the genes of an animal (35%).

This question was asked differently in 2012, and showed a broader spread of concerns than when asked across a ten-fold scale, which again demonstrates the different results that can be obtained from different questions. The 2012 study asked respondents to rate their answers according to the benefits outweighing the risks, the benefits being equal to the risks of the risk outweighing the benefits. There was also a *Don't know* category that received between 20% and 34% response across the four questions asked.

This high *don't know* response indicated the question was not appropriate for the knowledge levels of the audience, and needed to be reframed. The new questions resulted in different data, but a similar trend of diminishing support across more radical gene transfer compared to the host species.

Assessing the responses by age, the trend lines were similar. Again younger people were less concerned about different degrees of gene transfer, and those aged 31-50 were most concerned, with an overall increased concern about animal genes. An exception to this was that the oldest cohort was least supportive of introducing the genes of an animal (17%) or a bacterium (16%).

Figure 18: Attitudes to different types of modification by age



Q9b. Using a scale of 0-10 again, where 10 is completely acceptable and 0 is completely unacceptable, please indicate how acceptable it is to you if modifying the genes of *plants* to produce food was done by…

Base: *16-30 (n=299), 31-50 (n=488), 51-75 (n=468)*

The following figure shows analysis of the responses by gender. It indicates that females were more concerned about different types of genetic modification while males were more supportive. For example, 49% of males supported introducing the genes of the same species, while only 36% of females supported this. And while 42% of females did not support the introduction of genes from an animal, 28% of males did not support it.

Figure 19: Attitudes to different types of modification by gender

Q9b. Using a scale of 0-10 again, where 10 is completely acceptable and 0 is completely unacceptable, please indicate how acceptable it is to you if modifying the genes of *plants* to produce food was done by…

Base: *Male (n=605), female (n=650)*

Significantly higher than females

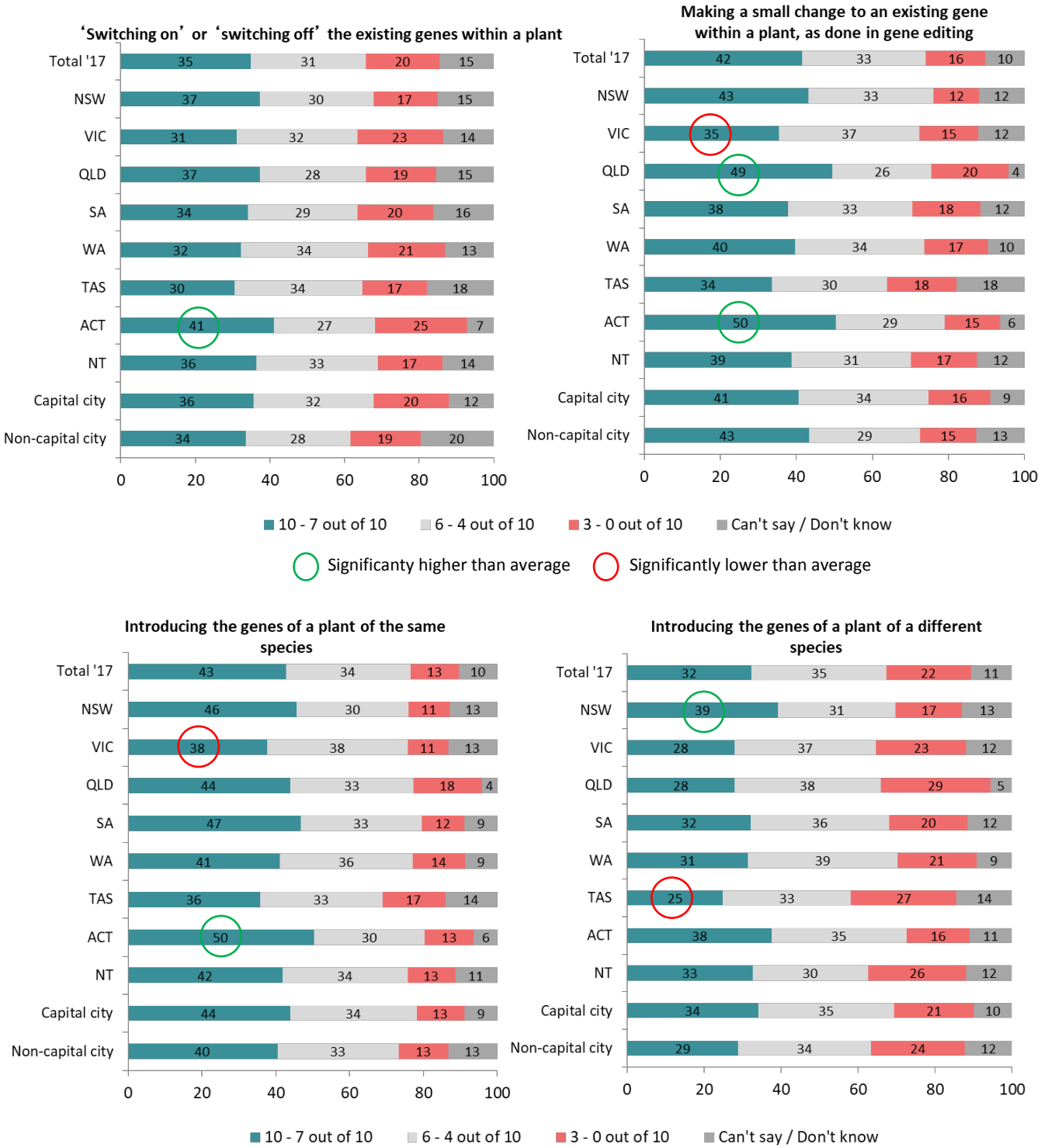
GM crops in your state or territory

There was relatively little variation across the states for switching on or off the existing genes within a plant, with most responses within 3 or 4 points of the average of 35%. Tasmania was notably lower at 30%, and the ACT notably higher at 41%.

Making a small change to an existing gene within a plant, as is done in gene editing, showed a larger spread of responses, with several diverging from the average of 42% support. Tasmania rated 34%, Victoria 35% (both well below the average), the ACT rated 50% and Queensland 49%.

There was little difference between capital cities and non-capital cities.

Figure 20: Attitudes to different types of modification by State



Q9b. Using a scale of 0-10 again, where 10 is completely acceptable and 0 is completely unacceptable, please indicate how acceptable it is to you if modifying the genes of *plants* to produce food was done by…

Base: *Total sample (n=1255), NSW (n=327), VIC (n=258), QLD (n=204), SA (n=132), WA (n=121), TAS (n=71), ACT (n=70), NT (n=72), Capital City (n=904), Non-capital city (n=351)*

For introducing the gene of an animal, the ACT again stood out as having the highest level of divergence from the mean, with 6 percentage points, at 28%. NSW was similar with 27% support and the lowest support was from Western Australia that only rated 11% support.

There was a three percentage point difference in support in the capital city and non-capitals at 23% and 20%. There was a much greater spread when looking at lack of support with the capital cities rating 32% and the non-capitals rating 39%.

For introducing the genes of a bacteria, the standout states with the highest levels of divergence from the mean of 22% highest cohort of support, were the ACT rating at 29% and those significantly below the mean were Tasmania at 13% and Western Australia at 17%.

The capital and non-capital divide was 25% support from capital cities and 18% support from non-capitals.

Figure 21: Attitudes to different types of modification by State

Q9b. Using a scale of 0-10 again, where 10 is completely acceptable and 0 is completely unacceptable, please indicate how acceptable it is to you if modifying the genes of *plants* to produce food was done by…

Base: *Total sample (n=1255), NSW (n=327), VIC (n=258), QLD (n=204), SA (n=132), WA (n=121), TAS (n=71), ACT (n=70), NT (n=72), Capital City (n=904), Non-capital city (n=351)*

Significanty higher than average Significantly lower than average

The mean response for highest support for introducing the genes of a plant of the same species was 43% and those states with the highest divergence from the mean were the ACT at 50%, Tasmania at 36% and Victoria at 38%. There was however, a difference in capital city and non-capital city response for this question, with 44% support in the capital cities and 40% in the non-capitals.

For introducing the genes of a different species, the highest divergences by state were again the ACT (38%) rating the highest above average and Tasmania (25%) rating the lowest. Victoria rated the second lowest at 28%, and again there was a marked difference in cities, with capital cities rating 34% and non-capitals rating 29%.

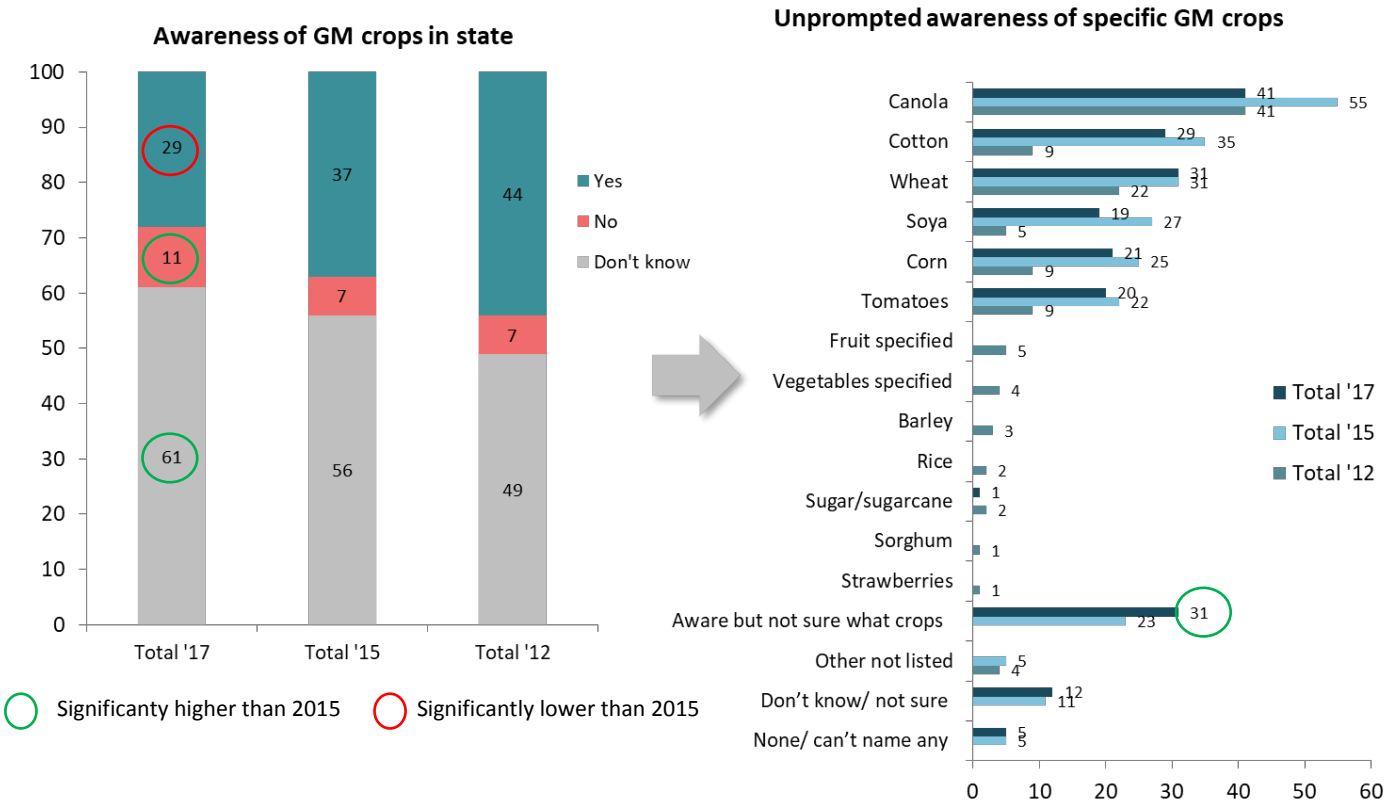
Awareness of GM crops grown in states and territories

Awareness of whether GM crops were grown in a respondent's state/territory was generally not high, with an average of only 29% claiming to know. This is a significant decline from 37% in 2015 and 44% in 2012, mirrored by increases in those who did not know from 49% in 2012 to 61% in 2017. This can best be explained by the general lack of media coverage of GM crops overall.

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 (31%), corn (23%) and tomatoes (20%) are being grown.

Of interest, awareness of canola being grown (the most prevalent food crop which has traditionally received most of the media coverage) has dropped from 55% of those who were aware of GM crops being grown in their state to 41%, and soya dropped from 27% to 19%. Other changes between 2015 and 2017 reflected minor diminution of awareness.

Figure 22: Awareness of GM crops being grown in respondents' states, by state



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

Base: *Total sample n=1255*

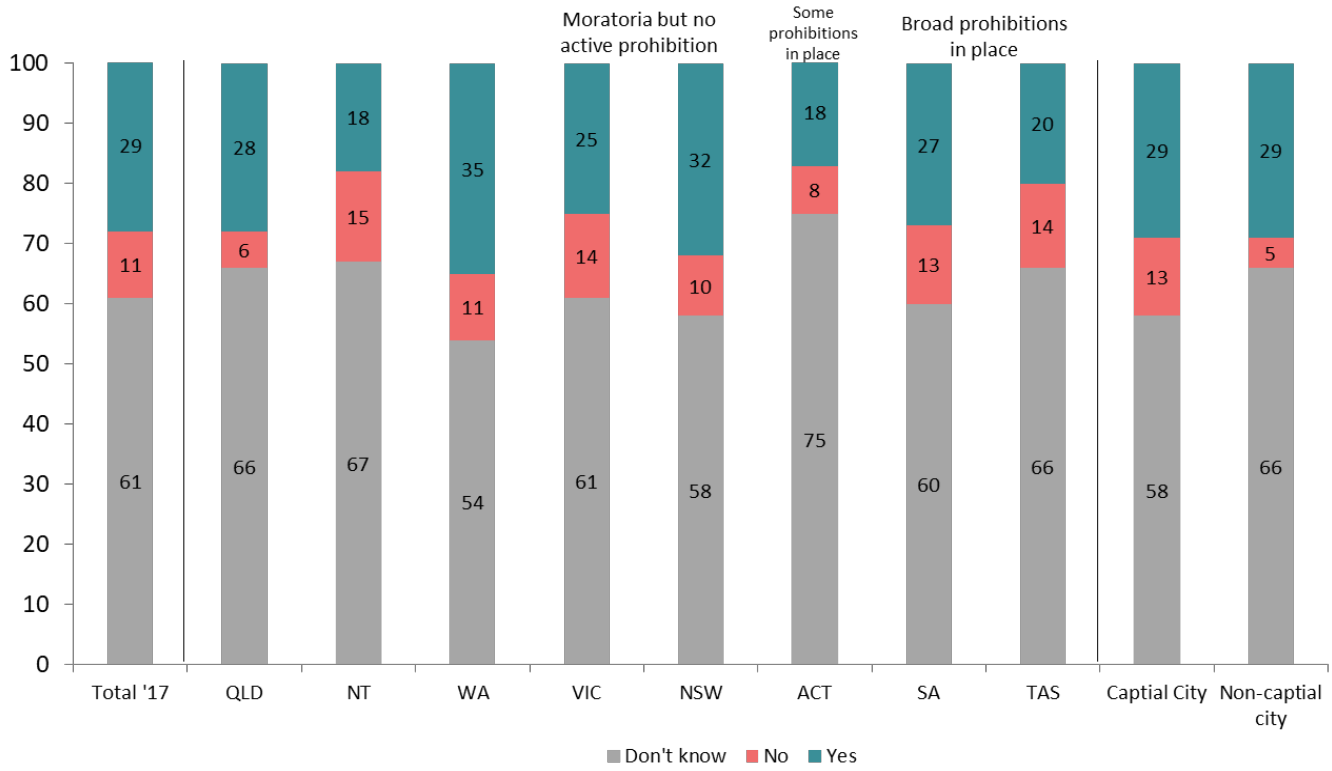
Q11. Can you name any genetically modified crops that are grown in your State or Territory?

Base: *Those who indicated that commercial genetically modified crops are grown in their State or Territory n=367*

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

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 61%. 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.

Figure 23: Awareness of GM crops grown in their state or territory – state & territory comparisons



Q10. As far as you know, are commercial genetically modified crops allowed to be grown in your State or Territory?
Base: *Total sample (n=1255), NSW (n=327), VIC (n=258), QLD (n=204), SA (n=132), WA (n=121), TAS (n=71), ACT (n=70), NT (n=72), Capital City (n=904), Non-capital city (n=351).*

Western Australia had the highest awareness of GM crops being commercially grown in that state (35%), while the ACT and the Northern Territory had the lowest awareness of 18%. *Don't know* responses were 61% nationally and highest in the Australian Capital Territory (75%), Northern Territory (67%), Queensland (66%) and Tasmania (66%).

Those states where GM crops are grown with no legal restrictions, had mixed responses. Western Australia had the highest correct *Yes* response at 35%—down considerably from the 2015 response of 48%. In Queensland, 28% accurately stated *Yes, GM crops were allowed to be grown in their state*, and in the Northern Territory only 18% accurately stated *Yes*.

Those states with moratoria, but no active prohibitions (Victoria and NSW), both had 25% and 32% *Yes* responses respective—quite close to the national average responses.

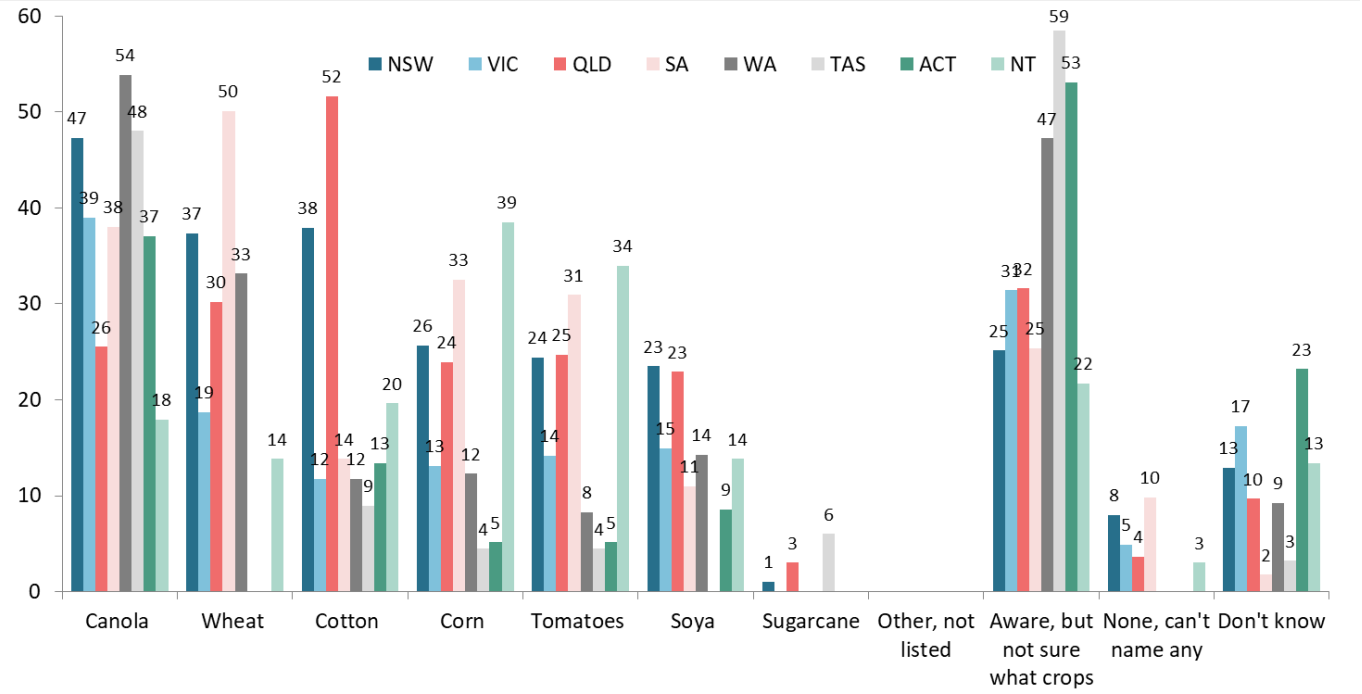
In the ACT where there are some prohibitions in place, but where GM crops are still able to be grown under certain conditions, only 18% agreed that commercial genetically modified crops were allowed to be grown in the Territory, well below the national average.

Of the two states that have broad prohibitions in place, Tasmania and South Australia, Tasmania's accurate *No* response has dropped considerably from 41% in 2015 down to just 14%, and South Australia maintained a very low accurate *No* response at only 13%.

There were no significant differences in claimed awareness between the capital cities and non-capitals for the *Yes* response, at 29% each, but the *No* responses varied more at 13% for capital cities and only 5% for non-capitals.

There were also significant differences between the states and territories in terms of the claimed awareness of the type of crop grown locally as shown below.

Figure 24: Awareness of specific GM crops grown in their state or territory



Q11. Can you name any genetically modified crops that are grown in your state or territory?

Base: *Those who believe commercial GM crops are allowed to be grown in their state/territory; Total sample (n=367), NSW (n=108), VIC (n=68), QLD (n=69), SA (n=34), WA (n=40), TAS (n=16**), ACT (n=16**), NT (n=16**). **caution, low base size*

The stand-out figures for unprompted awareness were GM cotton in Queensland and NSW. Of interest, there were also high scores for incorrect statements about growing GM corn in NSW, Queensland, South Australia and the Northern Territory and also incorrect awareness of growing GM wheat in NSW and South Australia.

Qualitative research insights on perceptions of GM crops grown in the State/Territory

The qualitative research found that knowledge and perceptions on what GM crops are grown in Australia and people's specific State or Territory in most cases is all a bit of hearsay and a guessing game. There is just a general assumption that volume and types GM crops are more prevalent than is the actual situation.

While some participants in the qualitative research knew or felt they knew that cotton and canola are the only GMOs being grown in Australia, and there is no GM fruit or vegetables grown or marketed in Australia, most were surprised. The following provides some examples of participants' responses to this information.

"I know that canola is definitely genetically modified and grown here in Australia. I do not know whether GM crops are really that good for you. I do not know what the long term effects of genetically modifying food will be."

"I knew there were only two GM crops grown in Australia. Too many misinformed people think that we are a lot more like America. Look the more the merrier is my attitude for GM products. Man has been manipulating crops for a long time with no great harm done to us or the environment. We used to eat white strawberries, purple carrots and multi coloured corn.
Tomatoes have gone through numerous transitions to get the best, firmest varieties we can produce. Genetic modification doesn't produce monsters like we see in the old movies when people didn't understand genetics."

"I was definitely not aware that it was only those 2. Just thought it may have been other common fruits and vegies....just a stigma behind it."

People believe more GM crops are grown in Australia than actually are:

- They have heard stories and reports on GM crops in the media, movies and documentaries at different times and don't necessarily pay attention to or discriminate between whether it relates to something local or international (often assuming if it is occurring overseas it is happening here or will happen here eventually)

  "Magazine articles that you read about them."

  "I have a sense and sometimes on Four Corners and some of the Channel 2 programs they have a lot of information on this subject."

  "Food Inc.", "GMO OMG"

  "Radio…e.g. 3AW"

- People specifically hearing and basing their knowledge and perceptions on stories about Monsanto and gene technology

  "The behaviour of Monsanto. They are bullies"

  "The Monsanto thing makes people sceptical of the whole GMO system."

- Seeing and reading information online, and again don't necessarily pay attention to or discriminate between whether it relates to something local and international
- *"Because we are reading a lot of stuff online so we don't necessarily pay attention to whether it is coming from a North American source or a British source so sometimes we are reading things and we are thinking it is happening in Australia but it is really happening overseas."*

  "I guess it is an assumption that if you have read something a while ago that it has made its way to Australia by now."

- Their perceptions of the food itself that they now can and do buy being different (e.g. large, smaller), less tasteful, being in so many process foods, etc and assuming this is because it is a genetically modified

  "The flavour is lacking from a lot of fruit and veg you get. Some of the organic stuff taste better so I thought maybe because it is GM and something is missing from it."

  "With wheat only because it is so widespread. It is in everything and there is always a scandal about the wheat. It is in sauces, canned foods and packaged foods."

- They think they see mentions of GM ingredients on the labels of food they buy

  "The labels on the packets."

  "That all of the product wasn't produced in Australia. I can see that it is genetically modified and I know it is sunflower oil for instance. Our good stuff goes out [of the country]."

  "I have read it on some products in the supermarket but it may have been something with canola that they had to put genetically modified."

When participants actually then looked at the labels on the products in their fridge and pantry they couldn't find any mention of GM ingredients or a lack of GM ingredients.

"I did a mini-tour of my fridge and pantry and I couldn't find any item with written 'non GM' nor anything that stated GM was present either."

Participants in the qualitative research were also asked if they thought most food they buy (whether fresh or processed) are from or have ingredients from GM crops. They were also asked if their perceptions on what is from or has ingredients from GM crops is influenced by it being fresh produce, processed food, certain types of processed food or if it is produced or packaged in Australia or in particular countries overseas.

Essentially there was a real mixed bag of responses on what influenced people's perceptions. The following provides some examples of participants' comments.

"I only buy food from Australia and always look at package. Can foods in supermarkets include GM or GM ingredients even if the labelling doesn't indicate it? My belief is no that it should always be labelled. [With fresh food] it could go either way and I don't think they would honestly tell as I think the only people who would know are the vendors selling it."

"So, Australian or imported, fresh or processed...

If it was stated that in Australia there's only GM cotton and canola, and then of course we put aside cotton in this instance, I think that yes, we could have GM canola as an ingredient in many processed food items and GM canola by itself sold in shops without the written indication "GM". Canola is listed as an ingredient in so many food products, I see it all the time but, I cannot recall the denomination GM ever being printed.

Then there's the imported food. I believe things go wilder here, because sometimes it's not even clear were the food was exactly produced, harvested, processed. For an example some food "from UE" is tricky: European Union has so many countries in it, how are we sure that the standards are equivalent in all of them? And I'm quite sure they wouldn't state if they use GM.

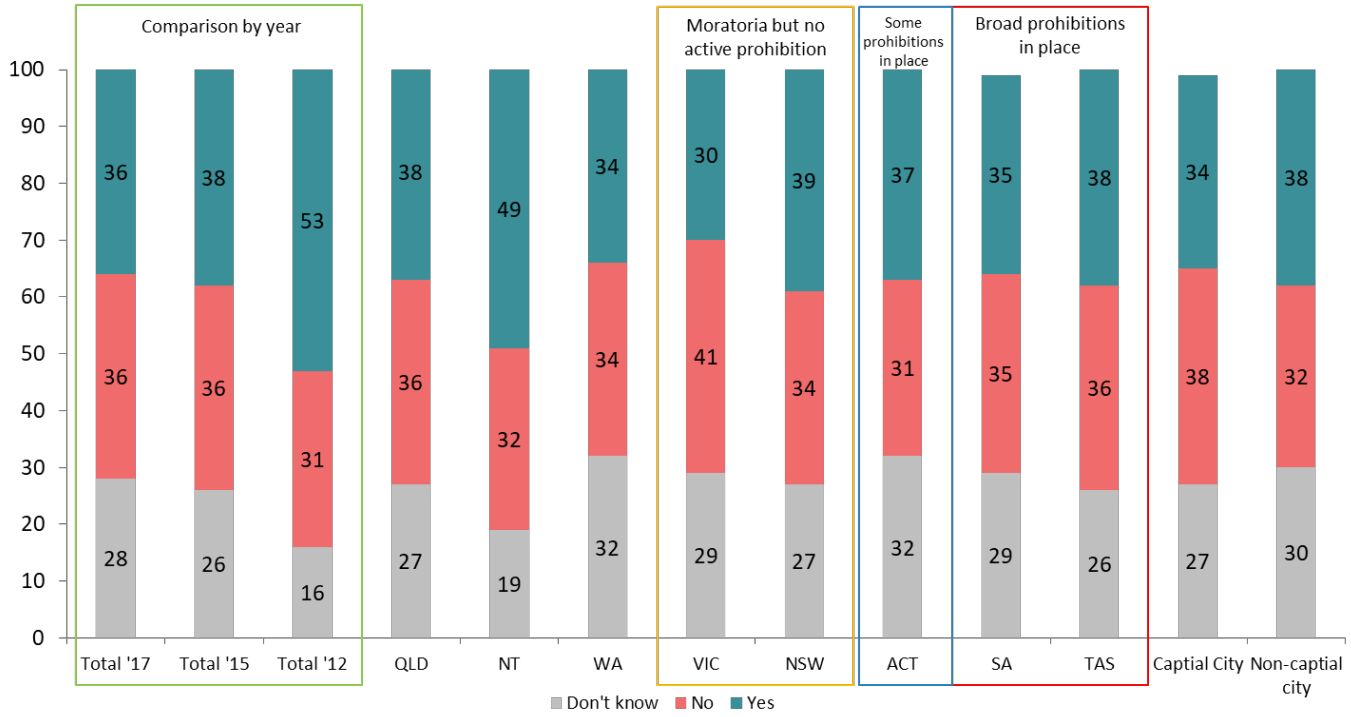
So in the end, I cannot recall Australian or imported food items -either fresh or processed- stating clearly that they use GM derived ingredients but, I think they are sold in shops.

What I do recall however, is that many food items indicate "non - GM" in the list of "good qualities" but, none in the ingredients list, just on the main part of the packaging. I've noticed this not only in the health food section of supermarkets or health food speciality shops (I don't even dare venture in them nowadays) but in the more common products displayed on supermarket aisles.

Support for growing GM crops in your state/territory

There was little movement in the number of those in favour of growing GM crops in their states, with 36% in favour and 36% opposed. The highest support was in the Northern Territory with 49% support, and the lowest levels of support were in Victoria (30%) and Western Australia (34%).

Figure 25: In favour of growing GM crops in their state or territory – comparisons by state & territory



Q12. Are you in favour of growing genetically modified crops in your State or Territory?
Base: *Total sample (n=1255), NSW (n=327), VIC (n=258), QLD (n=204), SA (n=132), WA (n=121), TAS (n=71), ACT (n=70), NT (n=72), Capital City (n=904), Non-capital city (n=351).*

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, there is still a considerable number of people who are undecided with the *Don't know* response at 28%.

Those states and territories with high support for growing GM crops were Northern Territory (49%, +13%), NSW (39%, +3%), Queensland (38%, +2%), Tasmania (38%, +2%) and the ACT (37%, +1%). Victoria had the highest response of those not supportive of growing GM crops in their state at 41% (+5%).

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:

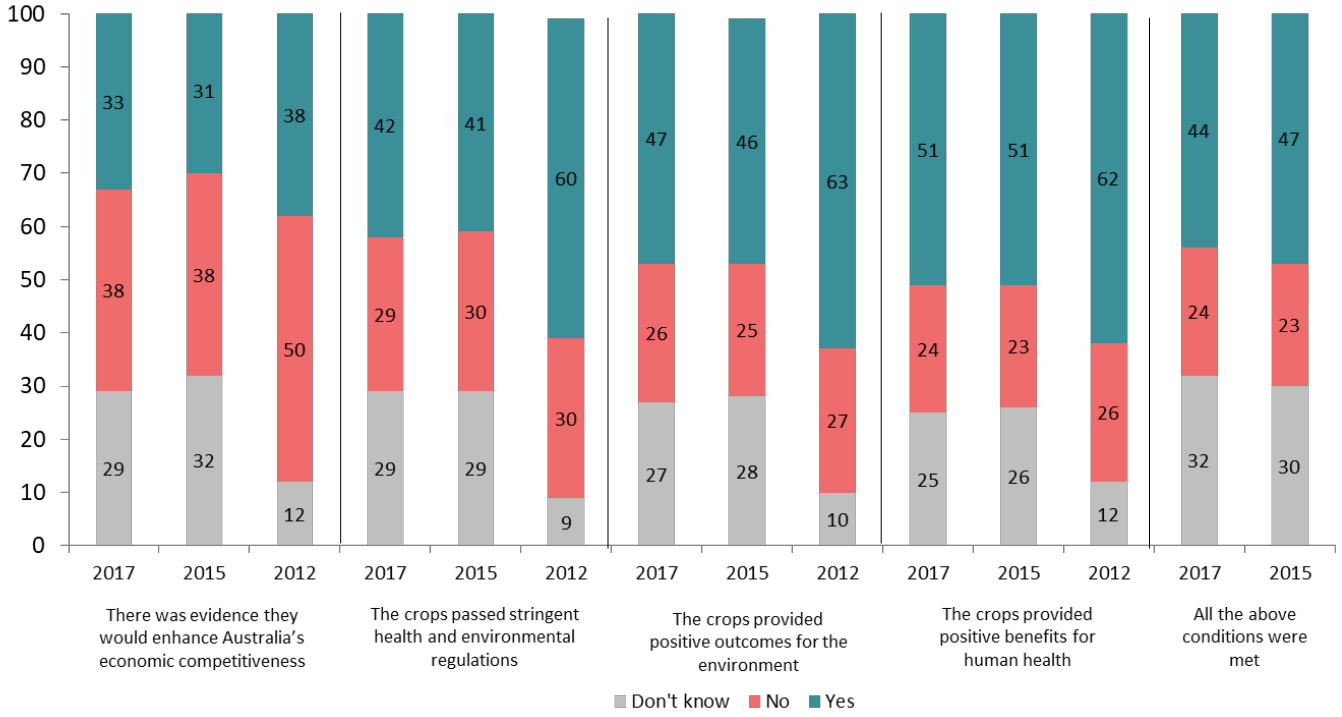
- if crops provided positive benefits for human health (51% of those opposed would change their position)
- if they provided positive outcomes for the environment (47% stated they would change their position)
- if they passed stringent health regulations (42% would change their position)
- if they enhanced economic competitiveness (33% 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. Also of interest was that the impact of all these factors was considerably higher in 2012.

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 26: 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=806).*

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 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, 13% accepted that it was a safe way to produce food, and 13% were also opposed to the production of food this way and nothing was likely to change their mind. The remaining 24% stated that they were against the production of food this way until the science proved it was safe.

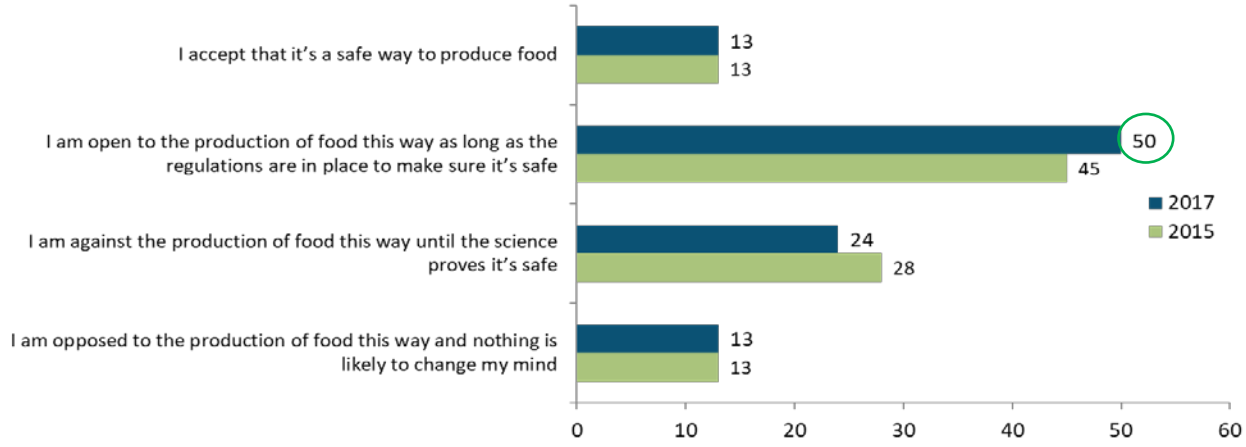
These results show no change among those most opposed to using GM technology to produce food and those accepting of it being a safe way to produce food. There was slight movement in the other categories with a drift away from those stating they are against the production of food this way until the science proves it's safe towards being open to the production of food this way as long as the regulations are in place to make sure it is safe.

The graphs below capture the general mood of this year's survey, with attitudes largely stable, no movement at the extreme ends and a slight drift towards more conditional support. The findings indicate that most support or rejection of GM food and crops is conditional, but that those conditions are likely to be based on regulation or scientific evidence of safety.

Segmenting the respondents by attitude to GM foods reinforced the finding that 13% of the population are very opposed to GM foods, about the same number are overwhelmingly supportive of GM foods and the remainder of the population are conditional, with 50 per cent stating they are open to the production of food this way as long as regulations are in place to make sure it is safe. About a quarter of respondents are against the production of food by GM until the science proves it safe. Together that is almost 75% of the population with conditional support for GM foods.

Breaking down the Likert scale spread of GM foods by the four segment groups above shows that those who felt GM was safe were more widely spread across the scales, while those opposed to it were very much centred at the lower end of the scale, with 55% rating 0.

Figure 27: Attitudinal category in using GM technology to produce food

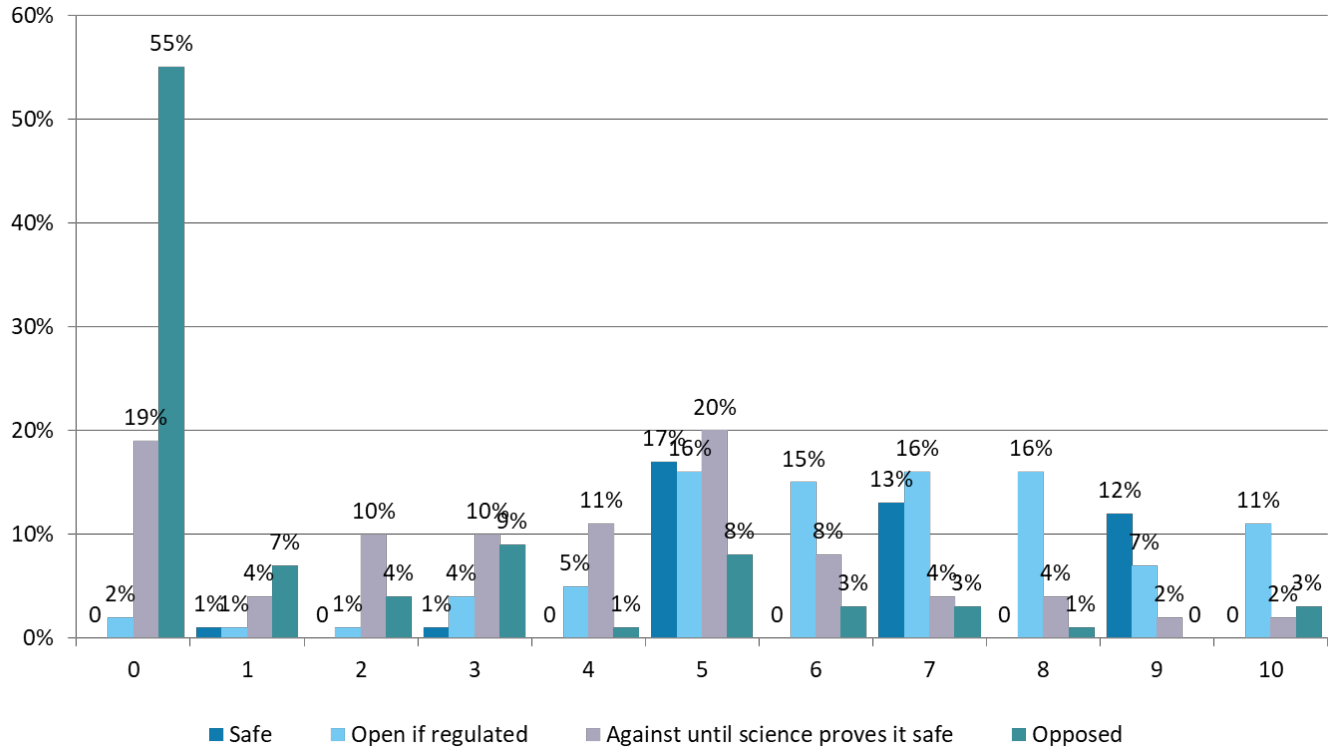


Q14a. Which of the following best describes your views on the use of genetically modified (GM) technology to produce food?

Base: *Total sample n=1255*

◯ Significant increase from 2015

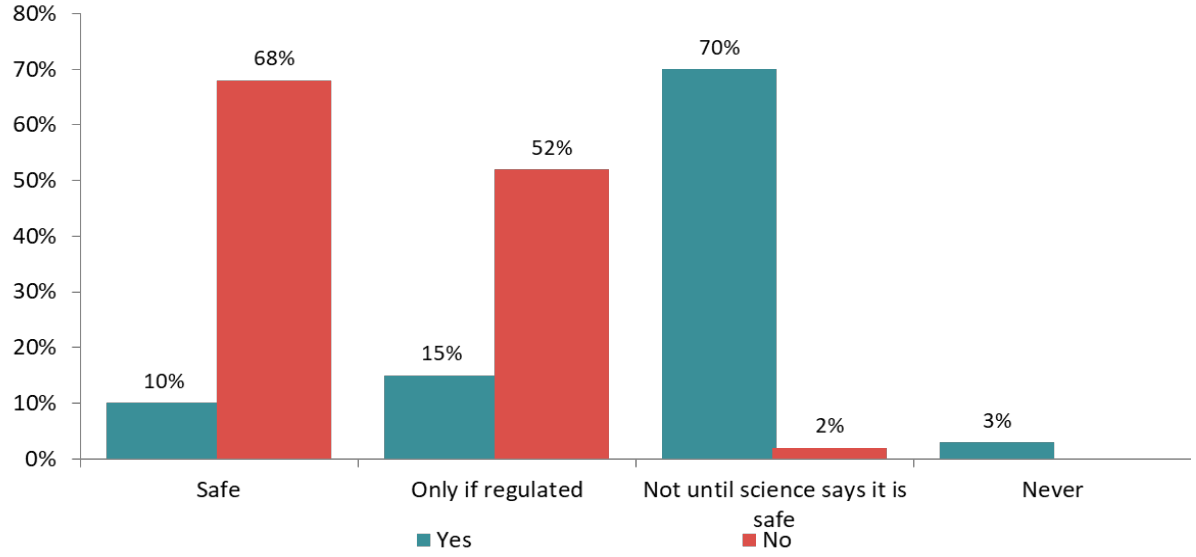
Figure 28: Attitudinal category in using GM technology to produce food



Q14a. Which of the following best describes your views on the use of genetically modified (GM) technology to produce food?

Base: *Total sample n=1255*

Figure 29: Attitude to growing GM in one's own state/territory by attitudes to GM food



Q14a. Which of the following best describes your views on the use of genetically modified (GM) technology to produce food?

Base: *Total sample n=1255*

Table 6: Attitudes by segments

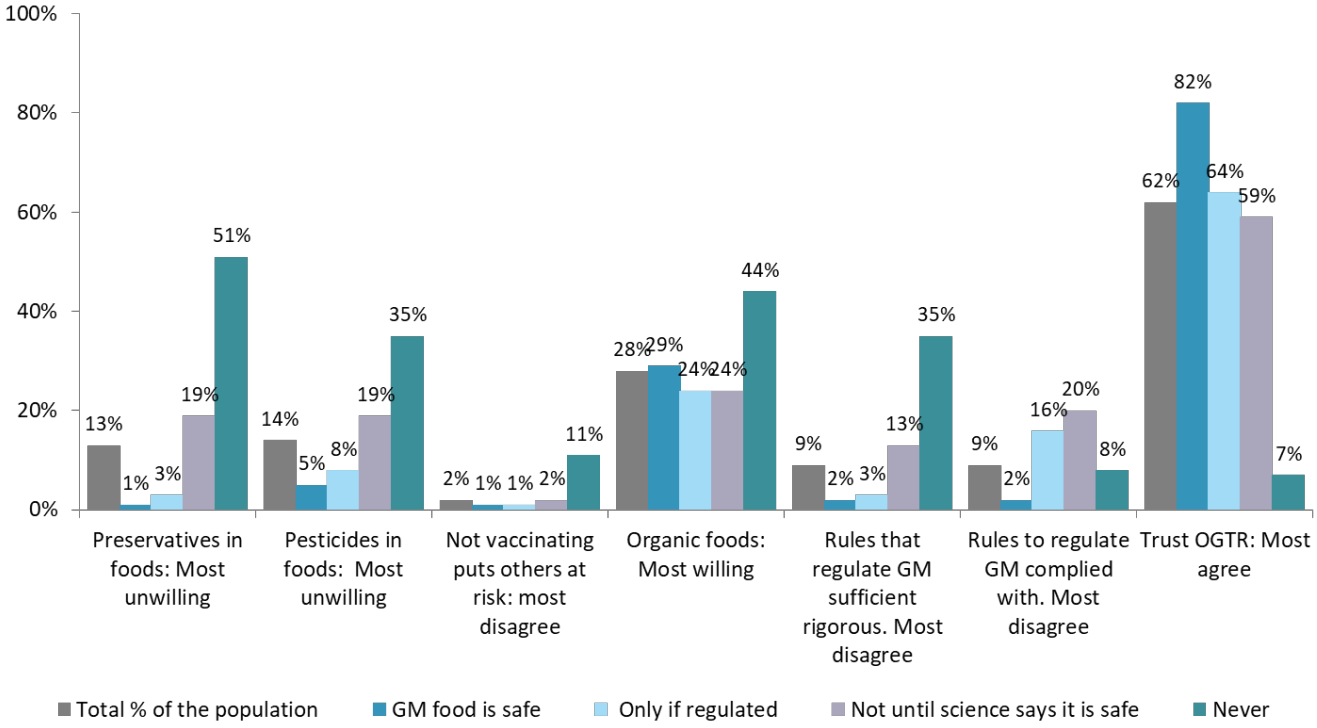
	Total % of the population	GM food is safe	Only if regulated	Not until science says safe	Never
Preservatives in foods: Most unwilling	**13%**	1%	3%	19%	51%
Pesticides in foods: Most unwilling	**14%**	5%	8%	19%	35%
Not vaccinating puts others at risk: most disagree	**2%**	1%	1%	2%	11%
Organic foods: Most willing	**28%**	29%	24%	24%	44%
Rules that regulate GM sufficient rigorous: Most disagree.	**9%**	2%	3%	13%	35%
Rules to regulate GM complied with: Most disagree.	**9%**	2%	3%	12%	31%
Trust OGTR: Most agree	**62%**	82%	64%	59%	7%

Looking at some of the key issues by attitudinal segments, those who would never approve of GM foods stand out from the others in terms of broader rejection of science, technology and regulation. They are the most unwilling to eat preservatives in foods (51% compared to the average of 13%), the most unwilling to support pesticides in foods (35% compared to the average of 14%), the most likely to disagree that not vaccinating puts others at risk (11% compared to the average of those who most disagree at 2%), the most willing to eat organic foods (44% compared to the average of 28%), the most likely to disagree that the rules that regulate GM foods are sufficient (35% compared to the average of 9%), and the most to likely to disagree that the rules that regulate GM foods are complied with (31% compared to the average of 9%). They are also the least likely to trust OGTR (7% compared to the average of 62%).

Across most measures, those who are most unwilling to eat GM foods under any circumstances are significant outliers (stand above the averages considerably). This indicates that their attitudes are not just more extreme than the respondent average, but are more likely to be emotionally anchored and less likely to be influenced to change under any circumstances.

The following graph compares the extreme differences of that segment compared to the other groups and to the sample average.

Figure 30: Attitudes by segments

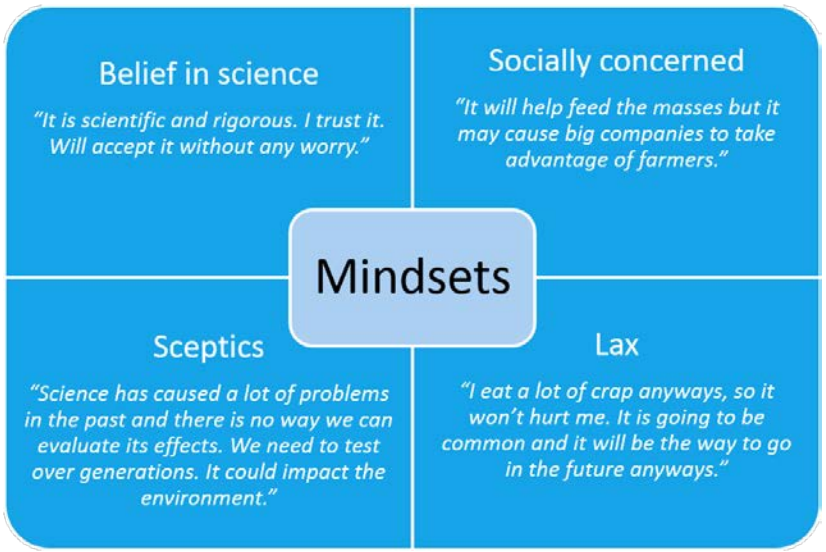


Q14a. Which of the following best describes your views on the use of genetically modified (GM) technology to produce food?

Base: *Total sample n=1255*

Qualitative research insights into attitudinal segments

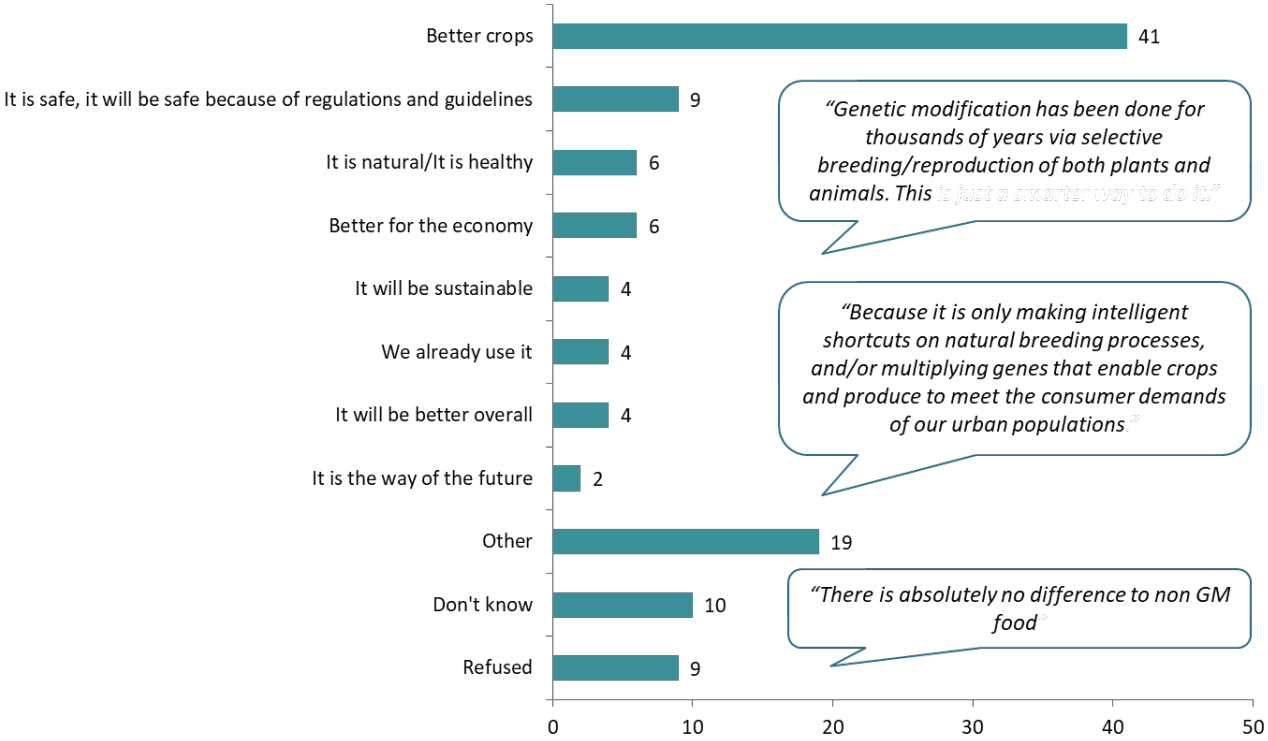
Four attitudinal sub-segments appeared to also emerge in the qualitative research even though in the survey these participants were neither strongly supportive nor strongly against gene technology. The insights suggest that it might not take much to influence or scare even the more neutral members of the community. The following provides a summary of the four mindsets that emerged.



Reasons for being in favour of or against gene technology

The 13% of respondents who accept that GM technologies are a safe way to produce food were asked why they were in favour of genetically modified (GM) technologies to produce food. The most common reason given was that it would produce better crops (41%) followed by it is safe because of the regulations and guidelines (9%). There were also those who stated it would be better for the economy (6%), it is natural or healthy (6%), and it will be better overall or sustainable (4%).

Figure 31: Why people are in favour of GM crops to produce food



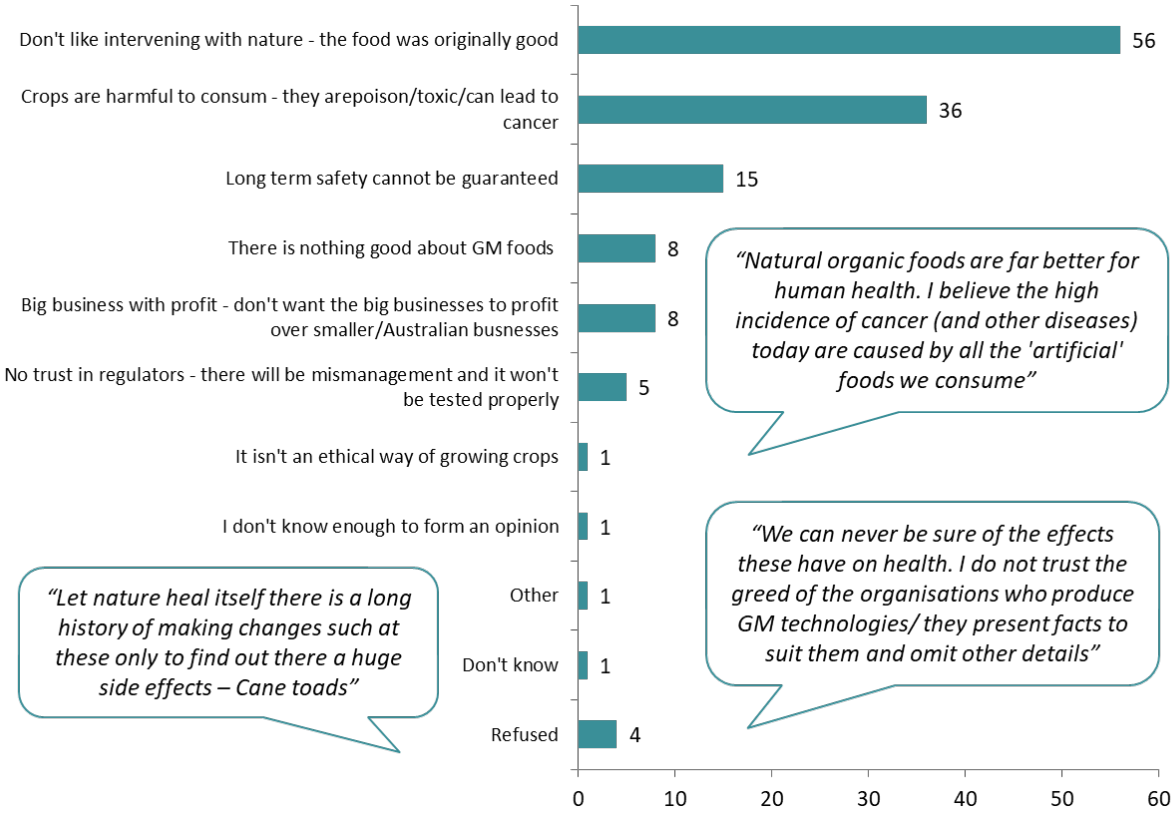
Q14b. Why are you in favour of genetically modified (GM) technologies to produce food?

Base: *Those who accept that GM technologies are a safe way to produce food n=161*

Those who were most opposed to using gene technology to produce food stated that the reasons behind their opposition were: they felt it was messing with nature (56%), it was harmful or toxic (36%) and long-term safety cannot be guaranteed (15%). Other answers included:

- *Big business will profit*
- *It is harmful*
- *Don't know the long term effects*
- *Not natural*
- *Nothing good about it*
- *Nothing wrong with food as it is*
- *The benefits won't last long*
- *Doesn't trust regulators*
- *It is not needed*
- *Bad for the environment*
- *Don't know enough about it or who to believe.*

Figure 32: Why are people opposed to GM foods



Q14e. Why are you opposed to the use of genetically modified (GM) technologies to produce food?
Base: *Total sample n= 164*

Qualitative research insights into reasons for supporting or opposing GM

Many participants in the qualitative research felt they did not know enough about gene technology to make any informed judgements on it and as a result it makes them insecure. Many also expressed the perception that gene technology 'is a work in progress' and still to be confirmed if it is 'completely' safe or not (especially when it comes to crops and food).

The topic is not top of mind for most people when compared to their other day-to-day concerns and priorities. As a result, it is not something that actively worries or involves them, but their sense of history of things claimed to be safe that have ended up not being so creates concern beneath the surface, especially if they have children. At the same time, many suggested they put those underlying concerns aside due to feeling they have a lack of information or ability to judge whether GM crops and food are safe and a lack of ability to influence what occurs.

The following tended to emerge as influencing the qualitative research participants the underlying perceptions, concerns and uncertainty:

- A tendency to associate GM food with mass produced and processed food and with unhealthy food and eating – often assuming the fast food and processed food has GM ingredients to make it cheaper and more efficient (but not necessarily healthier or better for people to consume).
- Questions on who is driving this push in GM crops and food and the underlying motivations with perceptions that it is industry and big business who are determining the agenda and that there is mostly 'greed' involved rather than greater community good.
- A sense of secrecy and lack of public transparency, discourse and controls around the development and use of gene technology (in crop and food production in particular).
- Perceptions on the scale of the risk if things go wrong; feeling any short or long term negative impacts or uses of GM crops and food could permeate crops, the environment and the human population nationally and worldwide causing lasting and irreversible damage — including concerns around rogue individuals or organisations (with reported stories of 'Monsanto behaviour in relation to GM crops' being frequently quoted as an example) and even terrorism.
- Associations of GM crops and food with being 'scientifically altered', 'unnatural', making things become unnaturally bigger (with some even associating it with steroids), less tasty, increasing the use of pesticides or herbicides or 'slicing genes and introducing a *foreign* element to something' and the perception of the added risk of 'human error'
- Impacting on each of the above is the wider decline in trust in society for authority and organisations generally and perceptions that government and in particular government agencies appear to be 'toothless tigers' and unable or unwilling to control what is occurring and to put the public health and good first.
- Past experiences and long standing recollections of things that were once deemed good and safe and subsequently were found to be bad or vice versa — common examples quoted included asbestos, smoking (by the tobacco industry), Thalidomide, Dolly the sheep having problems and dying, food being deemed bad and then good or at least not bad, allergies and even whether free range eggs and organic food are really what they are claimed or marketed to be.
- A strong sense it is all still 'early days' in the development and use of gene technology and concerns what will be found in 30, 40, 50 years or more with GM crops and food.

At the same time participants in the qualitative research also recognised the benefits of GM crops and food. Some examples included:

- It helps develop crops that are disease free or resistant, faster growing and helped allow more to be grown in a world where there is growing populations and demand on food supplies and concerns in meeting the growing future demand
- It helps develop better quality and new varieties of produce or products and helps us as a nation and farmers in particular to be competitive in a commercial sense which is then good for the economy.

In addition, the use of gene technology in medicine was not well known among the qualitative research participants and when the knowledge of it was introduced to participants in the research it appeared to often positively improve attitudes towards gene technology.

In fact as shown in the survey results in this report, attitudes and responses to gene technology often do depend on what type of gene technology it is and what it is used for.

Firstly it was found in the qualitative research that most participants found the concepts difficult to understand and they relied on other peoples' explanations and guidance or they would try to apply other conceptual models they know to help them understand and form an opinion.

The following outlines the aspects that tended to draw more negative responses among the qualitative research participants:

- There was more concern with gene technology being used with food and the word 'modified' tending to cause concerns among some, whereas concepts like cross-breading, cross-pollinating and grafting were seen as different and more in line with what occurs naturally.

  "Food is expected to be natural…not modified"

  "Modified implies it is dangerous…that it can have impact on the ecosystem"
  There were perceptions gene technology in food could have far reaching systemic ramifications

  "We're playing with nature…it's like superbugs"

- There was uncertainly and difficulty grasping the concepts of gene technology and aspects like gene editing and what actually occurs.

  "What do they put in or take out? It can't be good and what will it mean in the end by leaving something out or turned off?"

- There was concern what it would ultimately mean in terms of cost to individuals and the society in general

  "Is it cheaper or more expensive like organic food is more expensive…are we going to be all held to ransom?"

The following outlines the concepts and aspects the qualitative research participants were generally more comfortable with:

- There was less concern with gene technology used for medical applications and use. Participants indicated they feel this way because they believe there are more controls in place in the medical sector (than in the food sector), more long term rigour testing over many years (e.g. for 30-50 years) and more transparency within published reports on medical advances seen to be strongly peer reviewed, tested and reported in the public domain (i.e. media).
- There is more acceptance of gene technology involving 'like with like' — for example, plant with plant gene technology is more acceptable (even across different types) than introducing genes of an animal or bacterium into a plant.

- The mimicking of nature and small change is generally seen as better, although when gene editing was specifically discussed there were mixed responses to the term and concepts.

Even with the more acceptable aspects of gene technology, participants still often suggested they had nagging concerns in the back of their mind.

> *"In the end how do we really know it is okay and what can I do about it?"*

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.

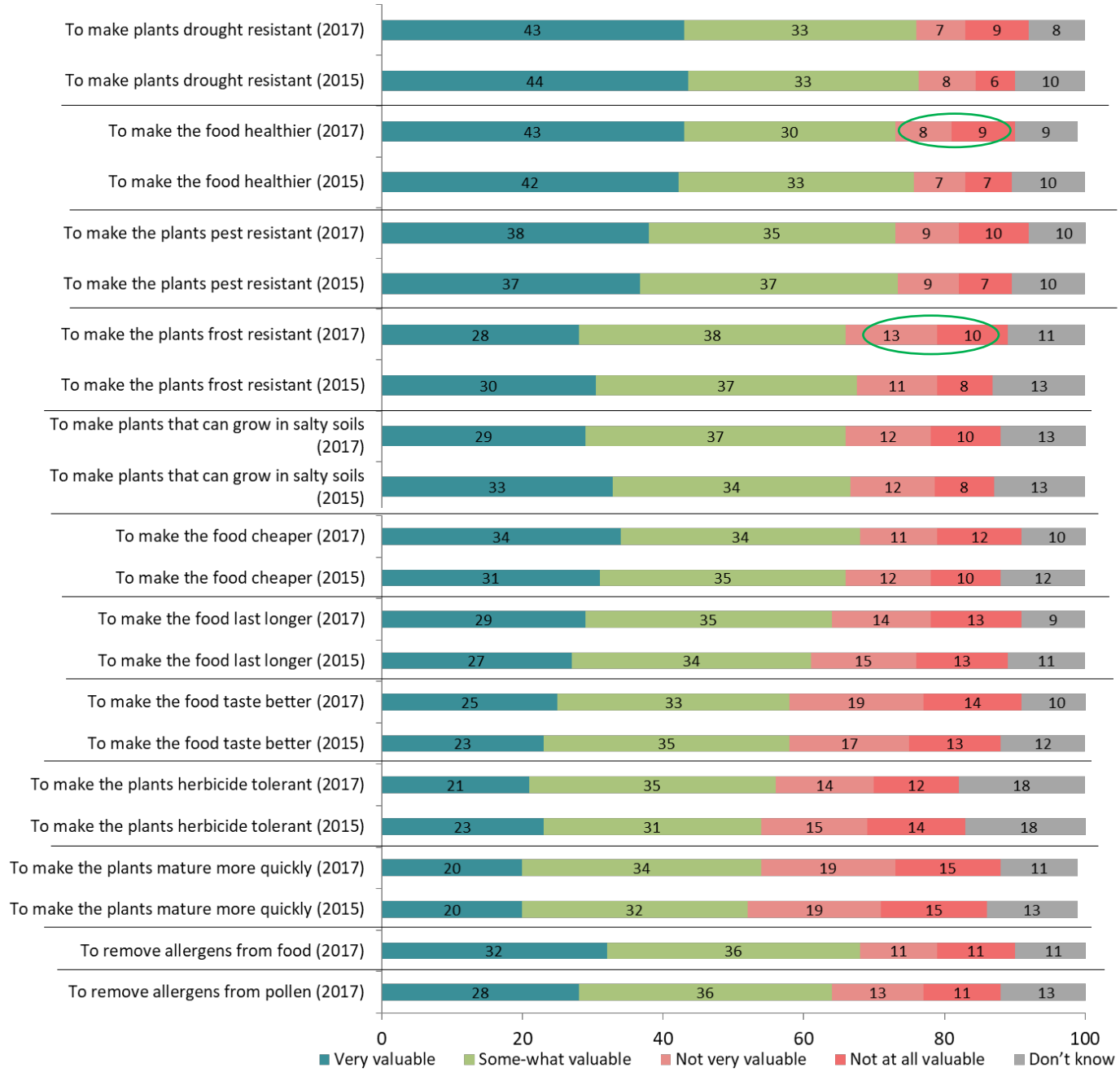
There was little change in the value people placed on the different objectives of making plants and foods GM. Those seen as very valuable were: drought resistance (43%); healthier (43%); pest-resistance (38%); frost resistance (28%); ability to grow in salty soils (29%); to make the food cheaper (34%); to make the food last longer (29%); to make the food taste better (25%); to make the plants herbicide tolerant (21%); and to make the plants mature more quickly (20%).

There was very little change in the value people placed on the different objectives of making plants GM from 2015, but there were slight increases in support for making food cheaper, lasting longer, tasting better and making plants pest resistant.

There was also a moderate to strong support for removing allergens from food and pollen, which was asked this year for the first time.

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 33: Attitudes to GM traits in plants



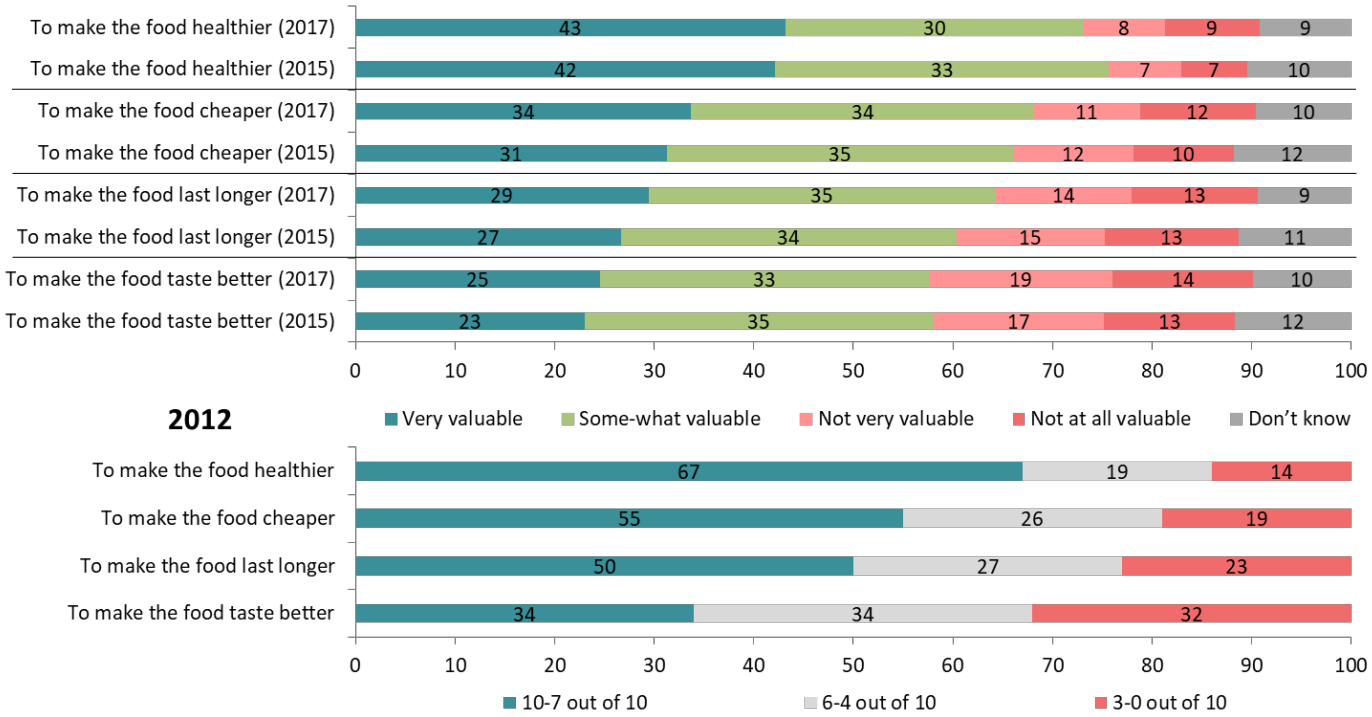
Q15. We now want to know what you think about different objectives of genetically modifying plant to produce food. Please indicate how valuable you think the following objectives are.

Base: *Total sample n=1255*

◯ Significant increase from 2015

It is worth noting that the 2012 findings were rated across a Likert scale and bunched in thirds, which gave similar trends and also showed a slight diminution across the four measures shown below.

Figure 34: Attitudes to modifying plants to produce food by trait



Q15. We now want to know what you think about different objectives of genetically modifying plant to produce food. Please indicate how valuable you think the following objectives are.

Base: *Total sample 2017 (n=1255).*

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

Table 7 – Whether the objective of genetically modifying plants to produce food is valuable

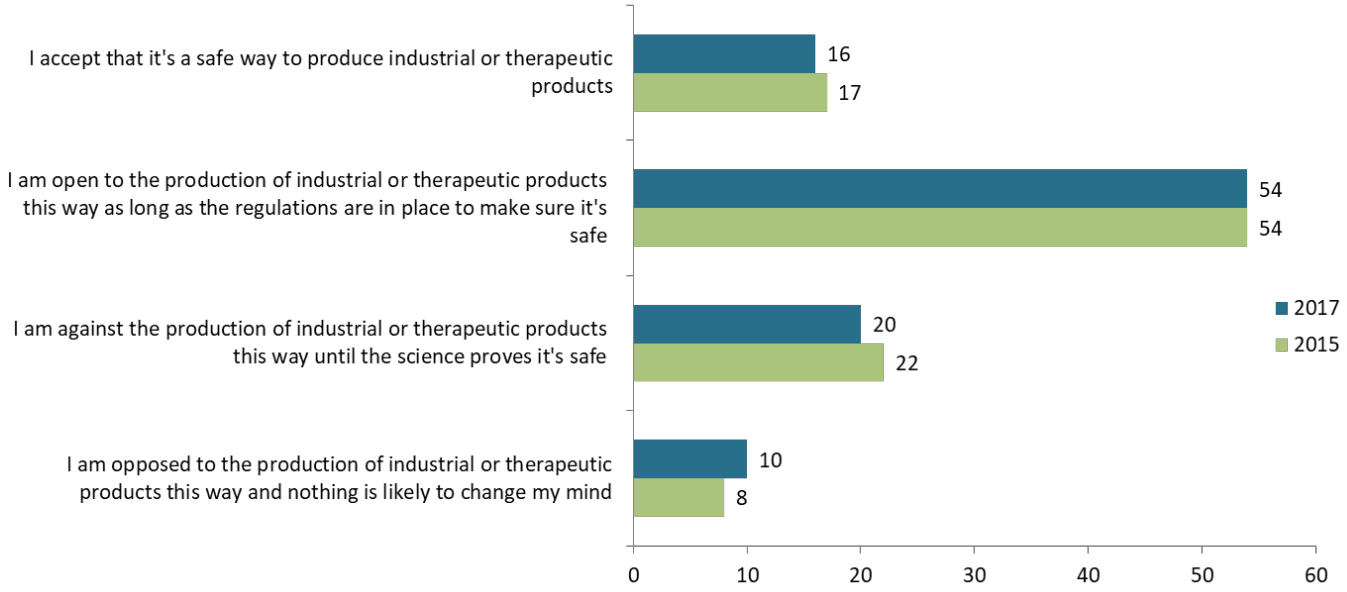
Objective	2015	2017
To make plants drought resistant	77%	76%
To make foods healthier	75%	73%
To make plants pest resistant	74%	73%
To make plants that can grow in salty soil	67%	66%
To make the foods cheaper	66%	68%
Too make the foods last longer	61%	64%
To make foods taste better	58%	58%
To make plants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

Attitudes to GM for industrial or therapeutic uses

Using another series of attitudinal statements, this time relating to attitudes to GM for industrial or therapeutic purposes with examples cited as being to make biofuels or plastic replacements, respondents were placed in one of four categories.

There was very little change in attitudes with the largest group stating they were open to the production if regulations were in place to ensure safety (54%). More felt it was a safe way to produce industrial or therapeutic products (16%) compared to GM foods (13%) and fewer were opposed to the production of therapeutic products this way (10%) than were opposed to GM foods (13%). There was a small diminution of those who were against the production of industrial or therapeutic products this way until the science proved it safe (22% in 2015 to 20% in 2017).

Figure 35: Attitudes to genetic modification for industrial or therapeutic uses



Q16. Which of the following best describes your views on the use of genetically modified (GM) technology for industrial or therapeutic uses (such as to make biofuels or plastic replacements from plants).

Base: *Total sample n=1255*

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.

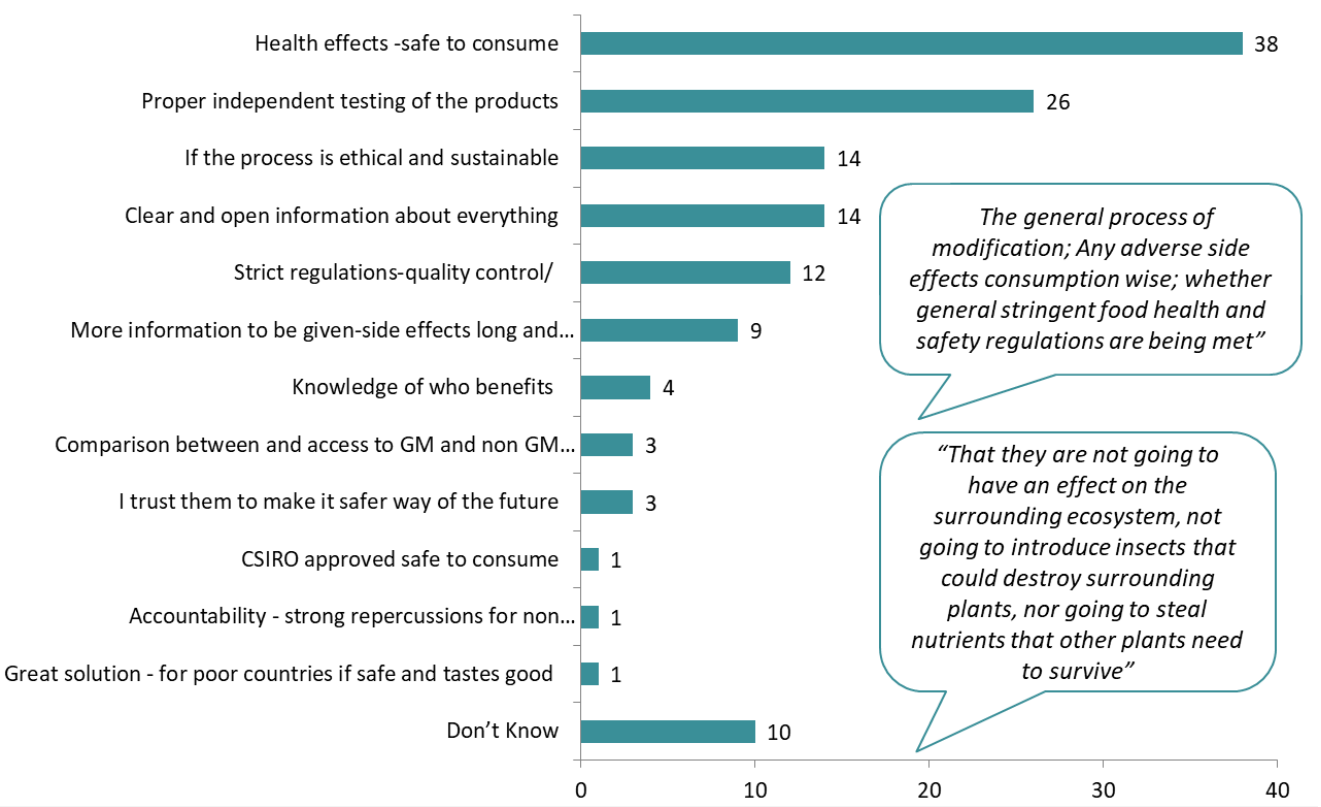
What people want to know to be assured GM crops and food are safe

The key messages people wanted from the regulator were:

- that health tests showed GM foods were safe to consume (38%)
- that there was proper independent testing (26%)
- that the process was ethical and sustainable (14%)
- that the process was transparent (14%)
- that there were strict regulatory controls (12%).

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 36: What people want to hear from the regulator



Q14c. What do you want to know from the regulator to be re-assured genetically modified (GM) technologies are safe to produce food?

Base: *Those who are open to production of food this way as long as regulations are in place make sure it's safe n= 624*

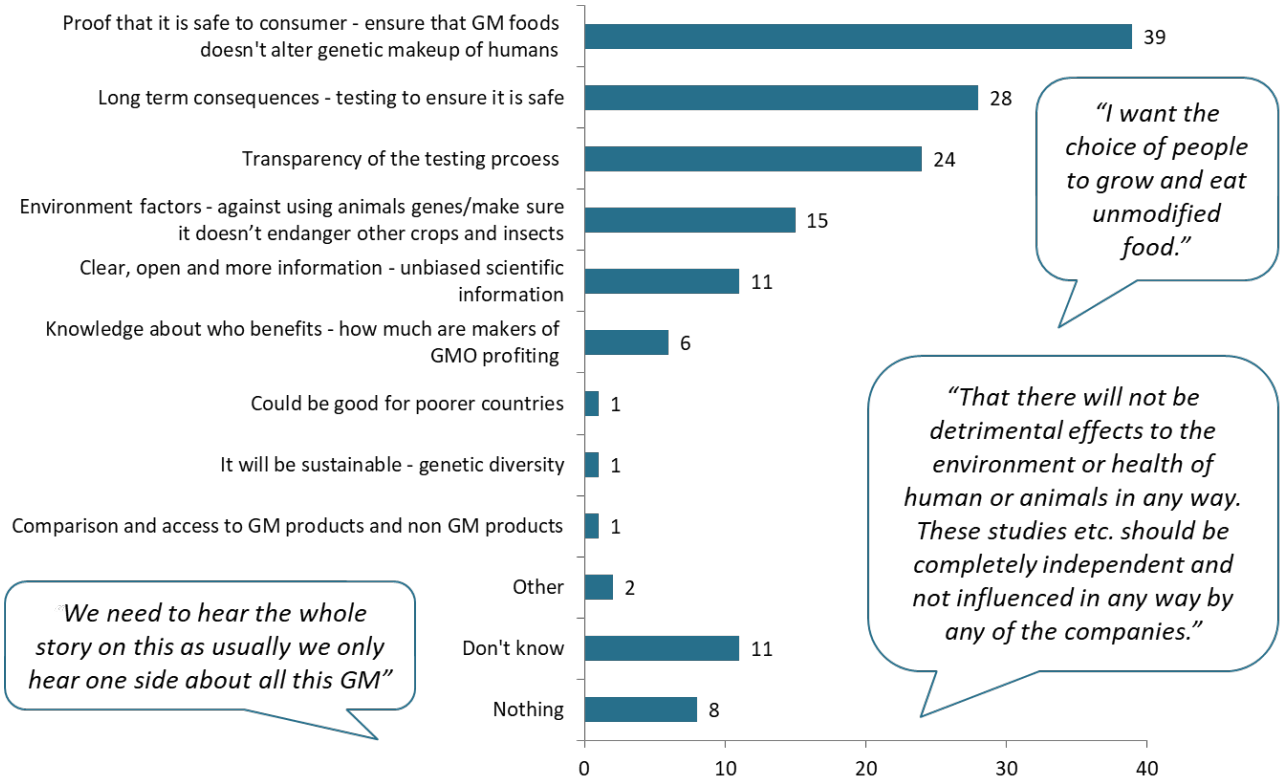
Other information that the community is interested in hearing from the Regulator included effects on health, the environment, and complete and transparent testing. These findings are important in understanding the framing for information needs of the public.

Other direct comments included:

- *Clearly stated as GM on packaging*
- *That both GM crops and non-GM crops are available*
- *That all guidelines are met*
- *Testing for long term effects*
- *No risk to children*
- *Benefits consumers, not businesses or government*
- *That there will be action if something goes wrong*
- *GM seeds won't contaminate other seeds*
- *That it is heavily monitored*
- *Everything is ethical*
- *Open and honest information.*

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.

Figure 37: What people want to know about the science



Q14d. What do you want to know about the science to be re-assured genetically modified (GM) technologies are safe to produce food?

Base: *Total sample n= 294*

The overwhelming thing people wanted to know about the science was that GM crops and foods were safe (39%), long-term consequences and testing (28%), transparency of the testing processes (24%) and that it doesn't endanger other crops (15%).

When asked what they wanted to know about the science of GM to be re-assured that GM technologies were safe to produce food, respondents' answers included:

- *Isn't harmful*
- *More public information*
- *Proof from scientists that it is safe*
- *Effect on environment*
- *Information on who benefits financially*
- *Assurance that farmers will benefit*
- *Side effects*
- *No cross contamination of non-GM crops*
- *GM food is nutritional.*

Those respondents who indicated they were opposed to the use of genetically modified technologies to produce food and nothing was likely to change their minds, were asked why they were opposed.

Qualitative research insights on what helps people have more trust in GM

The qualitative research also explored what would help people have more trust in gene technology and specifically GM crops and food. The responses were much in line with the survey results with three elements identified:

1. Long-term rigorous testing that is reviewed, published and publically debated — even acknowledging when things change with CSIRO being often acknowledged for doing this well and its scientists being trusted (although with a common expressed feeling the CSIRO has somewhat less capacity, independence and standing than it once had)
   "They are continually updating us like five years ago they might have said eggs were bad and you will get high cholesterol but as soon as the science proves otherwise then they do announce…okay we stuffed up eggs are actually good you can have two a day every day of your life. You have got to trust someone or an authority that is accepting that they do make mistakes or has new information contrary to what they advised us some time ago."

2. Independently formed statutory or government body that has teeth and shows it holds industry to account and to standards and puts public interest at the fore — some examples given were the ACCC, the CSIRO again and in particular ombudsman offices which were well regarded and trusted by most (but not completely by all)

3. Having labelling that indicates whether or not the item is from a GM crop or contains any ingredients that are GM based to provide transparency. Some participants discussed that in United States of America they found products that were clearly labelled regarding gene modification.

As part of the qualitative research participants were asked to look at two information sheets on arguments for and against GMOs and GM crops and indicate which of the arguments resonated with them, what impact they had on them and why. Copies of the documents are provided at Appendix II.

In the online forum heat mapping as shown below was used to help identify the most contentious arguments for and against GMOs. The circles indicate the area in the statement that elicited a strong response.

Arguments FOR	Arguments AGAINST
Crops can be engineered to be pest/disease resistant and so reduce or eliminate the need to use pesticides or herbicides. This reduction in chemicals can benefit the environment and wildlife. Reducing the need to spray also cuts farmers' emissions, helping to reduce global warming.	The creation of pest or herbicide resistant GM crops could result in 'superbugs' or 'superweeds' that evolve to be resistant to the chemicals or toxins developed in conjunction with GM crops.
GM foods could be made healthier than conventional foods by, for example, modifying them to include extra vitamins and nutrients. Increase natural production of antioxidants, increase the concentration of nutrients, lower the saturated fat content on cooking oils etc. Improving nutritional values of foods can be particularly significant in boosting diets for developing countries.	Seeds travel beyond the fields in which they are grown. The growing of GM crops could result in cross-pollination between GM crops and non-GM and organic crops thereby contaminating them.
Crops could be modified to enable them to survive and grow in unfavourable conditions and withstand drought or floods. This could be particularly beneficial to farmers in the developing world.	Long-term impacts on human health, food safety or the environment cannot be accurately predicted. Tampering with crops genetic make-up impacts down the food chain: scientists say GMOs have decimated butterfly populations in the US and led to birth defects among other animals. By the time we find out, it could be too late.
Crops could be modified to reduce or eliminate allergic affects, e.g. by removing the allergic properties from nuts or altered so they have medicinal benefits, e.g. contain vaccines for specific diseases.	GM is not the key to food security and GM crop developments to date have largely benefited northern countries and markets, not small scale farmers in the developing world. Food security lies in the more equal distribution of food, access to land and money by the poor.
Foods can be genetically modified to improve flavour and texture. Foods can also be given a longer shelf-life so consumers get fresher taste and the environment benefits from less waste.	GM crops which have additional proteins or altered genetic composition could result in toxic and allergic reactions in certain people.
Crops can be created that give higher yields and better quality food. This is particularly important to help meet the demand for food by an expanding world population.	Use of GM crops will result in increased dependency on transnational biotech corporations to supply seed and chemicals, the result being monocultures. This will prove particularly costly and damaging to small scale farmers in the developing world who rely on saving seed from year to year and often plant a diversity of crops.
Since the wide scale consumption of food from GM crops began some seven years ago there have been no substantiated cases of harm to human health.	GMOs increase resistance to antibiotics, making medicines less effective. Fears have been raised over possible links to cancer, reproductive malfunction, and digestive disorders. Nobody knows the long-term effects.

In the qualitative research the arguments identified as helpful in increasing participant's trust in gene technology and specifically GM crops and food included:

Crops can be engineered to be pest/disease resistant and so reduce or eliminate the need to use pesticides or herbicides. This reduction in chemicals can benefit the environment and wildlife.	*"As for benefiting the wildlife, I'd do anything in my power to protect them from human induced harm."*
GM foods could be made healthier than conventional foods by, for example, modifying them to include extra vitamins and nutrients.	*"This is a good argument for GM."* *"This is a powerful argument in favour of GM and what the focus should be."*
Foods can be genetically modified to improve flavour and texture—peppers made spicier, corn given enhanced sweetness. In blind tastings, testers refularly rate GM foods higher than naturally grown alternatives. One, in 2007, found 60% preferred GM tomatoes. Genetic modification can also give food a longer shelf-life meaning consumers get fresher taste and the environment benefits from less waste.	*"Another powerful argument for GM particularly in terms of the increase to shelf life. In Australia so much food is wasted because it is not consumed before the best before or expiry date. It would also help us exporting food to other countries to keep it fresher for longer."* *"This seems like it would really enhance our options."*
Crops could be modified to enable them to survive and grow in unfavourable conditions and withstand drought or floods. This could be particularly beneficial to farmers in the developing world.	*"I believe in the short term Third World countries are a lot more susceptible to changes in crop farming techniques but as these style of GM foods evolve and costing becomes more economically viable the smaller farmer will also come into a more consolidated approach.* *"This is an aspect Australia should really embrace with our generally nutrient poor soils and tough weather conditions in many parts of the country. GM could open up previously unproductive areas of land helping feed us and the rest of the world and boosting our economy."*
Crops can be created that give higher yields and better quality food. This is particularly important to help meet the demand for food by an expanding world population.	*"That's interesting."*

The following provides the arguments identified by qualitative research participants as undermining trust in and perceptions of gene technology and specifically GM crops and food included:

Because it is a new technology, there is a need to adopt the precautionary principle. The long-term impacts on human health, food safety or the environment cannot be accurately predicted. It is too risky to allow the commercial growing of GM crops at this stage.	*"This is no different an argument form most new scientific developments to do with health. Remember Thalidomide?"*
Studies show the introduction of GMO soybean and corn in the United States led to a 13 million kilo reduction in pesticide use in the 12 years up to 2009. By reducing the need to spray, GMOs also cut farmers' fuel emissions, helping to fight global warming.	*"There is no demonstrated link between herbicides and global warming and there isn't a demonstrated link about the opposite too so, GM might not help reducing the global warming (that's assuming that is happening)."*
Since the wide scale consumption of food from GM crops began some seven years ago there have been no substantiated cases of harm to human health.	*"As previously mentioned by [name of another participant], 7 years is not a long time. I dare to add, 7 years is near to nothing it's just the beginning, surely not a time long enough to produce reliable statistics."*
GMOs are a serious risk to the environment. Their seeds travel well beyond fields where they are grown. Cross-pollination creates herbicide-resistant 'super weeds' that threaten other crops and wild plants. Tampering with crops' genetic makeup impacts down the food chain: scientists say GMOs have decimated butterfly populations in the US, or led to birth defects among other animals. By the time we find out the long-term impact, it could be too late.	*This is what resonates with me and what I am most worried about."* *"This is my concern for GM foods. [But] this con does not outweigh the arguments for."* *"I am still quite concerned about the long term health effects from GM foods. It is difficult how this will affect the human race in the future."*

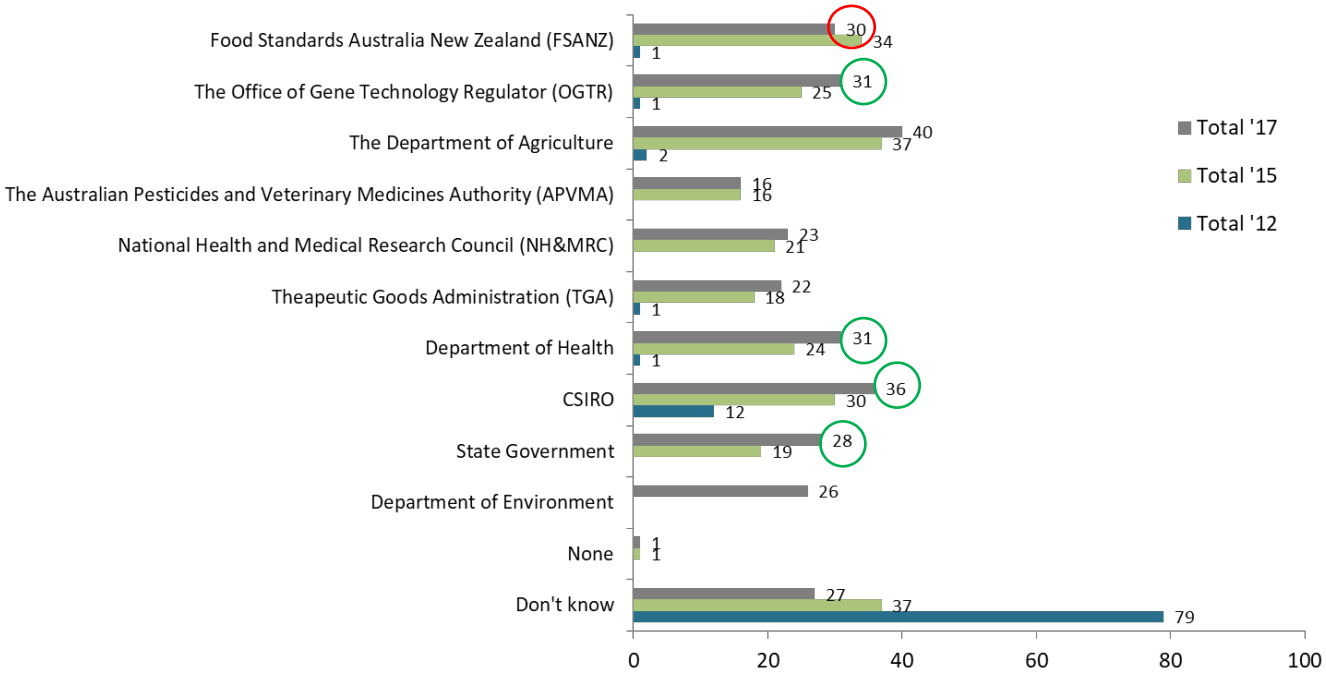
Awareness of organisations responsible for regulation of GM

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 (27%). Those organisations that were most commonly believed to regulate GM were the Department of Agriculture (40%), CSIRO (36%), the Office of the Gene Technology Regulator (OGTR) (31%), Department of Health (31%), Food Standards Australia New Zealand (FSANZ) (30%), State governments (28%), the National Health and Medical Research Council (NHMRC) (23%), TGA (22%), and the Australian Pesticides and Veterinary Medicines Authority (APVMA) (16%).

Overall findings of awareness of the agencies that might be responsible for GM regulation were fairly similar to 2015, with increases for OGTR, the Department of Health, state governments and CSIRO.

Figure 38: Organisation/s they believe are responsible for the regulation of genetic modification in Australia



Q17. Which organisation or organisations do you believe are responsible for the regulation of genetic modification in Australia?

Base: *Total sample n=1255*

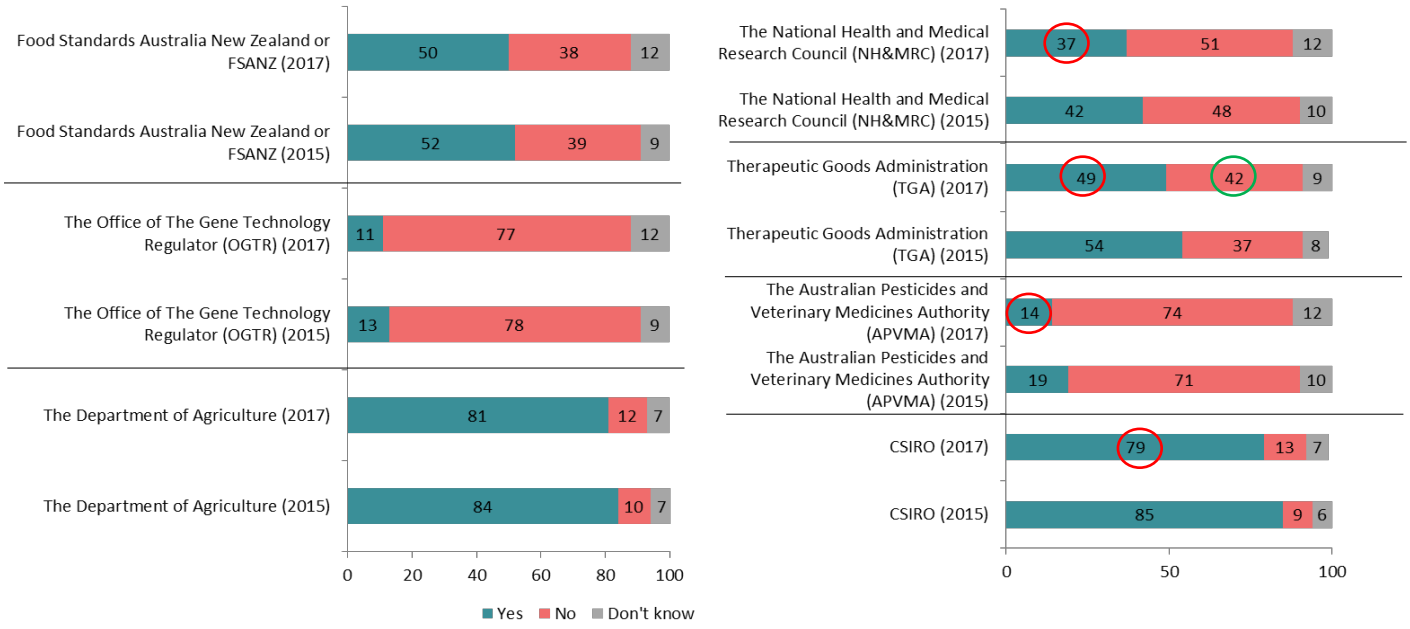
These are moderate to good findings for the regulators (though it is worth noting that CSIRO—not a regulator—rates quite highly) when their names are prompted. When a similar but unprompted response question (i.e. with no list of organisations) was asked in 2012, the only organisation that rated over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

many respondents are answering the question based on the names of the regulators, and deducing whether they are regulators, rather than knowing the answer.

This was confirmed when respondents were then asked if they had been aware of these organisations before the survey, and the figures were generally much lower for gene technology regulators. Only 11% were aware of the OGTR before conducting the survey—which was a minor fall from last year's figure of 13%, but in 2012 it had only been 5%. OGTR awareness was the lowest of all organisations tested.

The highest were the Department of Agriculture (81%), CSIRO (79%), Food Standards Australia New Zealand (50%), Therapeutic goods administration (45%), the National Health and Medical Research Council (37%) and the Australian Pesticides and Veterinary Medicines Authority (14%).

Figure 39: Awareness of organisations



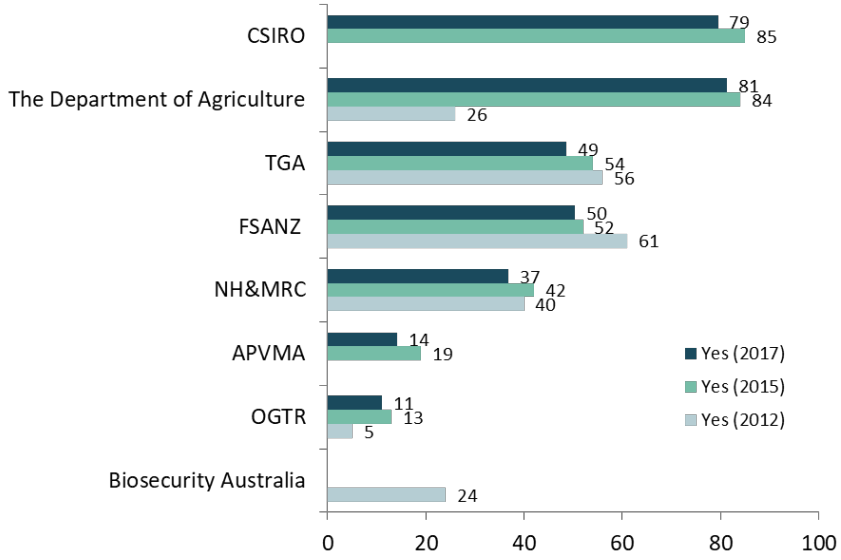
Q18. Had you heard of the following organisations before completing this survey?
Base: *Total sample n=1255*

Significanty higher than 2015 Significantly lower than 2015

Overall there was a slight downward trend of awareness across all organisations—the largest being the NHMRC (-5%), TGA (-5%) and CSIRO (-6%).

Comparing 2012 to 2015 and 2017 data, most organisations maintained fairly similar ratings. It should be noted that the increase in the Department of Agriculture rating from 26% to 84% and then down to 81% was based on the question asked in 2012 being slightly different.

Figure 40: Awareness of organisations responsible - Year comparison



Q18. Had you heard of the following organisations before completing this survey?
Base: *Total sample 2017 (n=1255).*

There was a poor correlation between who respondents felt was responsible for GM regulation and awareness of the regulator, with only the APVMA rating closely with 16% believing it responsible for GM regulation and 14% 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 36% believing (incorrectly) that it was responsible for GM regulation and 79% 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 (31% to 11%).

Table 8: Comparison between who was thought responsible for regulation and prior awareness

	Responsible for GM regulation	Heard of previously
OGTR	31%	11%
APVMA	16%	14%
NHMRC	23%	37%
FSANZ	30%	50%
TGA	22%	49%
Dept of Agriculture	40%	81%
CSIRO	36%	79%

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 it role is not well known in the public.

However, in the qualitative research it was identified that people could deduce the role of the agency based on the name OGTR. Hence better awareness of the existence of the OGTR should help to understand there is an agency responsible for regulating gene technology in Australia.

Trust in what organisations say about gene technology

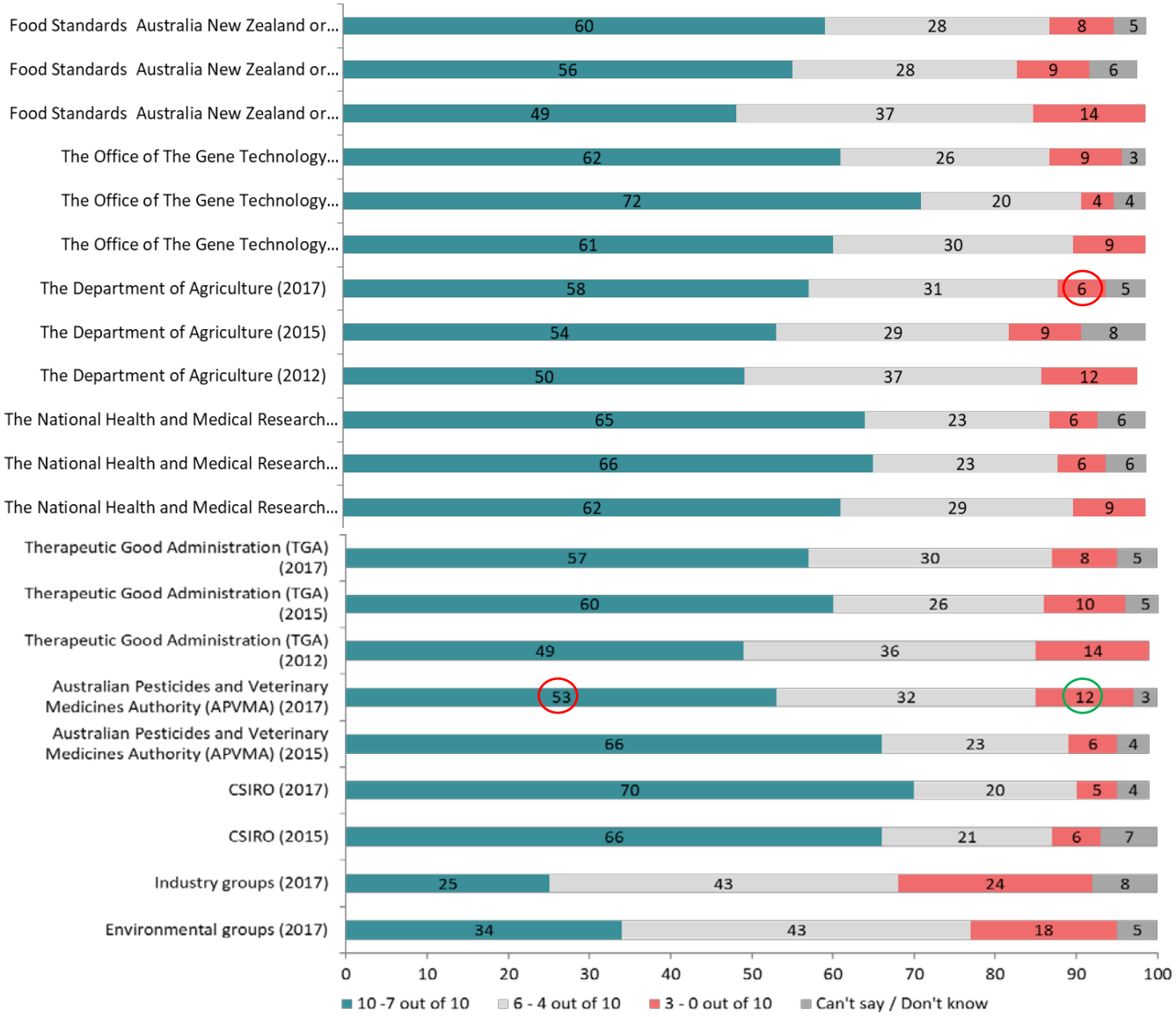
All the regulators and other organisations polled received considerable levels of trust in relation to the information that they might produce on gene technology (between 54% and 70%). Industry groups and environmental organisation rated much lower for trust though, at 25% and 34%, and also the highest levels of low trust (24% and 18%).

Movements of trust were mixed, however, with rises in trust for FSANZ (49% in 2012 to 56% in 2015 to 60% in 2017) and the Department of Agriculture (50% to 54% to 58%). The OGTR had seen a rise and then a fall (61% to 72% to 62%) as did the NHMRC (62% to 67% to 65%) and the TGA (49% to 60% to 56%).

APVMA and CSIRO were only tested over the last two polls, and the CSIRO's trust increased from 66% to 70% and the APVMA decreased from 66% to 54%.

It should be noted that this 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 41: Trust in what certain organisations say about GM and gene technology



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 organisations tell you about the risks and benefits of genetic modification or gene technology.

Base: *FSANZ n=658; OGTR n=154; Dept. Ag n=1042; NHMRC n=479*

Significanty higher than average Significantly lower than average

OGTR's levels of trust (62%) outranked the Food Standards Australia New Zealand (60%), the Department of Agriculture (58%), the TGA (57%) and the APVMA (53%). At the same time, while in general the lower ratings of trust declined or remained static, the APVMA and OGTR had small increases in their lower trust ratings (+6% for the APVMA and +5% for OGTR).

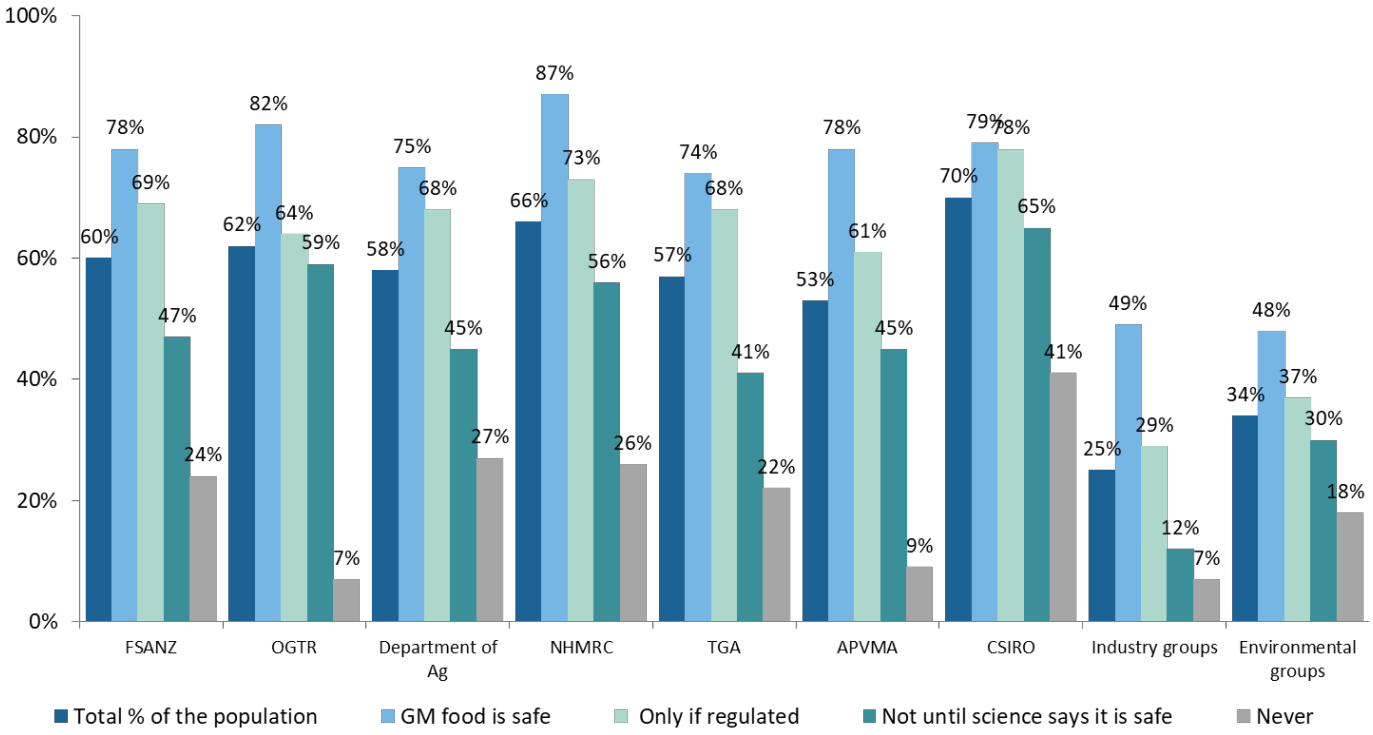
When organisational trust was examined across the key groups by attitudes to GM foods, the group most reluctant to support GM technologies in food production had the lowest levels of trust in all groups, including in environmental groups, which indicates that trust is not conditional on aligning

with a particular world view, but is just a constant low trust. They also had strikingly low trust in the OGTR and the APVMA.

Table: 9 Trust in organisations by segment

	Total	Safe	Only if regulated	Not until science says it is safe	Never
FSANZ	**60%**	78%	69%	47%	24%
OGTR	**62%**	82%	64%	59%	7%
Department of Ag	**58%**	75%	68%	45%	27%
NHMRC	**66%**	87%	73%	56%	26%
TGA	**57%**	74%	68%	41%	22%
APVMA	**53%**	78%	61%	45%	9%
CSIRO	**70%**	79%	78%	65%	41%
Industry groups	**25%**	49%	29%	12%	7%
Environmental groups	**34%**	48%	37%	30%	18%

Figure 42: Trust in organisations by segment



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 organisations tell you about the risks and benefits of genetic modification or gene technology.

Base: *TGA n=668; APVMA n=204; CSIRO n=1033; Industry groups n=1160; Environment groups n=1160*

It is also noteworthy that the group who felt that GM foods were safe to eat had the highest consistent levels of trust in all organisations.

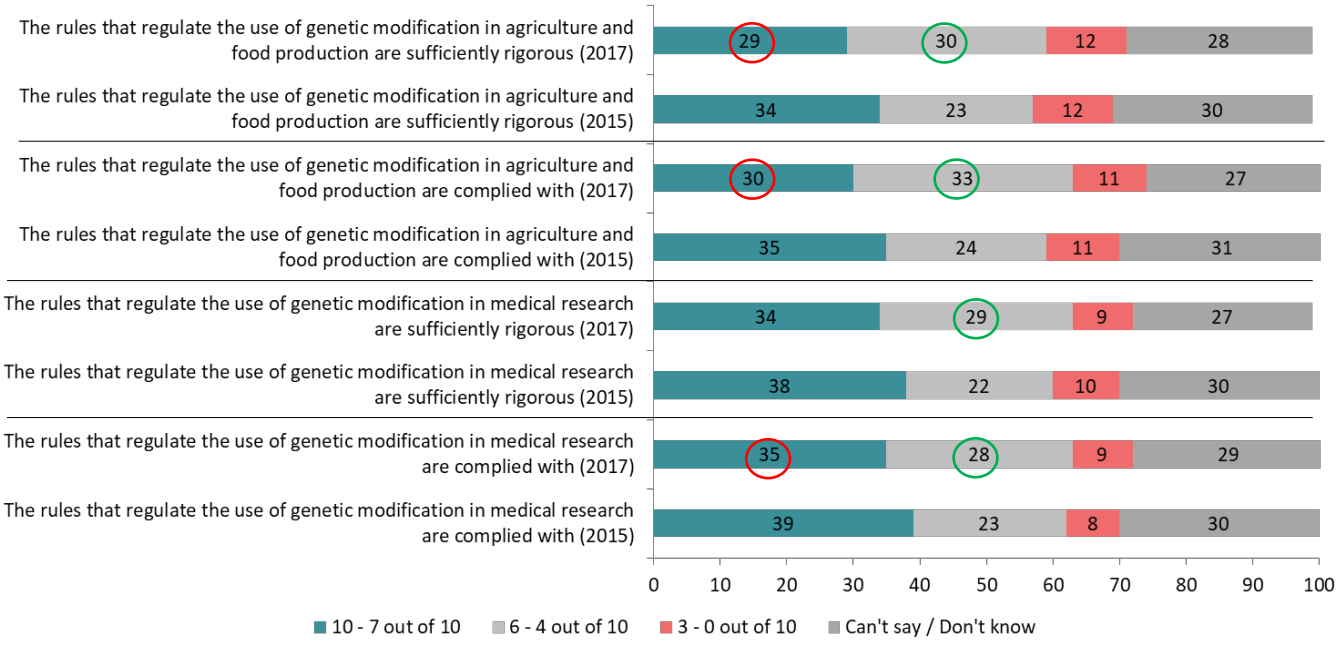
Attitudes and beliefs towards government involvement

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. There was a slight downward trend in those believing the rules that regulate the use of different GMs were sufficiently rigorous or complied with, but rigour and compliance were at comparable levels.

That the rules regulating the uses of GM in agriculture and food production are sufficiently rigorous was agreed to by 29% of the top cohort on a Likert scale, and 30% felt they were sufficiently rigorous. And that the rules regulating the uses of GM in medical research are sufficiently rigorous was agreed to by 34% of the top cohort on a Likert scale, and 35% felt they were sufficiently rigorous. This represented a slight reduction from 2015. There were also very high levels of *don't know* responses, rating between 27% and 29%.

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

Figure 43: Attitudes and belief in government rules and regulation



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 statements

Base: *Total sample n=1255*

Significanty higher than 2015

Significantly lower than 2015

It is worth noting that the likelihood that people would agree that the rules that regulate the use of genetic modification are sufficiently rigorous and that they are complied with, strongly correlate with their attitudes to genetic modification for food production and for industrial and therapeutic uses.

Qualitative research insights into awareness regulation and who is trusted

Most participants in the qualitative research were pleased to hear that gene technology is regulated in Australia but didn't know or hadn't thought much about 'who' would be doing the regulating. However, many also just assumed there would be a government agency responsible for the regulation.

When asked to indicate which organisation or organisations would be responsible for the regulation of gene technology in Australia the spontaneous associations included: CSIRO, 'Food Standards' (or just reference to the 'food regulator'), the Department of Agriculture, Customs and Immigration and the Department of Health.

There was essentially no recall or awareness of the Office of the Gene Technology Regulator (OGTR). Trust levels were mixed for OGTR largely due to it being unknown but association with an Australian Government Department (i.e. the Department of Health) was reassuring to many.

Participants spoke about having trust in independent professional or scientific bodies in relation to gene technology. For example AMA and particularly CSIRO were trusted although for some the trust in the CSIRO and its perceived capacity has declined.

Participants also spoke about Googling to an official site with 'gov.au' providing a level of confidence in the information they would find. Some even spoke about using Wikipedia as an initial source of information.

Other trusted sources included *Choice*, investigative journalists, family and friends and scientists they know personally.

Participants were also asked why they hadn't mentioned industry and environmental groups and why they may have received a lower rating in the survey as a trusted source of information on gene technology compared to other potential sources. Participants acknowledge that their level of trust does depend on their familiarity and affinity with particular industry or environment organisation or group, but in general they have become more aware that such organisation or groups (whether or not well intentioned) have particular agendas.

> *"We've got wiser about environmental and similar groups and know they have an agenda just like industry."*

The lack of presence of the regulator (OGTR) does not help demystify the concerns about GMOs. When participants were asked what they need the regulator to do to help in having confidence in gene technology in Australia there were three key elements identified:

1. **To be clearly informed about what GMO is and current developments** by having a public presence like the CSIRO or the ACCC. There was a view the regulator needs to stand for something and been seen as standing for the public and independent. An 'ombudsman' was generally seen as trusted and 'for the public' and one for gene technology was thought could be effective.

2. **Having potential long term impacts addressed and a clear and strong regulation process and standards** with published reports and a program of long term rigorous research and testing that is reported and discussed prominently to show how it is like the system for the medical sector. People need to be reassured and shown there can actually be a regulation standard that can be relied on in relation to gene technology and in particular with GM crops and food.

3. **Labelling on food and food products to provide a sense of transparency combined with education** and information that is easy to access and understood at point of purchase. Participants suggested a label like Australian Standards for GMO – saying what has been modified to achieve x and how. This also involved indicating where to find more information easily, including mobile compatible options and linking to food and health related sites and app services. Education at school level was also often mentioned.

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 46% of respondents, followed by documentaries on television (42%), news stories on television (31%) and current affairs shows on television (29%). 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.

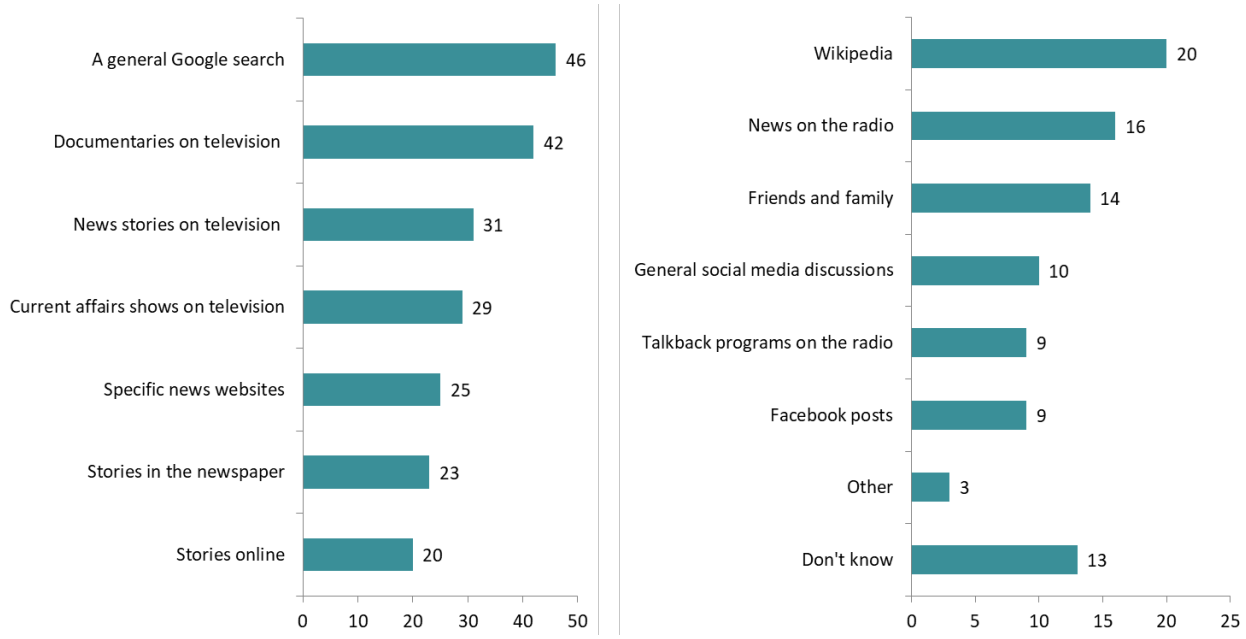
It should be pointed out, however, that a general Google search is an active form of seeking information on GMOs, while television tends to be a more passive form of seeking information, and in the absence of verifying if the responses align with people's actual information seeking habits, they should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

After the four sources of information that account for between 29% and 46% of the population, the next largest source of information on GM issues was stated to be specific news websites (25%), followed by stories in the newspaper (23%). These were followed by Wikipedia (20%), news on the radio (16%) and friends and family (14%), general social media discussions (10%), talkback programs on the radio (9%), and Facebook posts (9%).

It was worth noting that despite concerns about social media as a source of information or misinformation on gene technology, it rated at 10% or less for respondents.

Women were significantly more likely to say they searched for information through Google, specific news sites, and friends and family.

Figure 44: Sources of information



Q21. Where are you most likely to get information on gene technology and similar technology from?
Base: *Total sample n=1255*

Comparing sources of information to their trust shows that information preferences and trust are not necessarily closely aligned. Overall there was little major difference in trust of information sources, with TV documentaries, friends and family and Wikipedia rating 10% or more as being very trustworthy. There was a greater difference in lack of trust with social media and Facebook rating very poorly.

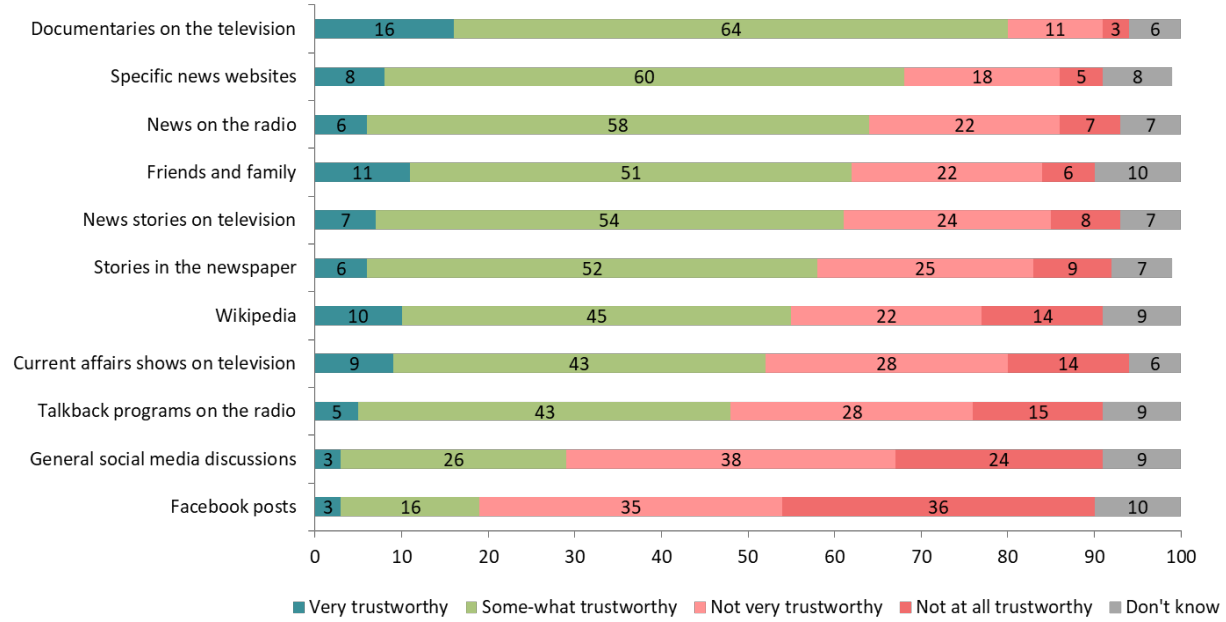
The most trusted medium for information was documentaries on television where 16% found them very trustworthy and 64% somewhat trustworthy (totalling 80%). This was followed by specific news websites (8%) very trustworthy and 60% somewhat trustworthy, totalling 68%. The third most trustworthy source of information was news on the radio (6% very trustworthy and 58% somewhat trustworthy, totalling 64%).

The fourth most trusted source of information was friends and family receiving the second highest rating of being very trustworthy (11%) and 51% somewhat trustworthy, totalling 62% trust.

Social media scored the highest level of distrust with Facebook posts rating 36% *not at all* trustworthy and 35% *somewhat* trustworthy, totally 71% distrust. The second least trusted source of information was general social media discussions, with 24% rating them as *not at all* trustworthy and 38% rating them *not very* trustworthy, totalling 62% distrust.

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

Figure 45: 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 organisations tell you about the risks and benefits of genetic modification or gene technology.

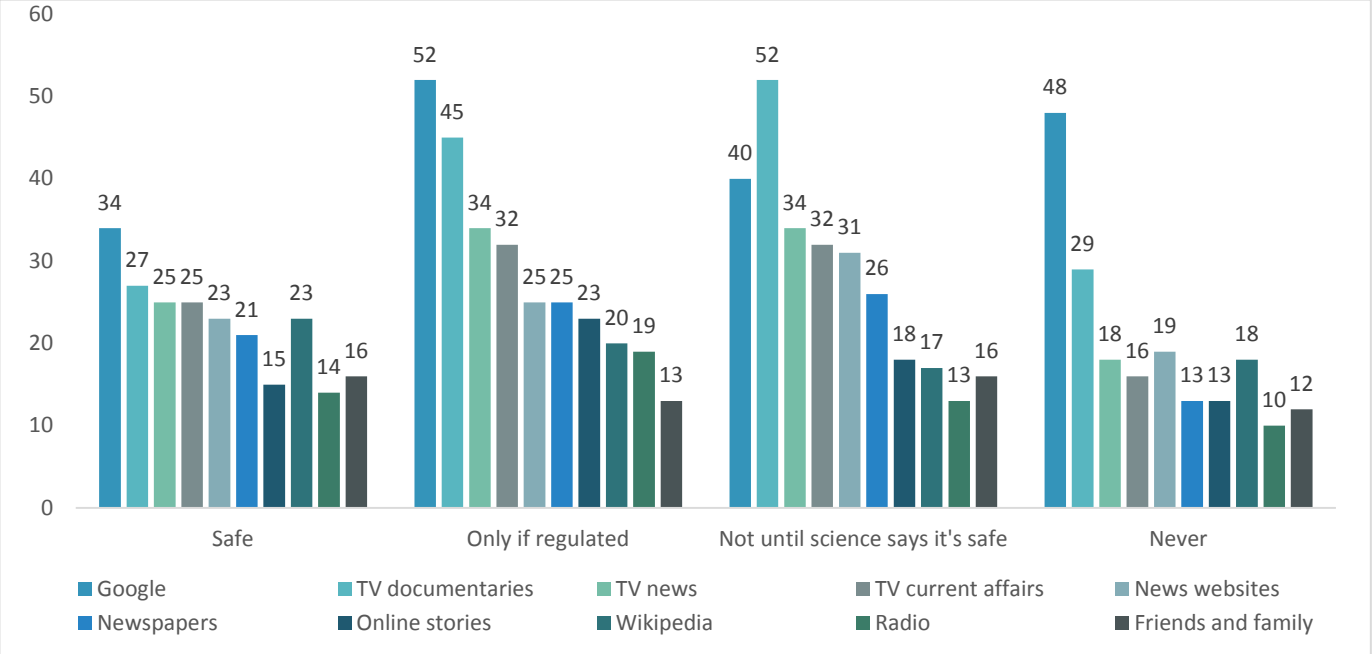
Base: *Total sample n=1255*

When correlated, the data 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

Source of information	Likely source of info	Total trust
General Google search	46%	n/a
Documentaries on TV	42%	80%
News stories on TV	31%	61%
Current affairs shows on TV	29%	52%
Specific news websites	25%	68%
Stories in the newspaper	23%	58%
Stories online	20%	81%
Wikipedia	20%	55%
News on the radio	16%	64%
Family and friends	14%	62%
General social media	10%	29%
Talkback programs on radio	9%	48%
Facebook posts	9%	19%

Figure 46: Sources of information by segment



Q21. Where are you most likely to get information on gene technology and similar technology from?
Base: *Total sample n=1255*

By breaking down the sources of information by the segments that define attitudes to GM some interesting trends became apparent. Firstly, those who felt GM foods were safe to eat were the least likely to use a Google search, yet those who felt they would never eat GM foods were the second most likely to use a Google search. TV documentaries were very high amongst the middle two groups. There was a general similarity to the flow of media use across the four segments, with a few exceptions. Those who believed GM foods were safe were more likely to watch TV current affairs relative to other news sources, and use Wikipedia relative to other sources of information. Those most opposed were much more likely to use Google, relative to other sources of information.

Table 11: Trust in sources of information by segments

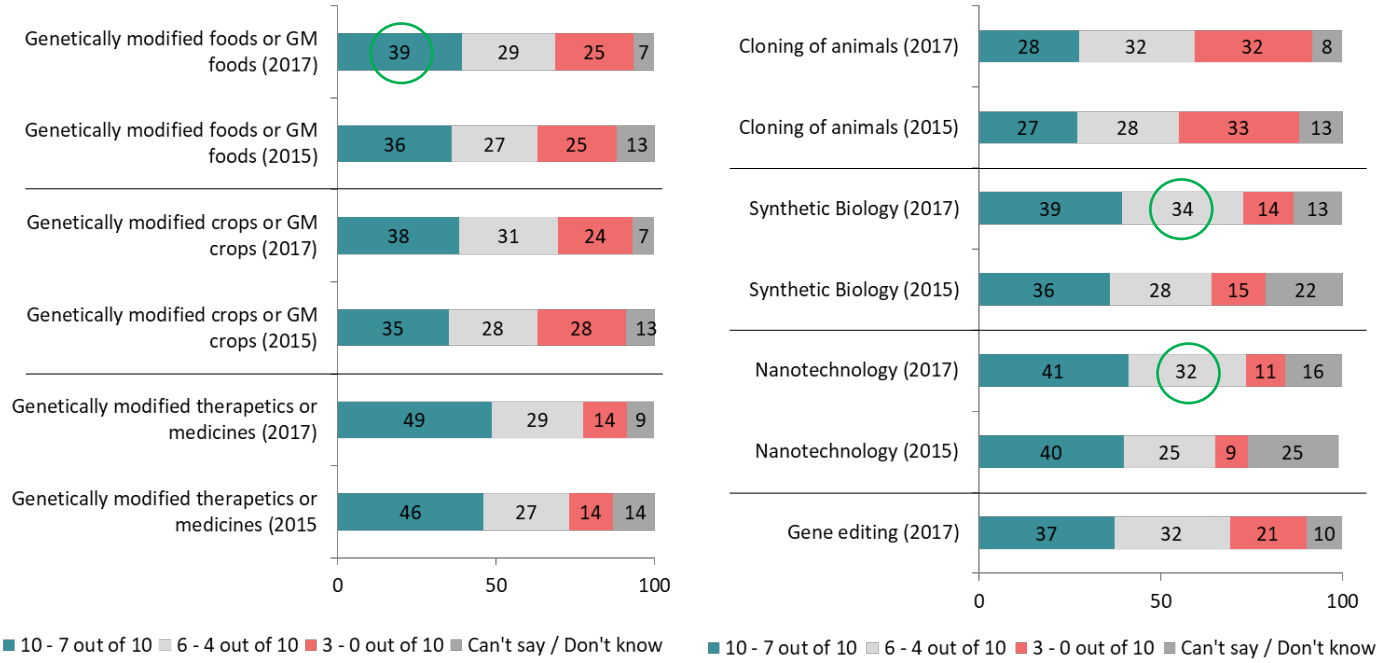
	Total	Safe	Only if regulated	Not until science says it is safe	Never
Newspapers	**84%**	85%	89%	80%	68%
Radio	**86%**	83%	91%	85%	70%
Talkback radio	**76%**	76%	79%	76%	66%
News on TV	**85%**	84%	89%	84%	72%
Current affairs	**80%**	74%	85%	81%	63%
Documentaries on TV	**91%**	87%	95%	90%	83%
Wikipedia	**77%**	78%	80%	73%	75%
Specific news sites	**86%**	82%	91%	85%	75%
Facebook	**54%**	59%	57%	51%	42%
General social media posts	**67%**	73%	70%	65%	52%
Friends and family	**11%**	21%	11%	10%	7%

Looking in more detail at trust across the segments, it shows that those who would never eat GM foods have the lowest levels of trust across almost all media surveyed, as well as the lowest levels of trust in regulators, so general low levels of trust can be assumed for this group.

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. There was a slight increase in support for all applications tested in the survey, with a general move from the centre more than those opposed to the technologies.

Figure 47: Support for biotechnology sciences and technologies



Q23. Please indicate your level of support for the following science and technology developments using the 0-10 scale, where 10 is completely supportive and 0 is not at all supportive

Base: *Total sample n=1255*

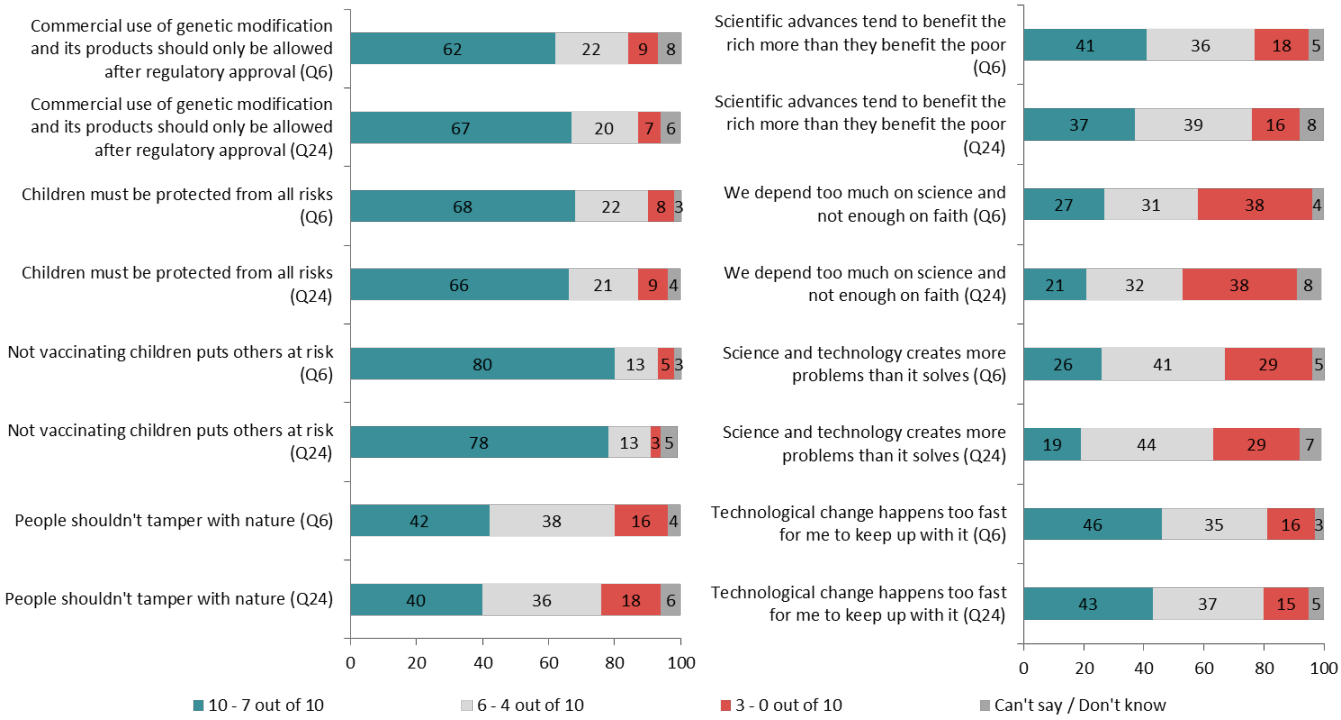
Significanty higher than 2015 Significantly lower than 2015

In exploring people's support or otherwise for the applications of GMOs and other technologies half the survey respondents were asked to indicate their level of agreement or disagreement to a set of statements at the start of the survey (question 6) and a second half of the survey respondents were asked to provide their responses at the end of the survey (question 24). The aim was to study what impact engagement or thinking about these technologies and their regulation had on people's attitudes, or indeed what impact all the questions in the survey had on people's responses.

In fact there was very little difference in the responses to the questions asked early in the survey at Question 6, and those asked later at Question 24. There was a slight diminution of those who did not know at the end of the survey and that tended to move towards strong support for a question or statement. This may also be an indication of attitudes having settled more.

In 2015 when this was done there was a slight increase in support for the technologies over the survey. For instance, 36% of respondents stated they had the highest levels of support for GM foods, and 35% stated they had the highest levels of support for GM crops, while at the start of the survey the ranking had been 33% for GM food and crops both.

Figure 48: Attitudes towards science and technology – responses at the start and end of the survey



Q6 & 24. On a scale of 0 – 10, where 10 is strongly agree and 0 is strongly disagree, please indicate how much you agree or disagree with the following statements.

Base: *Total sample n=1255 (636 for Q.6 and 619 for Q.24)*

Values-based segmentation

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

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

They were:

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

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

A cluster analysis was applied to the findings of the value statements. As in the 2105 segmentation, the data was standardised to rescale the variables so that each had a mean of 0 and a standard deviation of 1. This made sure that all variables contributed evenly. 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 in the following pages.

While the data in the survey showed few significant differences, the cluster analysis showed considerable movement in three segments, largely due to 'bracket creep' between segments. This means that there were only minor changes in people's actual positions—as was demonstrated in the main survey—but it was enough to move many into a new segment group. The three segments with significant changes were: The Lost (16%, down from 31% in 2015), the Uninformed Doubting Thomases (13%, down from 20% in 2015) and the Disciples (31%, up from 17% in 2015). It will be interesting to observe whether this trend continues in future years.

Segment 1 – The Disengaged/Lost 16% (down from 31% in 2015)

Table 12 – Segment 1 gender, age and state/territory profile

	Male	Female	30 years or younger	31-50 years	51 years or older	QLD	NSW	ACT	VIC	TAS	NT	SA	WA
	33%	67%	21%	50%	28%	29%	24%	1%	24%	3%	1%	6%	11%
Nat. Av.	50%	50%	27%	38%	34%	20%	32%	2%	25%	2%	1%	8%	10%

Demographic: This segment is more likely to be female, aged 31–40 years and be a TAFE or university student.

They are more likely to:

- Have never heard of **gene editing** and have a too limited knowledge of **cloning of animals** to be able to 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** in the low 0-3 out of 10, but this increases to 4-6 out of 10 for GM technology for **medical uses**.
- Rate their support of the following statements in the higher 7-10 out of 10 category—*We depend too much on science and not enough on faith, People shouldn't tamper with nature, Children must be protected from all risks.*
- Rate their willingness to eat the following in the lowest category:
  - food containing preservatives, food grown with the use of pesticides
  - processed foods such as bread or soy milk, that has been made from GM 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.
- Indicate they believe that most of the processed foods in Australian supermarkets contain genetically modified ingredients. They also rate their acceptance of modifying the genes of plants to produce food in the lower 0-3 out of 10.
- In terms of modifying the genes of plants to produce food, they consider the following unacceptable (lower 0-3 out of 10):
  - '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.

- Not sure whether commercial genetically modified crops are allowed to be grown in their state/territory, but 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 2 – Uninformed Doubting Thomases 13% (down from 20% in 2015)

Table 13 – Segment 2 gender, age and state/territory profile

	Male	Female	30 years or younger	31-50 years	51 years or older	QLD	NSW	ACT	VIC	TAS	NT	SA	WA
	55%	45%	44%	37%	19%	18%	30%	1%	28%	2%	2%	9%	11%
Nat av.	50%	50%	27%	38%	34%	20%	32%	2%	25%	2%	1%	8%	10%

Demographic: This segment is more likely to live outside of a state capital city, have a university degree or diploma, and or be a landowner who derives most or some of their income from primary production (farming).

They are more likely to:

- Claim to know enough about **biotechnology** to be able to explain it to a friend but believe it will either have no effect or will make things worse 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 the higher 7-10 out of 10 category:
  - science and technology creates more problems than it solves
  - we depend too much on science and not enough on faith
  - scientific advances tend to benefit the rich more than they benefit the poor
  - people shouldn't tamper with nature.
- Rate their willingness to eat the following in the lower 0-3 out of 10 category:
  - food containing preservatives
  - foods such as bread or soy milk, that have 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.
- 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.
- In terms of modifying the genes of plants to produce food, they rate the following in the lower 0-3 out of 10 category for acceptability:
  - '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
- They are not **in favour** of growing genetically modified crops in their state or territory. They are also more likely to <u>not</u> 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 31% (stable – 32% in 2015)

Table 14 – Segment 3 gender, age and state/territory profile

	Male	Female	30 years or younger	31-50 years	51 years or older	QLD	NSW	ACT	VIC	TAS	NT	SA	WA
	53%	47%	18%	31%	52%	22%	32%	2%	22%	2%	1%	8%	11%
Nat av.	50%	50%	27%	38%	34%	20%	32%	2%	25%	2%	1%	8%	10%

Demographic: This segment is more likely to be retired or pensioner, have no children under age of 10 living in household, aged 61-70 years old.

They are more likely to:

- Have heard about **biotechnology**, but know very little or nothing about it and have never heard about **synthetic biology**.
- Believe that **gene editing**, **cloning or animals**, **GMOs** and **biotechnology** will improve our way or life in the future.
- Rate their support of the **use of gene technology generally** as well as its use in foods and crops, and for **medical, industrial and for other uses** such as modifying microbes to clean up the environment in the high 7-10 out of 10.
- Rate their support of the following statements in the lower 0-3 out of 10 category:
  - science and technology creates more problems than it solves
  - we depend too much on science and not enough on faith
  - scientific advances tend to benefit the rich more than they benefit the poor
  - people shouldn't tamper with nature.
- Rate *Technological change happens too fast for me to keep up with it* in the lower higher 7-10 out of 10 category.
- Rate their willingness to eat the following foods in the higher 7-10 out of 10 category:
  - food containing preservatives
  - food grown with the use of pesticides
  - organic food
  - 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
  - products from genetically modified animals.

- Believe the following statements to be false:
  - most of the processed foods in Australian supermarkets contain genetically modified ingredients
  - 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 higher 7-10 category.
- In terms of modifying the genes of plants to produce food, they consider the following in the higher 7-10 out of 10 category:
  - '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.
- Say they know that commercial genetically modified crops are allowed to be grown in their state/territory and to incorrectly name corn and tomatoes as examples. They are **in favour** of growing genetically modified crops in their state or territory.

Segment 4 – The Disciples 31% (up from 17% in 2015)

Table 15 – Segment 4 gender, age and state/territory profile

	Male	Female	30 years or younger	31-50 years	51 years or older	QLD	NSW	ACT	VIC	TAS	NT	SA	WA
	49%	51%	30%	36%	34%	17%	35%	2%	25%	3%	1%	8%	9%
Nat av.	50%	50%	27%	38%	34%	20%	32%	2%	25%	2%	1%	8%	10%

Demographic: This segment is less likely to be retired or pensioner, less likely to be a landholder with any farming activities.

The Disciples are more likely to:

- Claim to know enough about **GMOs** and **cloning of animals** to be able to explain it to a friend.
- Have heard of **gene editing**, however know very little or nothing about it.
- Believe **biotechnology** will improve our way of life in the future.
- Rate their support of the **use of gene technology** for **medical**, **industrial and for other uses** such as modifying microbes to clean up the environment in the high 7-10 out of 10.

- Rate their support of the following statements in the lower 0-3 out of 10 category
  - Technological change happens too fast for me to keep up with it
  - Science and technology creates more problems than it solves.
- They rate the following statements in the higher 7-10 out of 10 category:
  - Scientific advances tend to benefit the rich more than they benefit the poor
  - People shouldn't tamper with nature
  - Not vaccinating children puts others at risk
  - Commercial use of genetic modification and its products should only be allowed after regulatory approval.
- Rate their willingness to eat *organic food* 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.
- 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.
- They are **mainly in favour** of growing genetically modified crops in their state or territory. Those who are not 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.

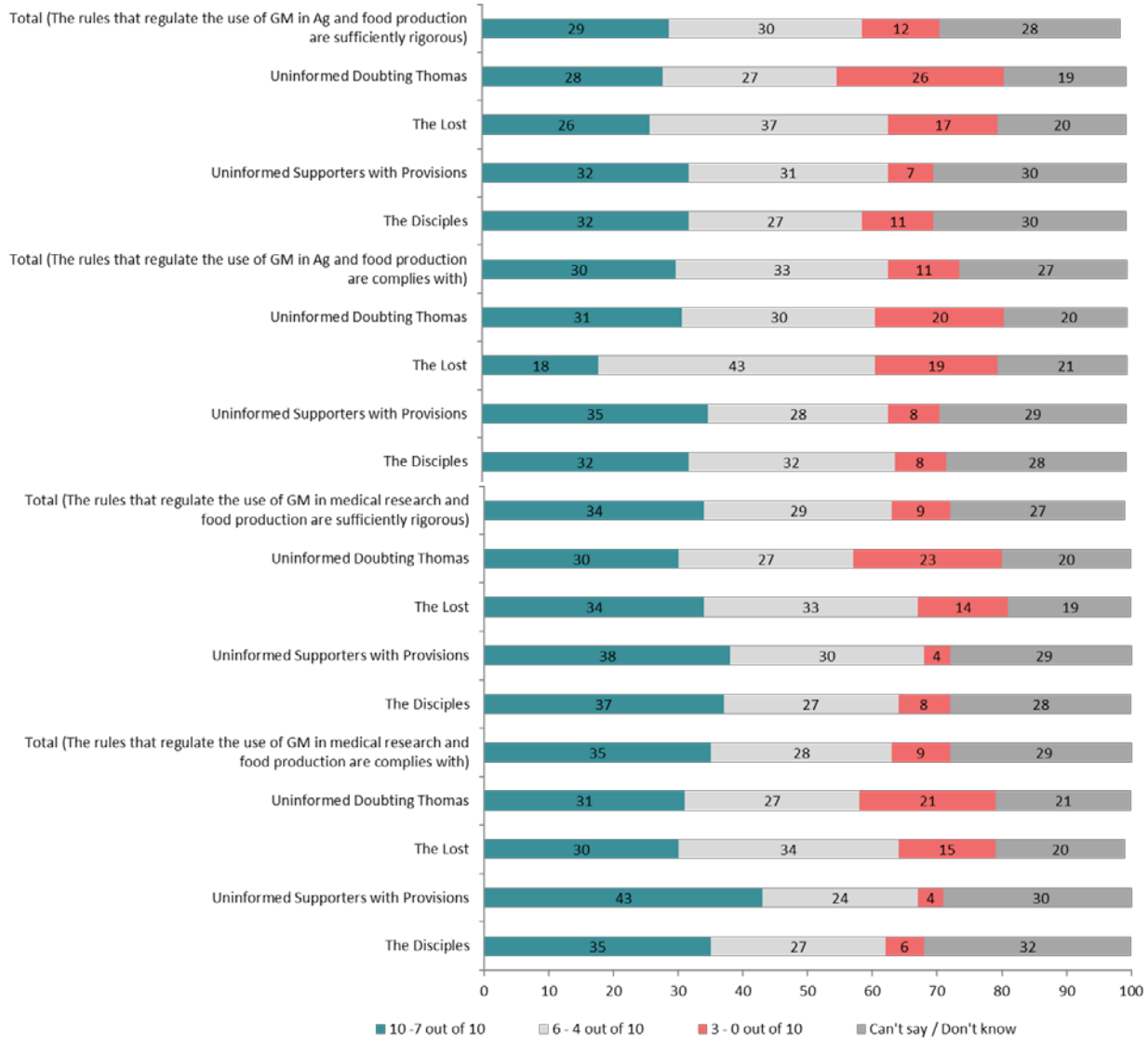
Further Segmentation Analysis

The values segments were analysed across several variables to understand them better and find out more on the defining differences between them. Firstly, they were divided up by how they viewed the rules and regulations relating to gene technology, and the results showed that the differences between them were not always very great, and the key differences were nuanced.

The spread of agreement that the regulations are sufficiently rigorous, was between 26% and 32%. There was a larger spread of disagreement, however, between 26% and 7%, with the Uninformed Doubting Thomases having the highest level of disagreement at 26%. It is worth noting that there were significant differences in the *don't knows* though, with the Uninformed Supporters with Provisos and the Disciples ranking around 30% *Don't Know*, and the Uninformed Doubting Thomases and the Disengaged/Lost at close to 20%.

Looking at agreement that the regulations are complied with, there was a larger spread of those most supporting this. The Disengaged/Lost only rated 18%, while the Disciples rated 32% and the Uninformed Doubting Thomases rated 31%. There was also much smaller disagreement with this statement, with the Uninformed Supporters with Provisos and the Disciples ranking at only 8%. The Disengaged/Lost and the Uninformed Doubting Thomases ranked close to 20%. *Don't knows* were again high, ranking between 20% and 29%.

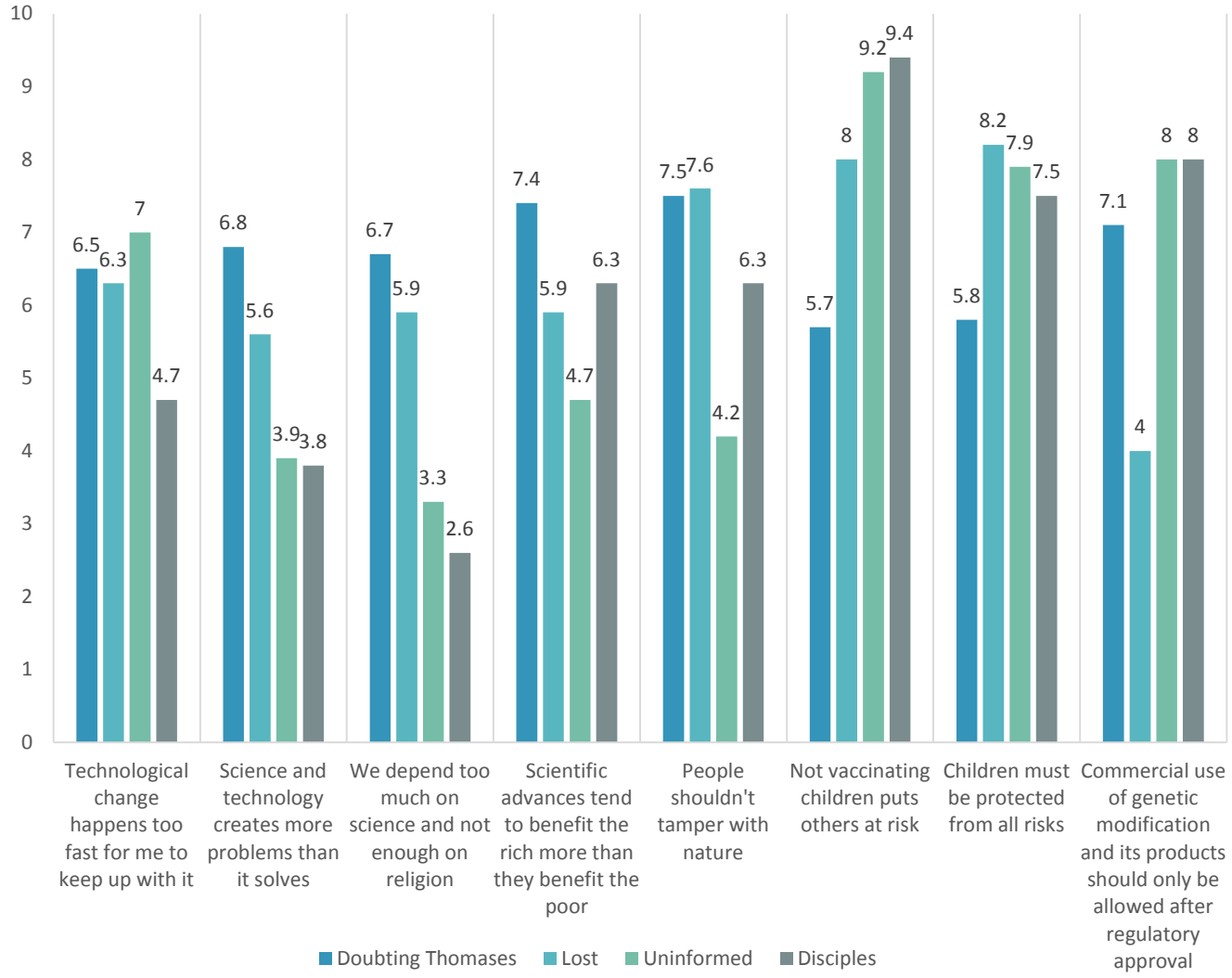
Figure 49: GM rules and regulation and whether they are rigorous and complied with (segments)



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 statements

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

Figure 50: Attitudes to technologies by values segments (Means)



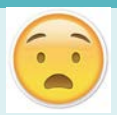
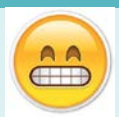
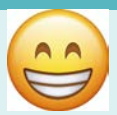
Q6. & 24. On a scale of 0 – 10, where 10 is strongly agree and 0 is strongly disagree, please indicate how you agree or disagree with the following statements.

Base: *Total sample n=1255 (636 for Q.6 and 619 for Q.24)*

Looking at the key values statements and attitudes to GM technologies, some general trends across the values segments were seen. For instance the Disciples and the Doubting Thomases tended to have the most polarised views on most issues. The Disciples had the lowest agreement that *the pace of technological change happened too fast to keep up with* (4.4) and *We depend too much on science and not enough on faith* (2.6) and *Science and technology creates more problems than it solves* (3.8). On some other issues, however, the Uninformed with Provisos had the lowest rating of agreement. These included *Scientific advances tend to benefit the rich more than the poor* (4.7), and *People shouldn't tamper with nature* (4.2). The Disengaged/Lost had the lowest agreement on only issues that the *Commercial use of genetic modification and its products should only be allowed after regulatory approval* (4.0).

Seeking a broader understanding of the composition of each values segment they were profiled by gender, age and some key attitudes. The data showed that the biggest gender split was in the Disengaged/Lost, who were 33% male and 67% female. The other segments were within ten or fewer percentage points of each other by gender.

Table 16: Segment profiles by gender, age and attitude

	Total	Uninformed Doubting Thomas	The Disengaged/Lost	Uninformed Supporters with Provisos	The Disciples	
						
Male	**50%**	55%	33%	53%	49%	
Female	**50%**	45%	67%	47%	51%	
16 - 30	**27%**	44%	21%	18%	30%	
31 - 35	**38%**	37%	50%	31%	36%	
51 - 75	**35%**	19%	28%	52%	34%	
Support for GM food and crops	**10%**	8%	4%	14%	11%	
Support for medical uses of GM	**24%**	8%	15%	31%	31%	
Agree people should not tamper with nature	**13%**	32%	20%	1%	15%	
Believe most fresh fruits and vegetables are GM	**23%**	38%	21%	21%	18%	
Believe S&T create more problems than they solve	**26%**	65%	36%	12%	15%	
Have heard of OGTR before	**11%**	22%	14%	9%	7%	
Trust OGTR	**62%**	53%	43%	77%	72%	
Most likely Google for information	**46%**	43%	47%	49%	53%	

In terms of age, there were larger differences between the segments. Uninformed Doubting Thomases were the youngest segment with 44% being between 16 and 30 years of age. The oldest segment was the Uninformed Supporters with Provisos with 52% between the ages of 51 and 75. The Disengaged/Lost were the largest group between the ages of 31 and 35 (50%).

Looking at the values statements relating to GM, the Disengaged/Lost had the least support for GM food and crops (4% in the 7-10 range compared to an average of 24%. The Uninformed Supporters with Provisos and the Disciples rated above average at 31% each.

However the Uninformed Supporters with Provisos had the least agreement that people should not tamper with nature, 1% rating in the 7-10 category compared to the average of 13%. Uninformed Doubting Thomases rated the highest against this at 32%.

There was more general agreement against the belief that most fresh fruits and vegetables in Australia were GM. The average was 23% and the spread across the segments was 18% (the Disciples) to 38% (Uninformed Doubting Thomases).

There were more differences between those who agreed that *science and technology created more problems than they solve*, with the Uninformed Doubted Thomases rating at 65%—far above the sample average of 26%. The lowest rating was from the Uninformed Supporters with Provisos at 12%.

Looking at who had heard of OGTR before, the Disciples rated the lowest at 7% (below the average of 11%) and the Uninformed Doubting Thomases rated a high 22%.

Figure 51: Segment profiles by gender and age

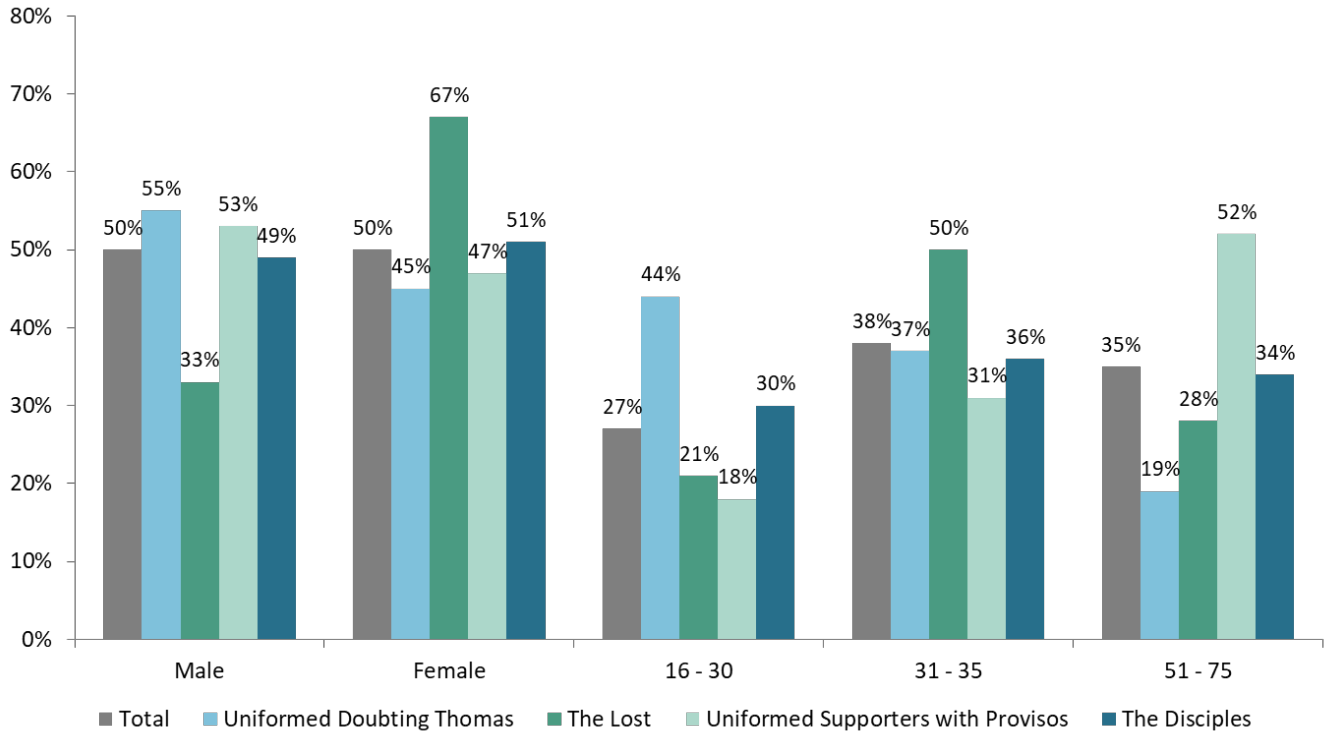
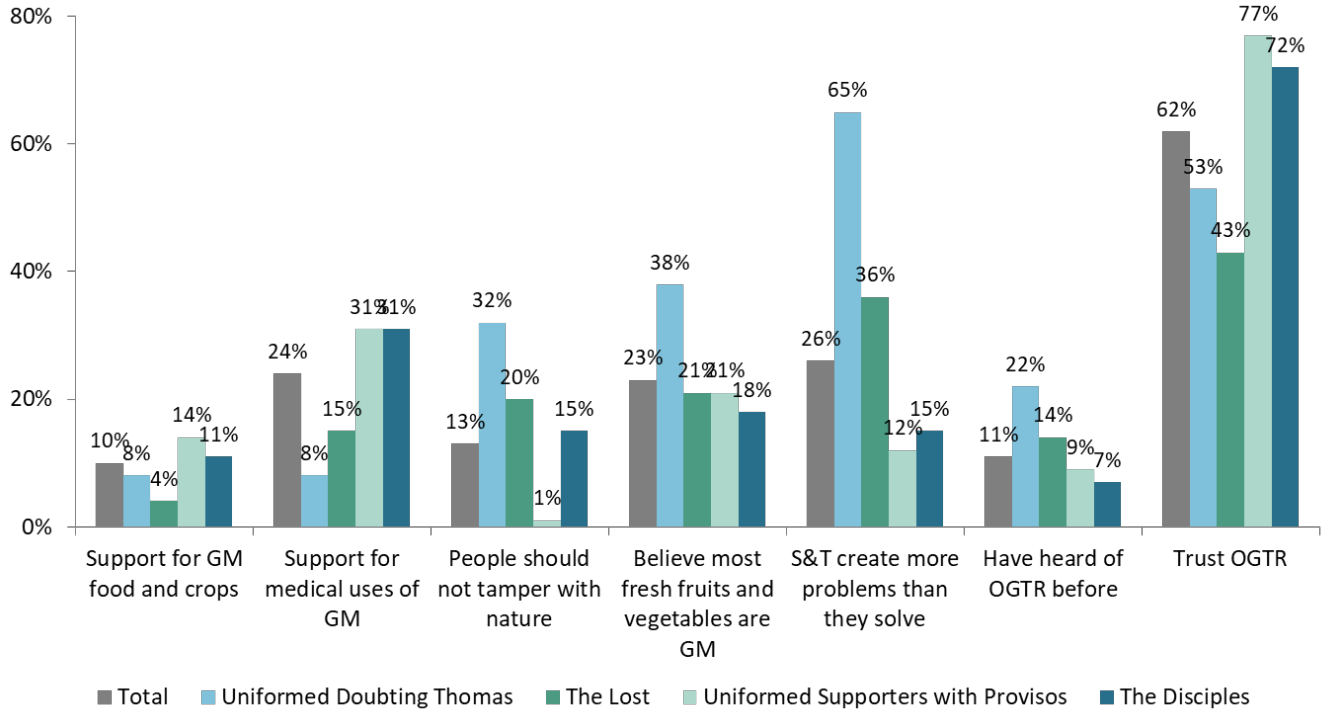


Figure 52: Segment profiles by key beliefs



Trust in OGTR was highest from the Uninformed Supporters with Provisos (77%) compared to the average of 62% and was lowest amongst the Disengaged/Lost at 43%.

The spread of those who would use Google to find information on gene technology was fairly even, with the Disciples most likely to use it (53%) and the Uninformed Doubting Thomases least likely to use it, at 43%.

Analysis of the four segments based around people's attitudes to GM foods (ie Not the values-based segments of the Disengaged/Lost, the Disciples etc, but the four categories as shown in Figure 27) showed a clear correlation with support for GM in general. For instance, those that accepted that GM was a safe way to produce food scored 75 across the highest Likert grouping, and had a mean score of 8.04, while the segment that were opposed to the production of GM foods with nothing likely to change their minds, scored 71 across the lowest Likert grouping, with a mean score of 1.76.

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

Figure 53: Segment profiles by attitudes to using GM technology to produce food

The Lost	%	Uninformed Doubting Thomas's	%
I accept that it's a safe way to produce food	26	I accept that it's a safe way to produce food	10
I am open to the production of food this way as long as the regulations are in place to make sure it's safe	26	I am open to the production of food this way as long as the regulations are in place to make sure it's safe	47
I am against the production of food this way until the science proves it's safe	28	I am against the production of food this way until the science proves it's safe	29
I am opposed to the production of food this way and nothing is likely to change my mind	21	I am opposed to the production of food this way and nothing is likely to change my mind	15
Uninformed Supporters with Provisos	**%**	**The Disciples**	**%**
I accept that it's a safe way to produce food	7	I accept that it's a safe way to produce food	16
I am open to the production of food this way as long as the regulations are in place to make sure it's safe	58	I am open to the production of food this way as long as the regulations are in place to make sure it's safe	60
I am against the production of food this way until the science proves it's safe	29	I am against the production of food this way until the science proves it's safe	19
I am opposed to the production of food this way and nothing is likely to change my mind	6	I am opposed to the production of food this way and nothing is likely to change my mind	5

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

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

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

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

6. Conclusions

- 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.
- Tracking data back of 19 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.
- 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.
- 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.
- Support or rejection of GM crops is still highly conditional, with only 13% (down from 15% in 2015) of the population are 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.
- 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 out of the 'lack of support' category.
- Those who supported or were opposed to growing GM crops in their State or Territory were even at 36% - with 28% unsure. State differences showed more concern or rejection of GM crops in Victoria and Western Australia, with the most support Queensland and NSW.
- 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.

Appendix I – Sample profile

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

Gender	n=	%
Total Sample	1255	100
Male	622	50
Female	633	50

Age	n=	%
Total Sample	1255	100
16 – 17 years old	1	0
18 – 20 years	63	5
21 – 30 years	279	22
31 – 40 years	240	19
41 – 50 years	234	19
51 – 60 years	190	15
61 – 70 years	194	15
71 – 75 years	55	4

Non-English language spoken at home	n=	%
Total Sample	1255	100
Yes	158	13
No	1097	87

State of residence	n=	%
Total Sample	1255	100
Sydney	259	21
Elsewhere in New South Wales	143	11
Melbourne	237	19
Elsewhere in Victoria	77	6
Brisbane	122	10
Elsewhere in Queensland	130	10
Adelaide	72	6
Elsewhere in South Australia	21	2
Perth	102	8
Elsewhere in Western Australia	29	2
Hobart	12	1
Elsewhere in Tasmania	16	1
Canberra/ACT	22	2
Darwin	7	1
Elsewhere in Northern Territory	5	0

Aboriginal or Torres Strait Islander origin	n=	%
Total Sample	1255	100
Yes	50	4
No	1205	96

Children under age of 10 living in household	n=	%
Total Sample	1255	100
Yes	306	24
No	949	76

Highest level of education	n=	%
Total Sample	1255	100
No formal schooling	4	0
Primary school	18	1
Some high school	57	5
Year 10/4th Form or equivalent	91	7
Year 11/5th Form or equivalent	35	3
Year 12/6th Form or equivalent	191	15
Technical school, commercial college or TAFE	351	28
University degree or diploma (undergraduate or postgraduate)	506	40
Other	0	0

Land ownership and farming	n=	%
Total Sample	1255	100
A landholder who derives **most** of my income from primary production (farming)	44	4
A landholder who derives **some** of my income from primary production (farming)	49	4
A landholder who undertakes hobby farming	40	3
None of the above	1121	89

Employment	n=	%
Total Sample	1255	100
Employed full time	440	35
Employed part time	240	19
Retired or Pensioner	217	17
Home duties	123	10
School or secondary student	12	1
TAFE or university student	119	9
Unemployed	96	8
Other	40	3
Prefer not to say	15	1

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Appendix II – Qualitative research stimulus

Document 1

Source materials for teaching controversial issues – Citizenship Foundation

GM Crops

This resource provides information and arguments around the issue of GM crops.

Arguments For and Against

This section provides more detailed information on the issue of GM crops and the main arguments for and against their development and commercialisation.

Summary of main arguments for and against GM crops

For GM crops	Against GM crops
Crops can be engineered to be pest/disease resistant and so reduce or eliminate the need to use pesticides or herbicides. This reduction in chemicals can benefit the environment and wildlife.	The creation of pest or herbicide resistant GM crops could result in 'Superbugs' or 'superweeds' that evolve to be resistant to the chemicals or toxins developed in conjunction with GM crops.
GM foods could be made healthier than conventional foods by, for example, modifying them to include extra vitamins and nutrients.	The growing of GM crops could result in cross-pollination between GM crops and non-GM and organic crops thereby contaminating them.
Since the wide scale consumption of food from GM crops began some seven years ago there have been no substantiated cases of harm to human health.	Because it is a new technology, there is a need to adopt the precautionary principle. The long term impacts on human health, food safety or the environment cannot be accurately predicted. It is too risky to allow the commercial growing of GM crops at this stage.

For GM crops	Against GM crops
Crops could be modified to reduce or eliminate allergic affects, e.g. by removing the allergic properties from nuts or altered so they have medicinal benefits, e.g. contain vaccines for specific diseases.	GM crops which have additional proteins or altered genetic composition could result in toxic and allergic reactions in certain people.
Crops could be modified to enable them to survive and grow in unfavourable conditions and withstand drought or floods. This could be particularly beneficial to farmers in the developing world.	GM crops will result in increased dependency on transnational biotech corporations to supply seed and chemicals, the result being monocultures. This will prove particularly costly and damaging to small scale farmers in the developing world who rely on saving seed from year to year and often plant a diversity of crops.
Crops can be created that give higher yields and better quality food. This is particularly important to help meet the demand for food by an expanding world population.	GM is not the key to food security and GM crop developments to date have largely benefited northern countries and markets, not small scale farmers in the developing world. Food security lies in the more equal distribution of food, access to land and money by the poor.

Impact on the environment

Superbugs and superweeds?

One of the main claims made by the advocates of GM technologies is that compared to conventional farming GM crops have the potential to reduce the amount of chemicals released into the environment. It is argued that, by engineering crops to resist certain pests or diseases, farmers can reduce or even eliminate the need to spray crops with pesticides.

Critics however, are concerned that planting up large areas with pest-resistant crops might lead to the evolution of "super-bugs" which are resistant to the toxins added to the crop. Ultimately this could lead to the need for new and potentially more lethal pesticides to control these new pests.

Many of the GM crops that have been developed to date are herbicide tolerant crops. This means that while weeds and other unwanted plants growing with the GM crop are killed by the chemicals used in herbicides, the herbicide tolerant crop itself remains unaffected. Proponents point to encouraging trials with herbicide tolerant crops. With non-GM crops, herbicides must be applied when the weeds are very small.

However, with herbicide tolerant crops it is possible to let the weeds grow larger before spraying. When the weeds are finally sprayed, their remains form a natural mulch which offers a good environment for insects. This mulch, it is argued, also conserves water and reduces soil erosion and can provide good habitats for birds such as skylarks and partridges, which nest in the middle of fields.

Critics, however, are concerned that the genes which have been added to GM crop plants to make them immune to the effects of particular herbicides might end up in related wildplants, creating "superweeds "that ultimately lead to the need for more powerful and potentially more harmful herbicides.

In response, advocates claim that the British countryside is under more threat from some types of exotic plants available at garden centres and from weeds accidentally introduced from other countries, such as Giant Hogweed and Japanese Knotweed, than from any potential herbicide tolerant weeds.

Cross-pollination?

One of the main concerns about GM crops is the potential threat posed by cross-pollination and the transfer of genes from GM crops to non-GM and organic crops. Scientists now recognise that this can occur between adjacent farms and even distant farms. In particular, EU and UK organic standards require organic food to be totally GM-free.

GM contamination of organic crops, or of organic products, will lead inevitably to a loss of organic status for that product at least, and a financial loss for the organic producer. In the province of Saskatchewan in Canada, for example, contamination from GM crops caused the loss of nearly the whole organic oilseed rape sector costing millions of dollars. The result was that many organic farmers were unable to sell their produce as organic due to the contamination.

Monoculture?

A more general concern raised about GM crops is that their wide use will encourage monocultures that threaten biodiversity. With less diversity of crops being grown, there is the danger of the loss of the flora and fauna which thrive on them. Single crops can also be more vulnerable to the spread of disease.

However, supporters of GM argue that this problem is not unique to GM crops and that in conventional agriculture single crops are also grown over wide areas. They further argue that the efficiency gains from GM crops will place less pressure on wild or natural habitats and thereby help preserve biodiversity.

Issues of food safety and human health

Taking necessary precautions?

The British Medical Association has warned that there is not enough evidence to state that genetically modified organisms are safe. They have stated that, the precautionary principle should be applied in developing genetically modified crops or foodstuffs, as we cannot at present know whether there are any serious risks to the environment or to human health involved in producing GM crops or consuming GM food products.

The importance of adopting the precautionary principle is one of the main arguments used by those opposed to or concerned about GM crops. They argue that scientists are still a very long way from truly understanding the DNA and genes of living things and therefore it is impossible to tell what the long-term health implications of GM food might be.

Healthier and safer foods?

Opponents are concerned about three main problems with regards to food safety and human health:

- the use of antibiotic resistance marker genes which could lead to the spread of antibiotic resistance from plants to humans;
- the development of allergic reactions to proteins contained in GM foods;
- possible unforeseen toxic effects caused by additional proteins or altered genetic composition of plants.

Critics also argue that the testing and regulatory controls for GM crops are inadequate and that the potentially harmful effects of genetically engineered organisms will only be discovered too late and that the damage may then be irreversible.

However, the biotech industry point to the fact that since 1996, when GM crops were first grown commercially in the United States, GM crops have been eaten on a regular basis by hundreds of millions of people and animals. They point to the fact that in this time there has been no substantiated case of harm arising from consumption of food from GM crops.

Furthermore, they claim that GM crops could actually make food safer and healthier. They point to examples of fruit and vegetables being modified to contain higher levels of nutrients.

For example, 'Golden Rice' has been developed by scientists in Zurich to improve vitamin A levels. Regular rice contains no vitamin A, and children brought up on it as their staple diet run a high risk of developing blindness and dying prematurely.

Advocates also believe that GM crops could hold great medicinal benefits, for example, wheat

with increased levels of folic acid could prevent spina bifida and with increased fibre content could reduce the risk of colon cancer. There is also the potential for the development of crops which produce vaccines for serious diseases.

In terms of allergic reactions, GM proponents argue that GM foods are subjected to a range of tests designed to pick up potential allergic reactions or toxicity problems before they receive regulatory approval. They argue that GM foods are subjected to far greater levels of scrutiny than conventional foods. Indeed, proponents argue that GM technology could even be used to reduce the allergic problems caused by some foods by for example removing the allergic properties from nuts.

Advocates of GM crops and foods accuse their opponents of slowing progress towards the potential positive developments that could arise from GM crops. They argue that inaccurate or misleading scare stories have left consumers fearful and sceptical of GM technologies. They believe that the scientific evidence is in their favour and that these foods are safe for consumption.

Issues of food security

Feeding a larger global population?

One of the main arguments used in favour of the development of GM crops is that they will be needed to feed the predicted two billion rise in the global population expected this century. It is argued that genetically engineered high yield crop varieties can produce the extra food to feed this greatly increased population.

However, the Soil Association, the organic certification body in the UK, claim that research carried out amongst farmers in the United States who have been using GM crops for a number of years paints a very different story. They claim that there have not been increased yields and that farmers have actually reported substantially reduced harvests.

Christian Aid, Oxfam, Save the Children and other development charities have strongly argued against GM crops as a way of tackling hunger. They argue that food security lies in a more equal distribution of food and issues such as access to land and money by the poor, not in technical fixes or increasing food production.

Providing better food to a global population?

Proponents believe it is not just the total yield that is important but the quality and efficiency of crops. Lack of protein is a major cause of malnutrition in many countries. Already, soya and maize have been genetically modified to enhance the value of their protein in animal feed. It is argued that similar developments for staple crops in tropical regions could benefit many of those who are undernourished.

For example, scientists in India have developed the 'protato', a potato with far higher protein content than traditional varieties. Advocates also claim that genetic modification has great potential for creating crops with higher vitamin content.

It is also argued that GM crops offer hope to people forced to farm on the least productive land by engineering crops that can withstand drought or floods. Also, about 25% of the world's food crops are currently lost every year through insect attack estimated to be enough food to feed over one billion people. By creating pest resistant crop varieties, this loss could be drastically reduced.

However, development groups argue that the transnational biotech companies, because of their need to maximise profits, aren t really interested in crops for the poor. They point to the fact that the major commercial GM food crops so far have been soya and maize which are grown largely to feed animals for meat, namely in the rich countries of the north.

Furthermore, soya not used for animal feed invariably ends up in processed foods, again aimed at western markets, not at alleviating hunger. There is also a concern that much research into new GM crops is aimed at finding substitutes for tropical products such as sugar or vegetable oils so that these can be grown in the North. Farmers and economies in the South could therefore be undermined, reducing rather than increasing their security.

Opponents also point to the fact that GM seeds and the associated chemicals are expensive for small scale farmers in the South and debt and dependency on large biotech companies will result. They argue that the livelihoods of millions of small farmers and others who customarily plant a range of varieties, make use of intercropping techniques, or harvest wild plants and animals growing among their crops, will be threatened. Development charities have therefore warned that GM crops could intensity rather than alleviate poverty and hunger in the developing world.

Document 2

Arguments for and against GMOs

FOR GMOs

1. FEED THE WORLD

By 2050, the world's population is expected to expand from today's 7 billion to way beyond 9 billion. To keep pace, the United Nations say global food production will have to double over the next 35 years. Yet the amount of farm land is shrinking. Biotechnology is the only way to feed that growing population, by increasing yields to get more food from less land. GMOs mean cheaper, more plentiful food to fight hunger in the Third World. It also cuts costs for consumers and raises livelihoods for farmers in developed countries.

2. STRONGER CROPS = LESS PESTICIDES

Through genetic modification, scientists can give crops built-in resistance to pests. That means less need for pesticides that are potentially harmful to the environment.
Studies show the introduction of GMO soybean and corn in the United States led to a 13 million kilo reduction in pesticide use in the 12 years up to 2009. By reducing the need to spray, GMOs also cut farmers' fuel emissions, helping to fight global warming.

AGAINST GMOs

1. ENVIRONMENTAL RISK

GMOs are a serious risk to the environment. Their seeds travel well beyond fields where they are grown. Cross-pollination creates herbicide-resistant "super weeds" that threaten other crops and wild plants.
Tampering with crops' genetic makeup impacts down the food chain: scientists say GMO's have decimated butterfly populations in the United States, or led to birth defects among other animals. By the time we find out the long-term impact, it could be too late.

2. REMEMBER WHEN CIGARETTES WERE 'HARMLESS'?

Biotech companies use old "tobacco" science to argue GMOs are harmless or even beneficial to health. Yet GMOs pose an array of concerns.
Mixing up plant genes can threaten allergy sufferers – like when Brazil nuts were crossed with soybeans. GMOs increase resistance to antibiotics, making medicines less effective. Fears have been raised over possible links to cancer, reproductive malfunction, and digestive disorders. Nobody knows the long-term effects.

3. TAMPERING FOR TASTE

Foods can be genetically modified to improve flavour and texture – peppers made spicier, corn given enhanced sweetness. In blind tastings, testers regularly rate GM foods higher than naturally grown alternatives. One, in 2007, found 60 percent preferred GM tomatoes. Genetic modification can also give food a longer shelf-life – meaning consumers get fresher taste and the environment benefits from less waste.

4. ENHANCED HEALTH

Biotech can make food healthier, giving lettuce a greater concentration of nutrients, reducing starch in potatoes or lowering the saturated-fat content of cooking oils. Studies suggest genes introduced into GMO tomatoes can increase their natural production of antioxidants that might help prevent cancer or heart disease. Improving the nutritional values of foods can be particularly significant in boosting diets for developing countries.

3. BIG BUSINESS EATS SMALL FARMERS

Farmers hooked on biotech crops are at the mercy of companies that own the patents on seeds and set the prices. So-called “terminator technologies” could prevent growers using last year’s seeds to plant new crops, forcing them to keep buying from the GMO companies. There is plenty of evidence to counter claims GMO will increase world food yields and show non-GMO crops can perform even better. GMO production favours big business over small farmers and encourages the trend toward industrial-scale “monoculture” growing that’s bad for the environment, farmers and consumers.

4. NOTHING TASTES BETTER THAN NATURE

Natural food tastes better and is better for you. We want apples that taste like apples, not artificially sweetened super apples. And we want the variety of products that come to us from nature. We also want to feel good about our food: a study last year suggested our taste buds and our consciences are intertwined. The research found consumers got more pleasure from eating food they believed to be organic or ethically produced.

References

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,*

Funk, C, and Rainie, L., (2015) Americans, Politics and Science Issues, Pew Research Centre.

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.*

Hallman, W. K., W. C. Hebden, et al. (2003). Public Perceptions of Genetically Modified Foods: A National Study of American Knowledge and Opinion (publication number RR-1003-004). New Brunswick, New Jersey, Food Policy Institute, Cook College, Rutgers - The State University of New Jersey.

Heiman, A., Agmon, O., Fleisher. R. & Zilberman, D. (2011). Attitude and purchasing decisions regarding genetically modified foods based on gender and education*, International Journal of Biotechnology*, Vol.12, No.1/2, pp.50 – 65.

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.

Lambert, R. (2017), *The Australian Beliefs and Attitudes Towards Science Survey,* The Australian National University, Canberra, Australia.

Legge Jr., J.S., Durant, R.F. (2010) Public Opinion, Risk Assessment, and Biotechnology: Lessons from Attitudes towards Genetically Modified Foods in the European Union. *Review of Policy Research 27*, 59-76.

Lusk, J.L., Jamal, M., Kurlander, L., Roucan, M., Taulman, L., (2004a) A Meta Analysis of Genetically Modified Food Valuation Studies, Working Paper, West Lafayette, In: Department of Agricultural Economics, Purdue University.

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

Moerbeek, H., Casimir, G., (2005) Gender differences in consumers' acceptance of genetically modified foods, *International Journal of Consumer Studies*, pp. 308-318.

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.

Moon, W. and Balasubramanian, S. (2004), Public Attitudes toward Agrobiotechnology: The Mediating Role of Risk Perceptions on the Impact of Trust, Awareness, and Outrage, *Review of Agricultural Economics,* Vol. 26, No. 2, pp. 186-208.

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.

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

Wagner, W. (2007). "Vernacular science knowledge: its role in everyday life communication." *Public Understanding of Science* 16: 7-22.