Public Perceptions of Biotechnology in South Africa

Conducted for the Public Understanding of Biotechnology Programme of the South African Agency for Science and Technology Advancement

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Biotechnology is widely seen as one of the critical domains of science and technology for the twenty-first century. It has a growing role, and further enormous potential, in the development and production of new classes of medicine, food, energy, and industrial processes. These areas all offer great opportunities for sustainable human development and economic growth. In South Africa, the Department of Science and Technology (DST) Bio-Economy Strategy provides a roadmap for the development of South Africa’s rich natural biological resources into commercial products which contribute to economic growth and improved quality of life.

However, despite this recognition, biotechnology faces several challenges in the public sphere. The public have a limited understanding of what biotechnology is, how it is governed, how knowledge is produced, and how the benefits are distributed and accrued. This provides fertile ground for reservations about biotechnology’s ethical, health, and environmental implications.

Understanding public perceptions of biotechnology is critical for informing policy for the sector. The Public Understanding of Biotechnology (PUB) programme of the South African Agency for Science and Technology Advancement (SAASTA) therefore commissioned a national survey of the South African public’s perceptions of biotechnology. This includes perceptions of agricultural biotechnology, medical biotechnology, and indigenous biotechnology knowledge. The results of this study provide indications of what the public know about biotechnology, how the public feel about a range of biotechnology-related issues, how the public access information about biotechnology, and the manner in which the public perceive biotechnology-related products.

This analysis provides key information that may be used to inform policy and debate in the South African biotechnology sector.
A specially developed national household survey was designed on the basis of international best practice, and also to accommodate the unique characteristics of the South African public and South African biotechnology. The survey was administered through the South African Social Attitudes Survey (SASAS) in November 2015. Interviews were conducted at 500 sites (or ‘Small Area Layers’ around the country, including each province, as well as urban and rural areas. This rendered a final sample of 2940 adult South Africans. The results provide nationally representative data for the South African adult population.

The analysis of these results examines aggregate national-level perceptions of biotechnology, and also examines the differences in perceptions across demographic groups, including differences based on education, income, gender, geographical location, and racial group. Changes over time are also examined, in instances where there is comparability to the previous (2004) national survey. Analysis was undertaken using basic statistical techniques, as well as Analysis of Variance (ANOVA) methods and multiple regression analysis.
South Africa is a highly stratified society, characterised by divisions along lines of economic inequality, educational inequality, ethnicity, race, and geographical location, amongst others. The intersections of these strata create distinct South African ‘publics’, each of which have different perceptions of biotechnology. The perceptions of the South African public can be delineated by key demographic indicators such as age, education, income, and geographical location:

Age: Age plays a unique and powerful role in determining perceptions of biotechnology, indicating that these perceptions are strongly influenced by inter-generations differences in attitudes, knowledge, and use of sources of information about biotechnology. Responses by age were almost in all respects reported on a gradient, with successively younger cohorts being successively more connected to sources of information, successively more knowledgeable, and having generally more positive attitudes towards biotechnology.

Education: Education plays an important role in shaping public perceptions of biotechnology. More educated groups are successively more connected, more knowledgeable, and more positive about biotechnology compared to less educated groups. However, those with a tertiary education are more likely than other groups to see biotechnology as risky rather than beneficial.

Living standard: Those with higher living standards are successively more connected, more knowledgeable, and more positive about biotechnology than lower living standard groups. Living standard can be seen as a proxy for social privilege, indicating that perceptions of biotechnology are also divided along this critical social axis.

Geographical location: Different geographical locations have distinct profiles of perceptions of biotechnology. Those in urban areas are more connected to sources of information about biotechnology, and are generally more knowledgeable about biotechnology. However, the public in rural areas have greater practical knowledge and familiarity with GM crops, and are more likely to have used biotechnology in the context of indigenous knowledge systems.

Perceptions of biotechnology, for all demographic groupings, are characterised by the polarisation of viewpoints: substantial proportions of the public are respectively in favour and against most of the main issues related to biotechnology, such as aspects of ethics, governance, economic impact, and safety. Only in the area of food labelling was there any meaningful consensus (a strong public opinion in favour of labelling).

Lastly, the question of ‘don’t know’ responses remains important: significant proportions of the public (generally between 10 and 30 percent) were not able to provide responses to survey questions. This indicates firstly that these sections of the public are disengaged from biotechnology as a topic, and also that the survey results need to be interpreted with this in consideration. This group also represents a strategic public for biotechnology stakeholders – a group where knowledge and attitudes are not yet fully formed, and where preconceptions or inherent biases are not yet present.
A review of changes in public perceptions of biotechnology between 2004 and 2015 shows a major increase in public awareness of biotechnology.

- Public familiarity with the term ‘biotechnology’ more than doubled during this period, from 21% of the population to 53%.
- Public awareness that GM foods form a part of their diet more than tripled, from 13% to 48%.

Each of these changes signifies a major shift in public awareness. We can hypothesise that these changes are due to increased levels of education, increased access to information, and greater prominence of biotechnology in the public discourse during this period. It may be the case that the labelling of (some) GM foods has played a role. However, testing these hypotheses would require further research, including qualitative research.

There has also been a major increase in attitudes that favour the purchasing of GM food. The proportion of the public that would purchase GM foods on the basis of health considerations increased from 59% to 77%, on cost considerations increased from 51% to 73%, and on environmental considerations from 50% to 68%.
Knowledge about biotechnology was measured along three main axes: the level at which the public rate their own knowledge about biotechnology (‘subjective knowledge’), the extent to which the public feel that biotechnology knowledge is accessible to them, and the extent to which the public feel they understand core biotechnology concepts. The measurement of more concrete biotechnology knowledge (‘objective knowledge’) was measured specifically in relation to aspects of food made using genetically modified crops.

Most South Africans (73%) report having little or no knowledge about biotechnology. However, younger and more privileged groups report considerably greater knowledge than older and less privileged groups. Almost half of the public feel that biotechnology is ‘too specialised for me to understand’.

The terms ‘genes’ and ‘DNA’ are far more widely understood than ‘biotechnology’, ‘genetic modification’ or ‘GM food’, although, again, those of younger age and greater privilege report substantially higher levels of knowledge of all the core biotechnology concepts in the survey.
How familiar are you with the following terms?

- DNA
- Genes
- Biotechnology
- Genetic modification
- Genetic modified food or GM food

- Have not heard of it
- I have heard of it, but know very little or nothing about it
- I know enough of it to explain it to a friend
- Do not know
PERCEPTIONS OF GM FOOD

In the public sphere, perceptions of food made from genetically modified crops (termed ‘GM food’) takes the centre stage in terms of media coverage and public controversy. Internationally, debates about the ethical and environmental implications of agricultural biotechnology have had a significant impact on the sector, for example leading to the emergence of contrasting governance structures and market mechanisms in different jurisdictions.

However, the South African public has low levels of knowledge and awareness of GM food. About half of the public are aware that GM crops are legally grown in South Africa. This mostly applies to maize, and awareness of GM cotton and GM soya crops is very low. About half the South African public are aware that their food contains GM products. Those who could identify GM maize as a legally grown crop in South Africa were substantially more likely to understand that they eat GM food, suggesting cognitive connections between understanding both the production and consumption of GM food.

Higher levels of knowledge about GM food are associated with younger age groups and with social privilege. Educational attainment is an important predictor: those with matric or tertiary qualification have a higher likelihood of demonstrating greater knowledge of GM foods compared to those with primary education or no formal schooling. Having previously engaged in traditional farming practices also increases the odds of being more knowledgeable about GM food.

Due to generally low levels of knowledge about GM foods, the South African public do not have strongly formed opinions about GM foods. Large proportions of the public did not engage with attitudinal questions about GM food, providing ‘don’t know’ responses instead of defined positions. The main exception is that the South African public are strongly in favour of labelling GM foods.

Most South Africans believe that GM foods are good for the economy, although levels of engagement with the issue are low. Younger South Africans are more positive than older South Africans about the economic benefits of GM food. Farmers are perceived to benefit from GM crops, but commercial farmers are seen to benefit more than subsistence farmers. The environmental impact of GM crops is commonly seen to be higher than traditional farming methods. The overall risk/benefit assessment of GM foods is positive. Younger generations and more educated groups are more likely to see GM foods as a benefit to society.

Religion plays a part in forming attitudes towards the ethics of GM food, serving to polarise the public into approximately equal groups that agree or disagree with the notion of GM ‘intervening in God’s plan’. The public are largely disengaged from assessing the ethics of the international corporations that play a role in the sector.

As far as you know, are genetically modified crops allowed in South Africa?

![Graph showing the percentage of people who believe genetically modified crops are allowed in South Africa]
% of the public who are aware of legally grown crops.

As far as you know, are genetically modified crops allowed to be grown in South Africa?

- Mean of GM food knowledge: growing GM crops in SA (0-100)
- South African average (M=53.7)
Have you ever eaten GM food?

Mean of GM food knowledge: eating GM food (0-100 scale) South African average (M=47.8)
### Attitudes towards GM food: summary (%)

<table>
<thead>
<tr>
<th>Attitudes</th>
<th>Agree</th>
<th>Disagree</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying GM food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would buy GM maize if it were healthier</td>
<td>77 (74-80)</td>
<td>11 (9-13)</td>
<td>12 (10-14)</td>
</tr>
<tr>
<td>I would buy GM maize if it cost less than ordinary maize</td>
<td>73 (69-76)</td>
<td>15 (13-18)</td>
<td>12 (10-14)</td>
</tr>
<tr>
<td>I would buy GM maize if it were grown in a less damaging way to the environment compared to non-GM maize</td>
<td>68 (65-71)</td>
<td>16 (14-18)</td>
<td>16 (14-18)</td>
</tr>
<tr>
<td>Ethics of GM food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The genetic modification of food is interfering in God’s Plan</td>
<td>41 (38-45)</td>
<td>36 (33-39)</td>
<td>23 (20-26)</td>
</tr>
<tr>
<td>The genetic modification of food is wrong</td>
<td>30 (26-33)</td>
<td>44 (41-47)</td>
<td>26 (23-29)</td>
</tr>
<tr>
<td>The international corporations that make GM foods act in an ethical manner</td>
<td>38 (35-41)</td>
<td>24 (21-26)</td>
<td>39 (35-42)</td>
</tr>
<tr>
<td>Safety and labelling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GM foods are safe to eat</td>
<td>49 (46-53)</td>
<td>21 (18-23)</td>
<td>30 (27-34)</td>
</tr>
<tr>
<td>The long term health effects of eating GM food are unknown</td>
<td>52 (48-55)</td>
<td>18 (15-20)</td>
<td>31 (28-34)</td>
</tr>
<tr>
<td>Products containing GM foods should be labelled</td>
<td>75 (72-78)</td>
<td>7 (5-8)</td>
<td>18 (15-21)</td>
</tr>
<tr>
<td>Benefits and risks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GM foods are good for the economy</td>
<td>53 (50-56)</td>
<td>16 (14-19)</td>
<td>31 (27-34)</td>
</tr>
<tr>
<td>GM foods benefit large-scale commercial farmers</td>
<td>56 (52-59)</td>
<td>13 (11-16)</td>
<td>31 (28-35)</td>
</tr>
<tr>
<td>GM foods benefit small-scale subsistence farmers</td>
<td>43 (39-46)</td>
<td>23 (21-26)</td>
<td>34 (30-37)</td>
</tr>
<tr>
<td>GM foods provide more secure access to food for my Family</td>
<td>47 (44-51)</td>
<td>22 (19-25)</td>
<td>31 (28-35)</td>
</tr>
<tr>
<td>The environmental cost of farming GM crops is higher than that of traditional farming methods</td>
<td>45 (41-49)</td>
<td>17 (15-20)</td>
<td>38 (34-42)</td>
</tr>
<tr>
<td>Overall, GM foods provide more benefits than risks for society</td>
<td>46 (43-49)</td>
<td>19 (16-21)</td>
<td>36 (32-39)</td>
</tr>
</tbody>
</table>

Note: figures in brackets represent 95% confidence intervals on point estimates.
Overall, knowledge about medical applications of biotechnology is similar to that of GM foods, suggesting that attitudes among the public cut across specific applications of biotechnology. Approximately half of the public have never heard of it, and only 6-7% report a high level of knowledge. As is the case for other knowledge indicators, greater knowledge about medical applications of biotechnology is associated with lower age and higher levels of privilege. Educational attainment appears to exert the strongest positive association with knowledge of medical biotechnology. As levels of education increase, the odds of possessing greater knowledge rise considerably.

In the context of a high level of ‘don’t know’ responses, the public were polarised in their views about medical biotechnology ‘intervening in God’s work’ (39% agreed and 33% disagreed) and in their views about whether it is ‘ethically wrong’ (26% agreed and 43% disagreed). The public is largely disengaged from the issue of corporate ethics in medical biotechnology, with 41% responding ‘don’t know’ to the related question. Only 22% of the public were concerned with the ethics of these corporations.
Knowledge of medical biotechnology

Mean knowledge of medical biotechnology (0-100 scale)  
South African average (M=19.5)

Index of medical biotechnology morality

Mean of biotechnology morality (0-100 scale)  
South African average (M=50.9)
The governance of biotechnology is a critical issue in the public sphere. Regulators and policy makers have a substantial influence over the structure and scope of biotechnology markets and biotechnology research and development. At the same time, large international firms exercise power in the sector, and also influence policy outcomes and market characteristics. Other social actors, such as lobby groups, environmental non-governmental organisations (NGOs), farmers, and scientists also play roles in the governance of biotechnology. The global debate over the governance of the biotechnology sector largely focuses on the roles of these social actors. These roles are often framed in terms of a polarised debate, with actors being either ‘for’ or ‘against’ aspects of biotechnology, although the manifestation of policy and regulation, and market outcomes, usually incorporate shades of grey.

The South African public feel that the governance of biotechnology should be most strongly influenced by commercial farmers, university scientists, and environmental groups/NGOs. The least favoured institutions for this purpose are seen to be international corporations, the general public, the media, and religious organisations. However, the public appear to favour a mode of ‘consensus governance’, in which all the main stakeholders play a role in governance.

<table>
<thead>
<tr>
<th>The development and use of biotechnology is governed by various laws and policies. I am going to list a number of groups in society. How much influence to you think they should have in making these laws and policies?</th>
<th>A great deal of influence</th>
<th>A fair amount</th>
<th>A little influence</th>
<th>None at all</th>
<th>(Don’t know)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial farmers</td>
<td>45 (42-48)</td>
<td>23 (21-26)</td>
<td>7 (6-9)</td>
<td>7 (6-9)</td>
<td>18 (51-21)</td>
</tr>
<tr>
<td>University scientists</td>
<td>41 (38-45)</td>
<td>26 (23-39)</td>
<td>8 (6-9)</td>
<td>8 (6-9)</td>
<td>18 (15-21)</td>
</tr>
<tr>
<td>Environmental groups/NGOs</td>
<td>39 (36-42)</td>
<td>28 (26-31)</td>
<td>5 (4-7)</td>
<td>9 (7-11)</td>
<td>18 (16-21)</td>
</tr>
<tr>
<td>South African businesses</td>
<td>38 (35-41)</td>
<td>27 (24-30)</td>
<td>9 (8-11)</td>
<td>9 (7-11)</td>
<td>18 (15-20)</td>
</tr>
<tr>
<td>Small scale/subsistence Farmers</td>
<td>38 (35-31)</td>
<td>26 (24-29)</td>
<td>10 (8-12)</td>
<td>9 (7-11)</td>
<td>18 (15-21)</td>
</tr>
<tr>
<td>South African government</td>
<td>39 (35-42)</td>
<td>24 (22-27)</td>
<td>10 (8-11)</td>
<td>10 (8-12)</td>
<td>18 (15-21)</td>
</tr>
<tr>
<td>International corporations</td>
<td>29 (26-31)</td>
<td>30 (27-33)</td>
<td>12 (10-14)</td>
<td>10 (9-13)</td>
<td>20 (17-23)</td>
</tr>
<tr>
<td>The general public</td>
<td>27 (25-30)</td>
<td>29 (26-32)</td>
<td>13 (11-15)</td>
<td>12 (11-15)</td>
<td>19 (16-22)</td>
</tr>
<tr>
<td>Media</td>
<td>23 (21-26)</td>
<td>30 (27-33)</td>
<td>14 (12-16)</td>
<td>15 (13-17)</td>
<td>18 (15-21)</td>
</tr>
<tr>
<td>Religious organisations</td>
<td>20 (18-23)</td>
<td>26 (23-29)</td>
<td>17 (15-19)</td>
<td>19 (16-21)</td>
<td>18 (16-21)</td>
</tr>
</tbody>
</table>
Do you think that GM foods are effectively regulated by the government of South Africa?

Mean of perceived effectiveness of government regulation (0-100 scale) South African average (M=43.6)
Biotechnology, in its broad sense, refers to ‘any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use’ (UNEP, 1992. Convention on Biological Diversity, Article 2. United Nations Environment Programme). In this sense, biotechnology has been evolving along with human civilisation for thousands of years, and is deeply embedded in the indigenous knowledge systems of all cultures. In its contemporary usage, biotechnology is often referred to as specifically related to applications of technologies for manipulating DNA. This usage frames biotechnology as an inherently high-technology and knowledge-intensive activity, closely tied to advanced biological sciences.

The juxtaposition between these two usages is particularly evident in South Africa, where indigenous knowledge systems (IKS) harbour extensive knowledge related to using biological systems, while at the same time genetically modified organisms are commonly produced through commercial agriculture, and many research centres practice various forms of genetic manipulation, thus adding to the global biotechnology knowledge frontier. Research into the public understanding of biotechnology in South Africa needs to encompass this diverse system, and utilise this diversity as a strength.

Indeed, most South Africans have used biotechnology in the context of indigenous knowledge systems and practices. South Africans have a far greater understanding of biotechnology-related traditional practices and knowledge bases than they do of biotechnology in the narrower sense. High levels of awareness and usage in daily life position IKS-based biotechnology as an ideal platform for engagement with the majority of the South African population. Groups with low incomes and low levels of education may find it difficult to engage with concepts of mainstream biotechnology, but harbour rich traditions of knowledge and practice of IKS that may be successfully leveraged to build greater awareness of biotechnology in the more modern sense.
How often have you engaged in the following traditional practices?

### Using traditional medicines (such as wild herbs)

- **Often**
- **Sometimes**
- **A few times**
- **Rarely**
- **Never**
- **Do not know**

![Using traditional medicines chart](chart1)

### Making food that uses biological processes (such as brewing traditional beer or processing sour milk)

- **Often**
- **Sometimes**
- **A few times**
- **Rarely**
- **Never**
- **Do not know**

![Making food chart](chart2)

### Traditional farming practices (such as growing crops using the traditional knowledge of your community)

- **Often**
- **Sometimes**
- **A few times**
- **Rarely**
- **Never**
- **Do not know**

![Traditional farming chart](chart3)
Understanding which sources of information the public are likely to use to access information about biotechnology is critical to the development of appropriate public engagement and communication policy and mechanisms.

On aggregate, radio and television are the most popular sources of information about biotechnology, particularly for those in rural areas and with lower incomes. Younger age cohorts are more likely to use all sources of information, except for radio. Younger generations are also far more likely than older generations to use the internet to obtain information. More educated groups and those with higher living standards are more likely to use the internet and print media, and less likely to use the radio. Those living on rural farms are significantly less likely to use any of the media channels to obtain information about biotechnology, highlighting the communications challenge this poses for public engagement efforts.

<table>
<thead>
<tr>
<th>If you wanted to learn more about biotechnology, how likely would you be to get your information from the following sources?</th>
<th>Very likely</th>
<th>Somewhat likely</th>
<th>Not very likely</th>
<th>Not likely at all</th>
<th>(Do not know)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TV</td>
<td>51 (47-54)</td>
<td>21 (19-24)</td>
<td>12 (10-14)</td>
<td>12 (10-14)</td>
<td>4 (3-6)</td>
</tr>
<tr>
<td>Radio</td>
<td>35 (32-38)</td>
<td>25 (23-28)</td>
<td>17 (15-20)</td>
<td>18 (16-21)</td>
<td>5 (3-6)</td>
</tr>
<tr>
<td>Print media (books, newspapers, and magazines)</td>
<td>27 (24-30)</td>
<td>29 (27-32)</td>
<td>19 (17-22)</td>
<td>20 (18-23)</td>
<td>5 (4-6)</td>
</tr>
<tr>
<td>Internet</td>
<td>34 (31-37)</td>
<td>20 (17-22)</td>
<td>12 (10-15)</td>
<td>29 (26-32)</td>
<td>5 (4-7)</td>
</tr>
<tr>
<td>School or college</td>
<td>26 (23-29)</td>
<td>20 (18-23)</td>
<td>15 (13-17)</td>
<td>34 (31-37)</td>
<td>5 (4-7)</td>
</tr>
<tr>
<td>Science centre</td>
<td>29 (26-32)</td>
<td>16 (14-19)</td>
<td>14 (12-16)</td>
<td>36 (32-39)</td>
<td>6 (4-7)</td>
</tr>
<tr>
<td>Friends or family</td>
<td>23 (20-25)</td>
<td>23 (21-26)</td>
<td>19 (17-22)</td>
<td>30 (28-33)</td>
<td>5 (4-6)</td>
</tr>
</tbody>
</table>
Questions of risk and benefit are central to public debates about biotechnology. However, meaningful engagement in these debates requires knowledge about biotechnology concepts and applications.

Only about half of the South African public engaged with the question of a general risk/benefit analysis of biotechnology, while the other half registered indifference or a ‘don’t know’ response. White and Indian South Africans were more likely to see biotechnology as an overall risk to society compared to Black African and Coloured groups. Increased educational attainment was associated with a more positive risk/benefit assessment, with the exception of those with tertiary education, where this pattern was strongly reversed, and those in the most highly educated group were most likely to see biotechnology as a risk. Higher living standard was associated with increased likelihood to view biotechnology as a risk. Those living on rural farms and in urban informal areas were substantially more positive in their assessments than those in other areas. An individual with no ethical or religious objections to GM food is much more likely to believe that biotechnology is a benefit rather than a risk. If an individual thinks that government effectively regulates GM food, then he or she will be less likely to view biotechnology with uncertainty, and more likely to rate it as a benefit than a risk.
Taking into account all that you know about this topic and thinking about you and your family, do you see biotechnology more as a benefit or more as a risk?
The evidence shows us that public engagement by the biotechnology sector takes place in the context of escalating public awareness of biotechnology. This paves the way for strategic interventions that will build up public knowledge, while at the same time cultivating constructive engagement between the public and the biotechnology sector.

The South African public is deeply stratified, and different demographic groups have markedly different perceptions of biotechnology. Policy interventions therefore need to include a strategic approach towards addressing these different publics in different ways, drawing on the evidence related to their levels of knowledge, attitudes, and preferred sources of information.

The suggested generic process for policy interventions is thus to firstly assess which ‘publics’ require engagement in terms of specific issues as identified in the key themes emerging from this report; for example, knowledge of or attitudes towards biotechnology in general, or of particular aspects of GM food, GM medicine, or IKS and biotechnology. Thesecondstagewouldbedoengage with these ‘publics’ using the sources of information they are most disposed to using for engaging with biotechnology. The third stage would be to conduct further research into qualitative and quantitative aspects of public perceptions of biotechnology in order to assess changes over time and the impact of engagement interventions.
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