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2021-22 Consumer Attitudes Towards Innovative Agricultural Technologies Survey and Focus Groups

Final Report

Prepared for Agriculture and Agri-Food Canada

Supplier name: Quorus Consulting Group Inc.

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For more information on this report, please contact Agriculture and Agri-Food Canada at:

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Ce rapport est aussi disponible en français.

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This public opinion research report presents the results of quantitative and qualitative research conducted by Quorus Consulting Group Inc. on behalf of the Department of Agriculture and Agri-Food Canada. The research was conducted in June and December, 2021.

Cette publication est aussi disponible en français sous le titre : Sondage et des groupes de discussion de 2021-2022 sur les attitudes des consommateurs envers les technologies agricoles novatrices rapport finale

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Table of Contents

EXECUTIVE SUMMARY	4
PURPOSE, STUDY OBJECTIVES AND ISSUES OF INTEREST	4
METHODOLOGY	4
OVERALL SUMMARY OF RESEARCH FINDINGS	5
A. GENERAL ATTITUDES TOWARDS AND FAMILIARITY WITH BIOTECHNOLOGY	5
B. BIOFUELS AND BIOPRODUCTS	7
C. GENE-EDITING	8
D. CELLULAR AGRICULTURE	9
E. SUMMARY OF ATTITUDES TOWARDS AGRICULTURAL TECHNOLOGIES	10
PURPOSE, STUDY OBJECTIVES, AND ISSUES OF INTEREST	14
SURVEY RESEARCH FINDINGS.....	15
A. BIOTECHNOLOGY	15
B. BIOFUELS AND BIOPRODUCTS	39
C. GENE-EDITING	45
D. CELLULAR AGRICULTURE	53
E. UNDERLYING ATTITUDES TOWARDS AGRICULTURAL TECHNOLOGIES	62
FOCUS GROUP FINDINGS	65
A. BIOTECHNOLOGY	65
B. BIOFUELS	66
C. GENE-EDITING	68
D. CELLULAR AGRICULTURE	71
E. SUMMARY	73
F. REGULATIONS	74
RESEARCH METHODOLOGY	75
QUANTITATIVE RESEARCH	75
QUALITATIVE RESEARCH	82
ONLINE SURVEY RESULTS.....	86
ONLINE SURVEY RESULTS – KEY CONSIDERATIONS	86
A. BIOTECHNOLOGY	88
B. BIOFUELS AND BIOPRODUCTS	93
C. GENE-EDITING	95
D. CELLULAR AGRICULTURE	98
E. UNDERLYING ATTITUDES TOWARDS AGRICULTURAL TECHNOLOGIES	100
APPENDICES.....	102
QUESTIONNAIRES	103
FOCUS GROUP MODERATION GUIDE	130
FOCUS GROUP RECRUITMENT SCREENER	138

Executive summary

Purpose, study objectives and issues of interest

Building on previous research waves in 2011 and 2016, Agriculture and Agri-Food Canada (AAFC) launched a third wave of public opinion research to assess Canadians' perceptions and attitudes towards emerging agricultural technologies and their applications in the sector, and to gather information on public trust regarding these technologies. Having explored some of these issues in past research, this study generated comparative data, allowing AAFC to track Canadians' attitudes over time. In addition, the results provide insights into Canadians' knowledge and awareness of new technologies that did not exist or were emerging at the time of previous research.

The total contract value of this research (including HST) was \$159,576.74. This research will inform policy development and engagement strategies by providing critical insights on the opinions of Canadians on agricultural innovation.

Methodology

In order to provide reliable tracking data, Quorus used a similar approach to what was used in the previous waves, using both quantitative and qualitative research. More specifically, the study consisted of the following:

- **Quantitative Phase:** This phase of the research project consisted of a national survey with Canadian adults aged 18 and older. Approximately half of the data (1,009 completed surveys) was collected using an online panel of households, and the other half (1,033 completed surveys) via a stratified random sample of Computer Assisted Telephone Interviewing (CATI) interviews. Data collection took place from June 25th to July 16th, 2021. The CATI questionnaire had an average survey duration of 24 minutes, while the online version took roughly 12 minutes to complete. **The previous waves of this study used telephone interviewing to track data. In order to accurately track the data with previous waves, the results for each methodology have been presented separately in this report and all associated deliverables. The results in the main report and in this executive summary are those from the telephone interviews while those from the online survey are presented separately in a section near the end of the report.**
- **Qualitative Phase:** This phase of the research project consisted of 10 online focus groups. Eight focus groups were completed with members of the general population located in four parts of Canada: Ontario/Nunavut, Quebec, Atlantic Canada, and Western Canada/Yukon/Northwest Territories. In each of these regions, participants were

segmented into two age groups: 18 to 34, and 35 years of age and older. The two remaining focus groups were dedicated to individuals living in official language minority communities (OLMC) in Ontario and Quebec. Data collection took place from December 8th to 15th, 2021. Each focus group lasted approximately 90 minutes, a total of 73 individuals participated and each received \$100 for their participation.

Qualitative research disclaimer

Qualitative research seeks to develop insight and direction rather than quantitatively projectable measures. The purpose is not to generate “statistics” but to hear the full range of opinions on a topic, understand the language participants use, gauge degrees of passion and engagement, and leverage the power of the group to inspire ideas. Participants are encouraged to voice their opinions, irrespective of whether or not that view is shared by others.

Due to the sample size, the special recruitment methods used, and the study objectives, the results discussed in this report are exploratory in nature. The findings are not projectable to a larger population.

One cannot suggest or infer that few (or many) real world users would behave in one way simply because few (or many) participants behaved in this way during the focus group sessions. This kind of projection can only be done through quantitative research.

Overall summary of research findings

A. General attitudes towards and familiarity with biotechnology

Based on the current wave of research, the results show that a little more than half of Canadians (52%) are at least somewhat familiar with “biotechnology”. Longitudinal tracking of this measure shows that while familiarity had remained fairly consistent from 2003 to 2016, the current study saw a decrease of 4% from the last wave in 2016, where 56% reported being familiar with “biotechnology”. For the most part, Canadians are also supportive of the use of biotechnology. The survey results show that, without the benefit of a basic definition, participants were approximately three times more likely to have a positive reaction to the term “biotechnology” (35%) as opposed to a negative one (12%). Once a short explanation was provided, nearly eight in ten (79%) survey respondents either “strongly support” or “somewhat support” the general use of products and processes that involve biotechnology. Despite a lack of increase in familiarity with biotechnology over the same period, support has largely increased, reaching an all-time high of 79% in the current wave (an increase of 8% from 2016).

There are, however, important considerations when assessing these generally favourable findings in support of biotechnology. First, a majority (52%) of survey respondents have a neutral opinion of “biotechnology” without being provided a definition or description and, when it comes to support and familiarity, more than four in ten survey respondents (44%) are “somewhat familiar” and almost six in ten (57%) “somewhat support” the general use of products and processes that involve biotechnology. All these findings point to some degree of hesitation, reservation or uncertainty regarding biotechnology. This was something that was also witnessed in the focus groups where, despite many participants having some notion of what biotechnology was about, most could not speak about or describe the concept with complete confidence. The focus groups also revealed that although participants were generally supportive of the use of biotechnology, this support was not unconditional or without concerns.

The survey findings show Canadians are consulting an increasing variety of sources when it comes to biotechnology. The primary sources cited by respondents were a general internet search (80%), labels available on food packaging (67%) and news media (66%), among a variety of other information sources. At first glance, these results seem to suggest Canadians are actively looking up information on biotechnology, however, the focus group findings point to a much more infrequent and passive approach to accessing information on biotechnology. Participants may have seen information pertaining to biotechnology at some point through many of the sources listed in the survey, however, this is a topic they are rarely researching. The general lack of knowledge among focus group participants when talking about biotechnology supports the conclusion that research on the topic of biotechnology is not a regular activity. References in the focus groups to biotechnology in the context of COVID-19 vaccines might also partially explain the survey findings showing relatively high levels of use of resources like the Internet, government-related sources and news media, especially as they compare to study findings from 2016.

The survey research also reveals that familiarity is related to comfort when it comes to biotechnology. The more familiar respondents felt towards biotechnology and its regulatory system, the more likely they were to feel positively towards biotechnology.

On the topic of the regulatory system, both phases of this research point to a low level of familiarity among Canadians. More specifically, 3% of survey respondents felt “very familiar” with the process by which biotechnology is regulated in Canada, whereas 43% felt “not at all familiar.” This lack of familiarity was echoed in the focus groups, where very few could confidently describe how regulation was done or who was responsible for it.

Despite this general lack of familiarity, survey respondents did seem to have an opinion of how strict or lax the rules and systems are in Canada. On this, nearly three in five (57%) of Canadians scored the regulatory process as “very strict” (8%) or “somewhat strict” (49%) – the largest percentage observed across all recent waves of the study. Feedback from the focus groups suggest

some participants have trust in the regulatory system simply because they feel there is no reason to believe that regulation is not being done properly. Canadians are seeking some form of “strictness” in their regulatory system given the concerns raised regarding the health, environmental, and ethical impacts they feared might come from the use of biotechnology in general or specific types of biotechnologies, such as gene-editing and cellular agriculture.

Just as familiarity with biotechnology seems to generate positive sentiments towards the use of biotechnology, a similar relationship seems to exist when it comes to the regulatory system. Overall, roughly one in four (24%) survey respondents feel they are extremely (8%) or quite confident (16%) in the safety and regulation of biotechnology in Canada whereas 35% are not confident. Results from the survey also indicate the more familiar a respondent is with the regulatory system, the more likely they are to feel confident in the safety and regulation of biotechnology in Canada.

B. Biofuels and bioproducts

Results from this most recent wave of research show a fair level of familiarity with, and support for, the development and use of biofuels and bioproducts, although, like every other type of biotechnology explored in this study, participants are not without any concerns.

Study participants were provided the following information about biofuels:

Biofuels use biological materials such as plants, wood and waste to produce fuels that can be used for cars, trains, airplanes, or to heat and power buildings.

Survey results show nearly three in five (57%) respondents were either “very familiar” (12%) or “somewhat familiar” (44%) with biofuels, a slight increase from 54% observed in 2016. Familiarity was also fairly common in the focus groups, both before and after participants were provided with a description of the technology. Focus group participants were also fairly supportive of biofuels, pointing out their environmental benefits (for example, biofuels use renewable resources, producing them causes less environmental harm than converting fossil fuels, their emissions are less harmful than those from fossil fuels). Participants also liked the idea of waste diversion or recycling associated with the production of some biofuels. Overall, there was a sense that the use of biofuels is a credible strategy to help lower greenhouse gas emissions.

However, along with the general support for biofuels, participants did show some concerns for various uses of this technology. Both survey and focus group results show when it comes to producing biofuels and bioproducts, support was highest for processes involving non-food crops

and notably lower for processes involving the use of land or crops that could otherwise be used as food sources.

- For instance, roughly nine in ten (89%) survey respondents “strongly support” (59%), or “somewhat support” (30%) the use of crop and agriculture waste **to produce biofuels**. Eight in ten (80%) feel the same way regarding using crops that cannot be used as food, and processes involving non-food crops grown on poor-quality land that cannot be used to grow food.
- Similarly, 93% support **making bioproducts** from non-food crops, such as using hemp to make clothing fibres, with a similar level of support for making bioproducts from agricultural waste like straw or husk to make packaging, paper products or chemicals. Support decreased to 78% when it comes to making bioproducts from food crops, such as using corn to make food packaging or car parts.

Specific concerns regarding processes involving the use of land or crops that could be used as food sources was explored in the focus groups. Those who struggled with this approach were generally concerned with food security in both Canada and in the world and felt there were other viable ways to produce biofuels. There were also some concerns about the extent to which farmers would switch from growing consumable crops to crops used exclusively for biofuel purposes, possibly threatening food security for the sake of greater profits.

The focus groups raised other noteworthy concerns. For instance, some questioned whether the environmental costs of producing biofuels offset or outweighed the environmental benefits of using biofuels. Some were also concerned with the potential for clearing land and deforestation to produce biofuels and using wood that could be used for other purposes. That said, most of these concerns were hypothetical – none of the participants had seen, read or heard anything that would suggest their concerns are based on experience or fact.

C. Gene-Editing

Results from this most recent wave of research show some familiarity with and support for the use of gene-editing, however, study participants also had very clear concerns. Study participants were provided the following information about gene-editing:

Gene-editing involves making small changes to a cell’s gene structure and does not necessarily involve mixing together DNA from different species of plants or animals. Gene-editing is often used for medical and agricultural purposes.

Survey results reveal that 40% of respondents were either “very familiar” (7%) or “somewhat familiar” (34%) with gene-editing. This has also increased since 2016, where 34% reported familiarity with gene-editing. Both survey and focus group results showed the greatest level of

support was for the use of gene-editing in medical or human health improvements, with nearly nine in ten survey respondents supporting experimental treatments for certain types of cancer (86%) or sickle cell disease (85%). Support was similar for using gene-editing to create chemicals for use in the production of biofuels (83%).

Support for medical applications was also quite high in the focus groups, with a few who explained that they support its use in applications such as vaccines such as messenger ribonucleic acid (mRNA) and fighting congenital diseases. Some focus group participants also felt that gene-editing has been common practice for a long time and there have not been any negative effects but rather only positive outcomes (for example, more nutritious food, food with longer shelf life, etc.). Others believed gene-editing can help address issues related to world hunger, global food supply and food security by improving crop yields, improving nutrition, and, helping crops become more resilient to pests, diseases, and changing or challenging climates.

Support of gene-editing begins to drop when plants and animals are involved. In the first instance, support stands at 73% for improving plants, such as improving their resistance to disease and drought. Support drops further when it comes to using gene-editing in livestock to improve animal health (69%) or animal welfare (52%). The focus groups revealed the main concern was the potential for negative effects on human health due to human consumption. Participants were also concerned with the unknown long-term impact. Some also said gene-editing might unbalance the natural food chain, or it could have negative effects on animal health. This was also seen in the survey results, where the application of gene-editing to produce fish that grow faster, and which would potentially be eaten or become part of the natural food chain, received the lowest levels of support (44%) across the specific gene-editing applications explored in the survey.

D. Cellular agriculture

Cellular agriculture was a new topic added in the 2021 study to explore familiarity with and perceptions of this technology. Study participants were presented with the following explanation of cellular agriculture:

Cellular agriculture involves making animal products such as meat, seafood, dairy, or leather from animal cell cultures instead of using live animals. By taking cells from an animal and growing them with nutrients, we can obtain products such as meat, leather and milk. Cellular agriculture also includes inserting DNA from an animal into a microorganism like yeast or fungi to make food ingredients like egg or milk protein.

Survey results revealed that 32% of respondents were either “very familiar” (5%) or “somewhat familiar” (27%) with this technology. The focus group findings reinforced these results by showing

that, even with an explanation and examples, many participants could still not wrap their heads around the concept and the technology, leaving them with many questions. The extent to which some participants still confused cellular agriculture with plant-based “meat” products might suggest the survey results could be somewhat misleading and the actual level of familiarity is lower.

Despite low levels of overall familiarity, there are moderate levels of support for the three specific applications explored in this study. Roughly two in three (62%) respondents support growing skin cells from animals to produce materials such as leather. As well, 61% support using microorganisms, such as bacteria or fungi, to recycle carbon dioxide out of the air to produce proteins as ingredients for human food. Support drops to 47% for using cellular agriculture to make food products such as meat, milk, or eggs without having to raise farm animals. In the focus groups, participants echoed results from the survey where a minority of respondents (45%) agree that food products made using cellular agriculture are as nutritious as food products taken from animals. Furthermore, somewhat of a majority (60%) who agree that government will ensure products of cellular agriculture, such as cheese, seafood or meat, are safe for people to eat.

Positioning this technology to participants as a way to protect the environment and aquatic ecosystems had limited appeal, with some arguing there are other or better ways of achieving that goal, however they did not mention any specific alternatives. This was heard in the focus groups but also seen in the survey results where cellular agriculture was proposed to respondents to ultimately reduce the environmental impact of agriculture. This proposal was met with mixed feelings of support (47%) and opposition (49%).

E. Summary of attitudes towards agricultural technologies

In the end, various results from this research point to guarded optimism in relation to biotechnology overall and with respect to each of the three specific technologies explored, some more than others. While both survey and focus group participants feel each of these technologies holds strong promise for benefiting them and society, there are important concerns that would need to be explained or addressed in order for them to be more accepting.

Case in point, the survey revealed that nearly three quarters (74%) of respondents felt quality of life could be improved from advanced biofuels and biotechnology in general. This sentiment decreases to 55% of respondents when it comes to genetically modified plants. Similarly, while many believe there are benefits for society, many also believe there are risks. More specifically, survey results showed 45% believe gene-editing offers either a strong or a substantial benefit to society, however 75% of all respondents also believe it poses at least a moderate risk. Similarly,

41% of survey respondents believe cellular agriculture offers either a strong or substantial benefit to society while 62% also believe it poses at least a moderate risk. In terms of specific benefits for society, there is broad consensus on the following:

- Almost three quarters (73%) of respondents believe products made using cellular agriculture will help produce more food to feed a growing global population given the world's limited natural resources.
- As well, 84% agree overall, and 41% strongly agree that increasing the use of innovative agricultural technologies in general can help feed a growing global population while limiting the impact of food production on the environment. This result represented a significant increase in agreement compared to what was observed in 2016 (67%).
- A similar proportion (84%) agree that increasing the use of innovative agricultural technologies in general can help reduce Canada's greenhouse gas emissions and increase our chances of meeting our country's targets.
- Finally, 82% agree that Canada's food production and distribution systems have faced certain challenges brought on by extreme events, like global pandemics, and that increasing the use of innovative agricultural technologies in general may help address these challenges.

While study participants did have some notable concerns about how some of these technologies could be used, there was a clear indication of where these technologies should be developed. There is strong agreement (85%) among survey respondents that these technologies are going to be developed somewhere in the world, so it is better they are developed in Canada than somewhere else. In fact, 90% believe Canada should be among the world's leaders in this area, a position that fewer (72%) believe Canada actually holds.

The study reveals respondents continue to demonstrate an awareness of the risk these technologies may pose but are accepting of the inevitability of their future use. Nearly nine in ten (88%) respondents "strongly agree" (56%) or "somewhat agree" (33%) that all we can do is ensure the uses of technologies like biotechnology are as safe as possible.

Finally, when taking demographics into account, a few trends appear in the results when responses are broken down by gender and age. When taking gender into account, generally, men tended to say they were more familiar and supportive of biotechnology and the three specific technologies studied. Youth (18-34 years) were more likely to support all biotechnologies

mentioned in the questionnaire. Overall, youth and men saw these technologies as a benefit to society and less risky compared to women and respondents 35 years and older.

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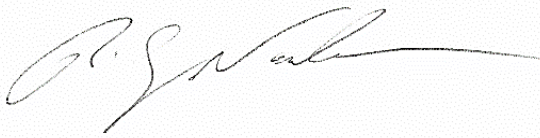
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Specifically, the deliverables do not include information on electoral voting intentions, political party preferences, standings with the electorate or ratings of the performance of a political party or its leaders.

Signed:

Date: March 31, 2022

A handwritten signature in black ink, appearing to read "R. Nadeau", is written over a light gray, textured rectangular background.

Rick Nadeau, President
Quorus Consulting Group Inc.

Purpose, study objectives, and issues of interest

Agriculture and Agri-Food Canada (AAFC) conducted the Innovative Agriculture Technologies survey in 2011 and 2016 to track Canadians' attitudes towards emerging agricultural technologies. The previous study waves consisted of national surveys, followed by qualitative research through focus groups to help further explore and interpret the survey findings.

Additionally, public opinion research on Canadian's attitudes towards applications of biotechnology was conducted annually by the Canadian Biotechnology Strategy Secretariat, dating back to 1996 and concluding in 2006. These previous research studies offer further longitudinal tracking data to understand how several measures have changed over the last 15 years.

AAFC conducted the third wave of research in 2021, building on previous research waves to provide comparative data and track Canadians' attitudes over time. The results will also expand AAFC's knowledge on Canadians' perceptions of new technologies that did not exist or were just emerging at the time of the previous study waves. The results from this wave of the study will also allow AAFC to measure specific challenges and opportunities for consumer acceptance of emerging agricultural technologies. This research will inform policy development and engagement strategies by providing critical insights on the opinions of Canadians on agricultural innovation.

Objectives

The objectives of the research were to assess perceptions and attitudes towards emerging agricultural technologies and their applications in the sector, and to gather information on public trust regarding these technologies.

Specific objectives of the research include, but are not limited to, providing AAFC with up-to-date data on Canadians':

- perceptions and attitudes towards emerging agricultural technologies and their applications in the agriculture and agri-food sector;
- changes in attitudes since previous survey waves (2016 and 2011) towards applications of innovative agricultural technologies in key areas such as biotechnology and their impact on confidence in the safety of Canada's food supply;
- attitudes, views, and knowledge of biotechnology, bioproducts, and biofuels, and familiarity with the regulatory system; and,
- awareness and support for emerging innovative agricultural technologies [products of cellular agriculture (for example, cultured meat) and products of genome editing (for

example, plants, animals)], including identifying existing and newly emerging areas of opportunity for the sector.

In order to provide reliable tracking data, Quorus used a similar approach to what was used in the previous waves, using both quantitative and qualitative research. In addition to the tracking data, the results from the quantitative survey research helped to identify specific areas and themes that could be explored in more depth through a qualitative phase.

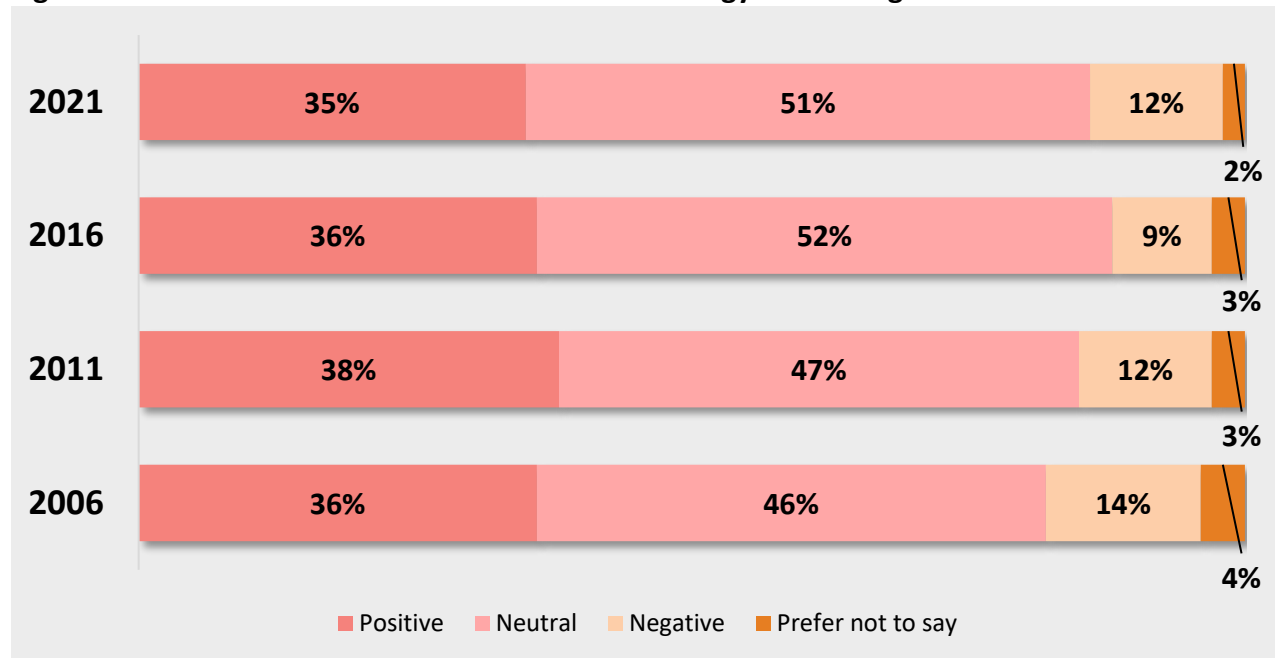
Survey research findings

A. Biotechnology

General reactions to the term “biotechnology”

Canadians were asked to describe their reaction to the word biotechnology without being prompted with a definition or description for reference. Over one in three (35%) responded positively towards the word “biotechnology.” Opinions were negative among more than one in 10 Canadians (12%), while about half (51%) had a neutral opinion without being provided with a definition or description. These results remain stable across all previous waves of the study.

Figure 1 – General reactions to the term “biotechnology” – tracking



B1. This part of the survey focuses on biotechnology. Generally, when you hear the word biotechnology, do you have a positive, neutral, or negative reaction? Base: Telephone respondents, n=1033.

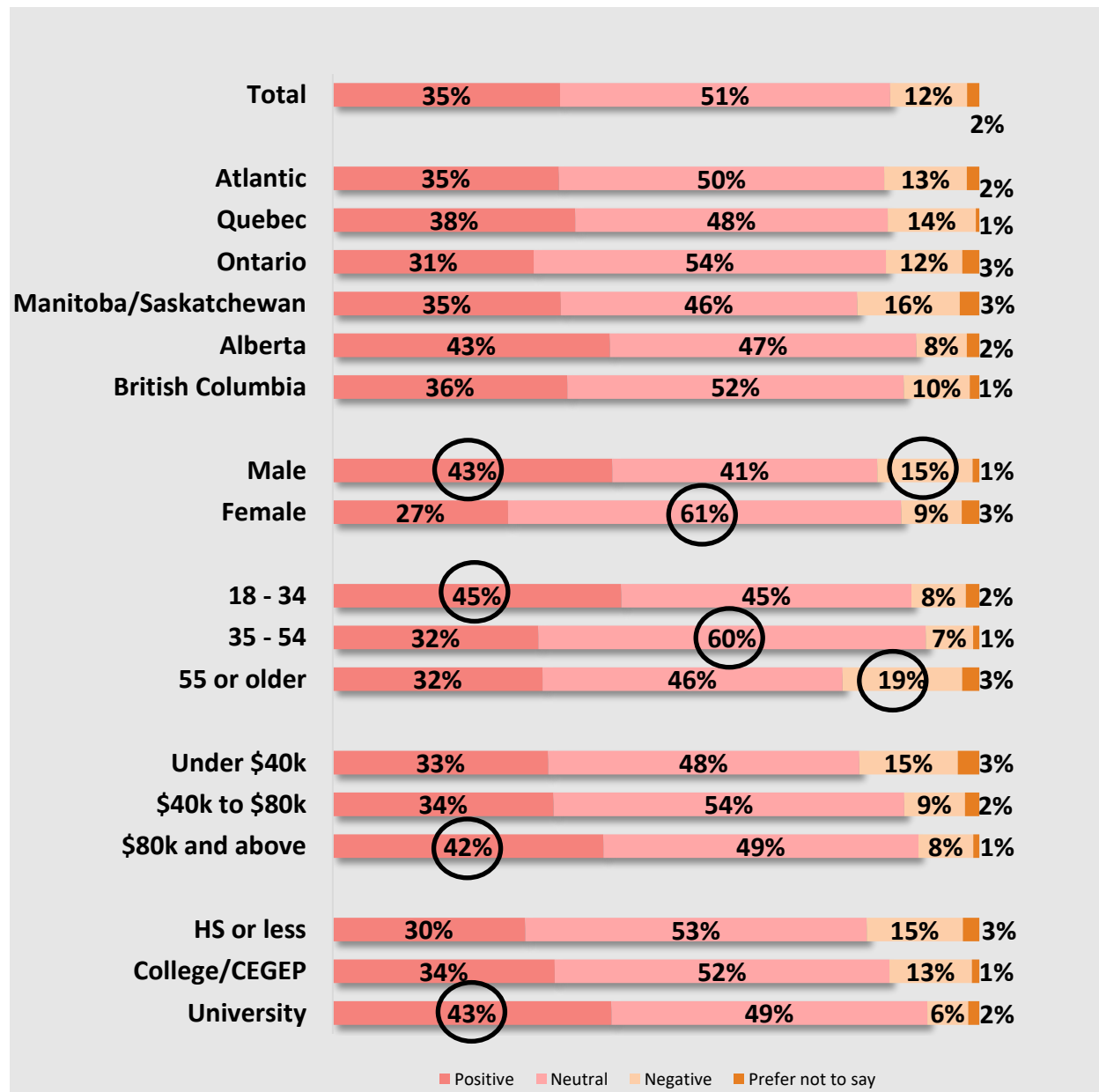
Results were consistent from one region to the next, with the most positive reaction to the term biotechnology coming from respondents from Alberta, at 43%.

Men were generally more polarized on hearing the term “biotechnology” compared to women, who predominantly felt “neutral” (61%) about the term. Men were more likely to be either positive (43%) or negative (15%) compared to women (27% positive and 9% negative).

When looking at results across the three age groups, results show the youngest group (18-34) were most likely to have a positive reaction (45%). Those aged 35 to 54 years old were most likely to have a neutral reaction (60%), whereas those in the oldest group (55 or older) were most inclined to have a negative reaction (19%).

Those earning a household income of \$80,000 and above had more positive reactions (42%) compared to those earning less. Additionally, those with university educations had more positive reactions (43%) to the term “biotechnology” compared to those with a high school education or less (30%).

Figure 2 – General reactions to the term “biotechnology” – by region, gender, reaction to biotechnology, age, income, and education



B1. This part of the survey focuses on biotechnology. Generally, when you hear the word biotechnology, do you have a positive, neutral, or negative reaction? Base: Telephone respondents, n=1033.¹

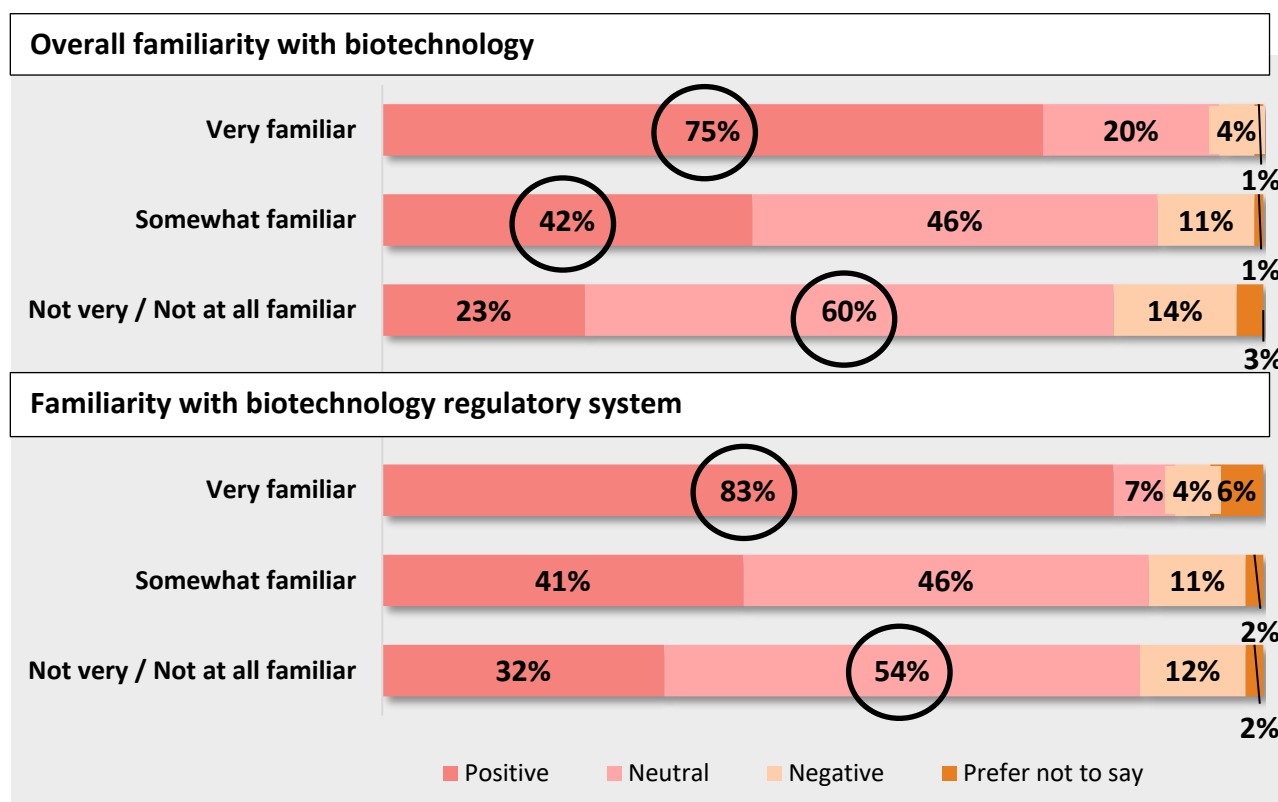
The higher the respondent’s self-reported familiarity with biotechnology, the more positive the reaction. As familiarity increases, the likelihood of having a positive reaction increases – more specifically, those who are ‘very familiar’ scored higher than those ‘somewhat familiar’ and not

¹ Statistically significant differences between sub-groups in this and all other figures in this report are circled. Data comparisons are limited to sub-groups within the same group – for instance, men are compared to women, those 18 to 34 are compared to those in older age groups, etc.

very or not at all familiar (75% versus 42%, 23%). Significant differences on the overall familiarity with biotechnology is identified in Figure 3 below.

Similarly, respondents who reported having a higher familiarity with the regulatory system were more likely to report positive reactions to biotechnology. As shown below, 83% of those who said they were “very familiar” with the regulatory system had a positive reaction to the term biotechnology. This gradually decreases to 32% among those who said they were not very or not at all familiar with the regulatory system. These trends have been observed in the previous waves of research conducted since 2011.

Figure 3 – General reactions to the term “biotechnology” – by overall familiarity with biotechnology and familiarity with regulatory system



B1. This part of the survey focuses on biotechnology. Generally, when you hear the word biotechnology, do you have a positive, neutral, or negative reaction? Base: Telephone respondents, n=1033.

Results also show as the average income of Canadians increases, the likelihood of reporting a positive opinion of biotechnology rises. Those earning \$80,000 and above were more likely to respond positively compared to those earning between \$40,000 and \$80,000, and those earning less than \$40,000 (42% versus 34%, 33%).

A similar trend was observed among respondents with a higher level of education. Those with a university education tended to have a positive opinion compared to those with a college or high school education (43% versus 34%, 30%).

Sources of information about biotechnology

After being asked to provide an unprompted reaction to biotechnology, respondents were provided with the following definition before answering a series of questions specific to biotechnology:

Biotechnology is used in many areas, such as health, natural resources, manufacturing and agriculture. Biotechnology involves engineering living organisms, such as plants and animals, or parts of living organisms to produce useful products, such as, medicines or creating plants that are not affected by pests or insects.

Respondents were then provided with a list of various sources of information and asked to select the ones they consult to get information on biotechnology. Compared to 2016 results, the percentage of respondents using each of the listed information sources had increased. These findings suggest Canadians are increasingly consulting a variety of sources.

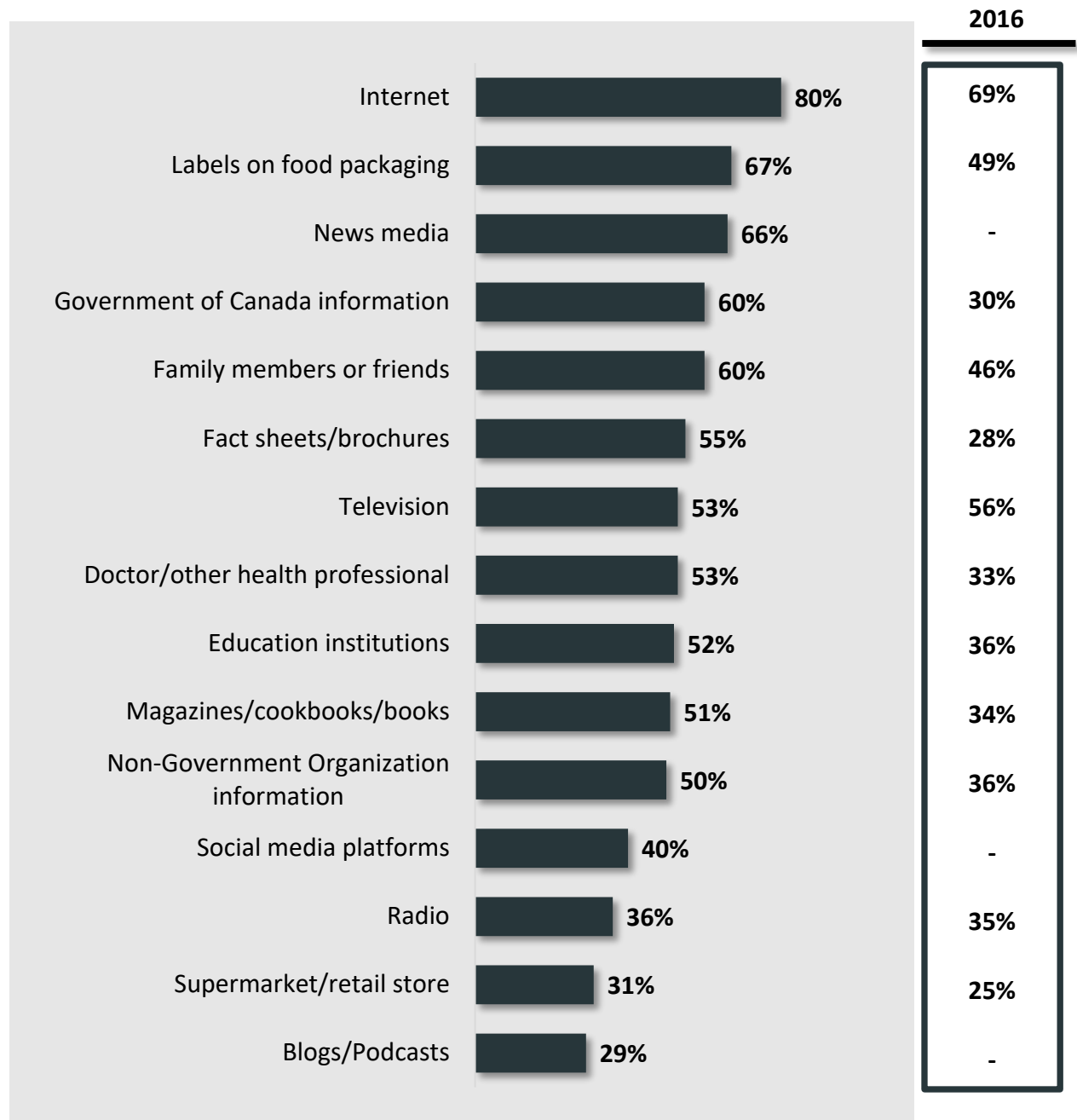
The primary source cited by respondents was a general internet search (80%, up from 69% in 2016), followed by labels available on food packaging (67%, up from 49%) and news media (66%, not included in previous waves). More than half of Canadians consult specific expert sources of information, including Government of Canada information (60% compared to 30% in 2016), various fact sheets (55% up from 28% in 2016), health professionals (53% up from 33%) and educational institutions (52% up from 36%). All these expert sources saw a large increase in usage compared to the results in 2016.

Two traditional sources of information, television (53%) and radio (36%), saw stable results compared to 2016 (56% and 35% respectively).

Results also show friends and family were a common source of information, as noted by 60% of respondents. This has increased since 2016 when 46% indicated word of mouth as a source of information.

Two other new items listed in this year's study were social media platforms and blogs and podcasts, each selected by noteworthy proportions of respondents (40% and 29% respectively).

Figure 4 – Use of information sources about biotechnology



B2. Which of the following sources do you use or consult to get information on biotechnology? Base: Telephone respondents, n=1033.

When usage of information sources is broken down by familiarity with biotechnology, respondents who were “not very” or “not at all familiar” were less likely to consult specific expert sources through a variety of channels, including education institutions (41% versus 62%), Government of Canada information (54% versus 66%), and health professionals (47% versus 58%).

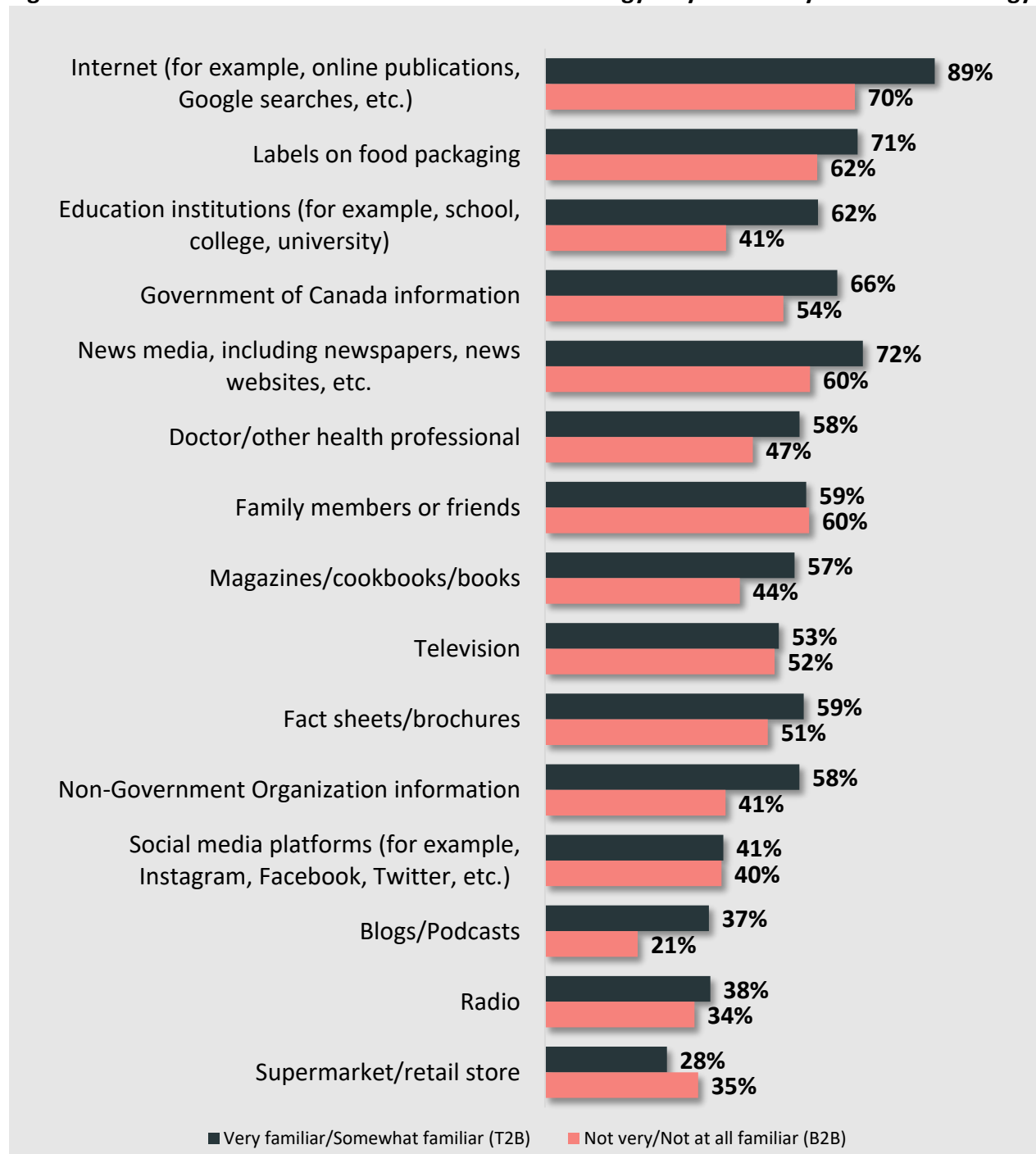
Additionally, those who were “not very” or “not at all familiar” were also less likely than those “very familiar” or “somewhat familiar” to consult information available online, including general

internet searches (70% versus 89%), or blogs and podcasts (21% versus 37%). Other notable differences include a reduced tendency to consult Non-Government Organization sources (41% versus 58%), books (44% versus 57%), news media (60% versus 72%) and food packaging labels (62% versus 71%).

A similar trend was observed between respondents who were “very familiar” compared to those that were only “somewhat familiar”. The largest gaps were observed in specific expert sources through a variety of channels including education institutions (77% versus 59%), Government of Canada information (72% versus 65%), as well as health professionals (65% versus 57%).

Those who were “somewhat familiar” with biotechnology tended to get their information from news media (73% versus 68%), and Non-Government Organization sources (59% versus 49%) at an increased frequency compared to those who were “very familiar”.

Figure 5 – Use of information sources about biotechnology – by familiarity with biotechnology

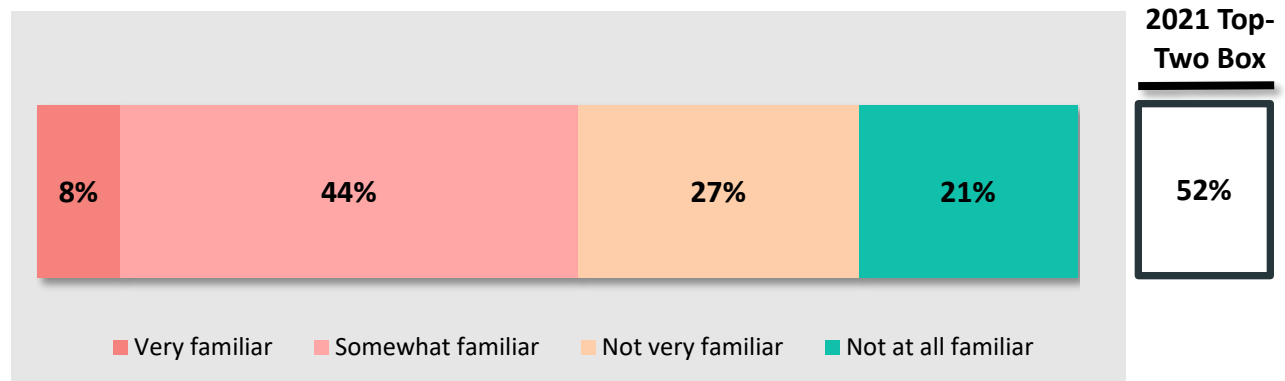


B2. Which of the following sources do you use or consult to get information on biotechnology? Base: Telephone respondents, n=1033.
 T2B refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.
 B2B refers to the combination of the 2 lowest scores, in this case, those who selected “not very familiar” or “not at all familiar”.

Familiarity with biotechnology

Respondents were asked how familiar they are with biotechnology. Over half of Canadians (52%) described their level of familiarity as “very familiar” (8%) or “somewhat familiar” (44%). About one in five (21%) respondents described themselves as “not at all familiar”.

Figure 6 – Familiarity with biotechnology

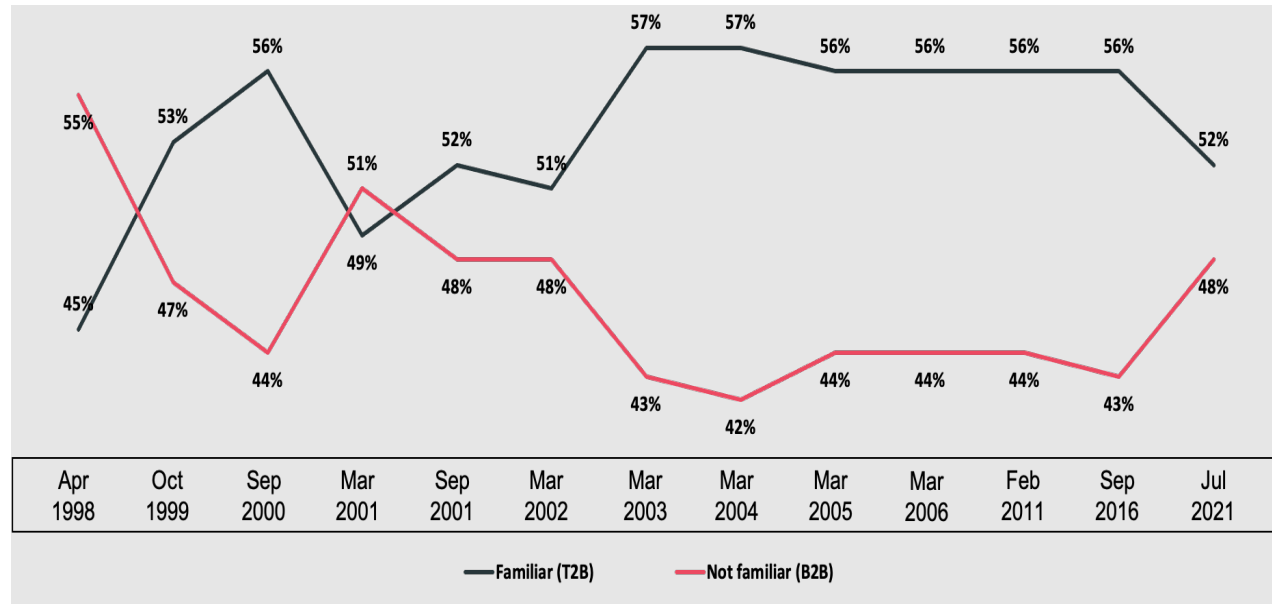


B3. Before participating in this survey, would you say you were very familiar, somewhat familiar, not very familiar, or not at all familiar with biotechnology? Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

The results for familiarity have dropped slightly when compared to previous tracking waves. While familiarity stayed quite consistent between 2003 and 2016, the 2021 findings show a 4% drop in Canadians who describe themselves as either “very familiar” or “somewhat familiar”, and a corresponding 5% increase in those who report being “not very familiar” or “not at all familiar”.

Figure 7 – Familiarity with biotechnology – tracking



B3. Before participating in this survey, would you say you were very familiar, somewhat familiar, not very familiar, or not at all familiar with biotechnology? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “not very familiar” or “not at all familiar”.

When comparing familiarity by region, those living in Alberta and Ontario were more likely to report being “very familiar” or “somewhat familiar” with biotechnology compared to those in Quebec (67%, 58% versus 33%).

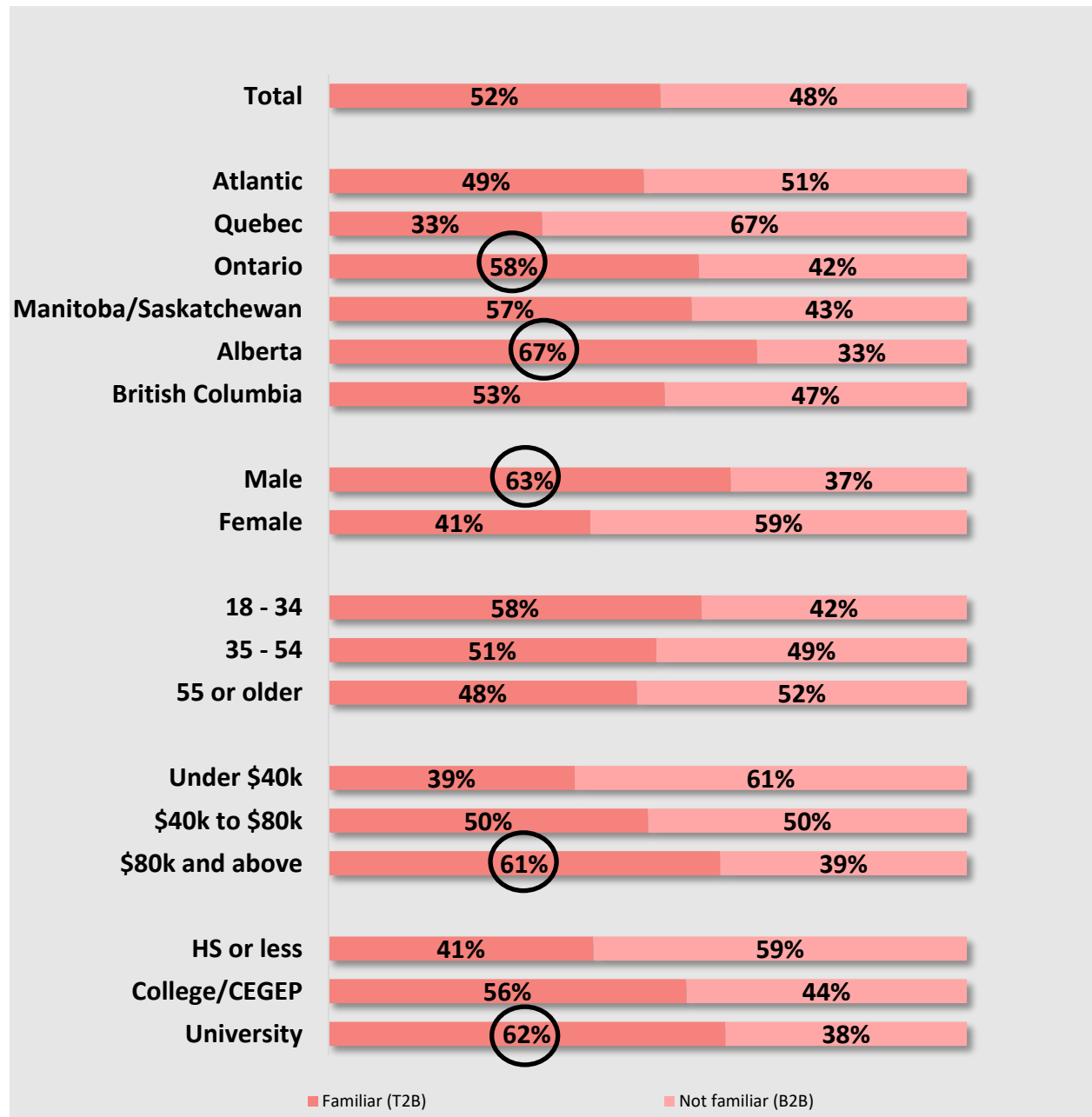
Results also show that men were more likely to report being “very familiar” or “somewhat familiar” compared to women (63% versus 41%).

Respondents who had a positive reaction to biotechnology were more likely to be “very familiar” or “somewhat familiar” compared to those with a neutral or negative reaction (69% versus 43%).

A trend was observed among household incomes which revealed that as income increases, the likelihood to specify being “very familiar” or “somewhat familiar” also increases. Familiarity was highest among those earning \$80,000 and above compared to those earning under \$40,000 (61% versus 39%).

A similar trend was observed when it comes to level of education. Those with a university education reported higher familiarity scores compared to those with a high school education (62% versus 41%).

Figure 8 – Familiarity with biotechnology – by region, gender, age, income, and education



B3. Before participating in this survey, would you say you were very familiar, somewhat familiar, not very familiar, or not at all familiar with biotechnology? Base: CATI respondents, n=1033.

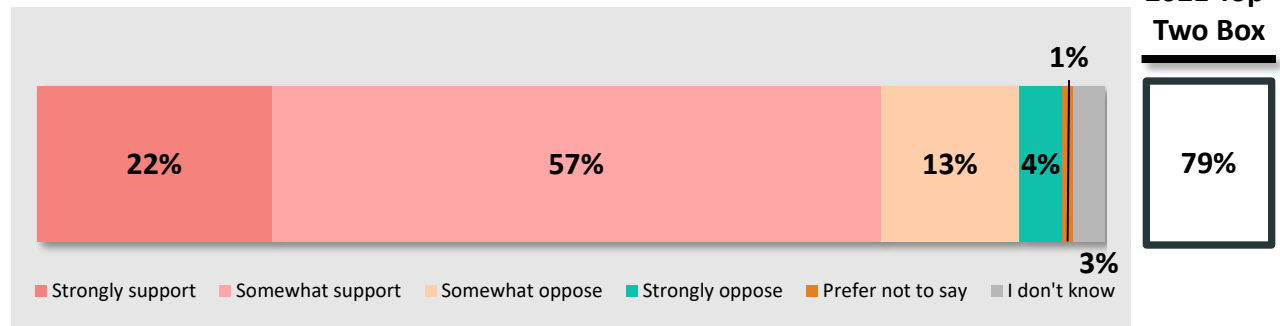
T2B refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “not very familiar” or “not at all familiar”.

Support for biotechnology

Nearly four in five (79%) respondents said they “strongly support” (22%) or “somewhat support” (57%) the general use of products and processes that involve biotechnology.

Figure 9 – General support for biotechnology

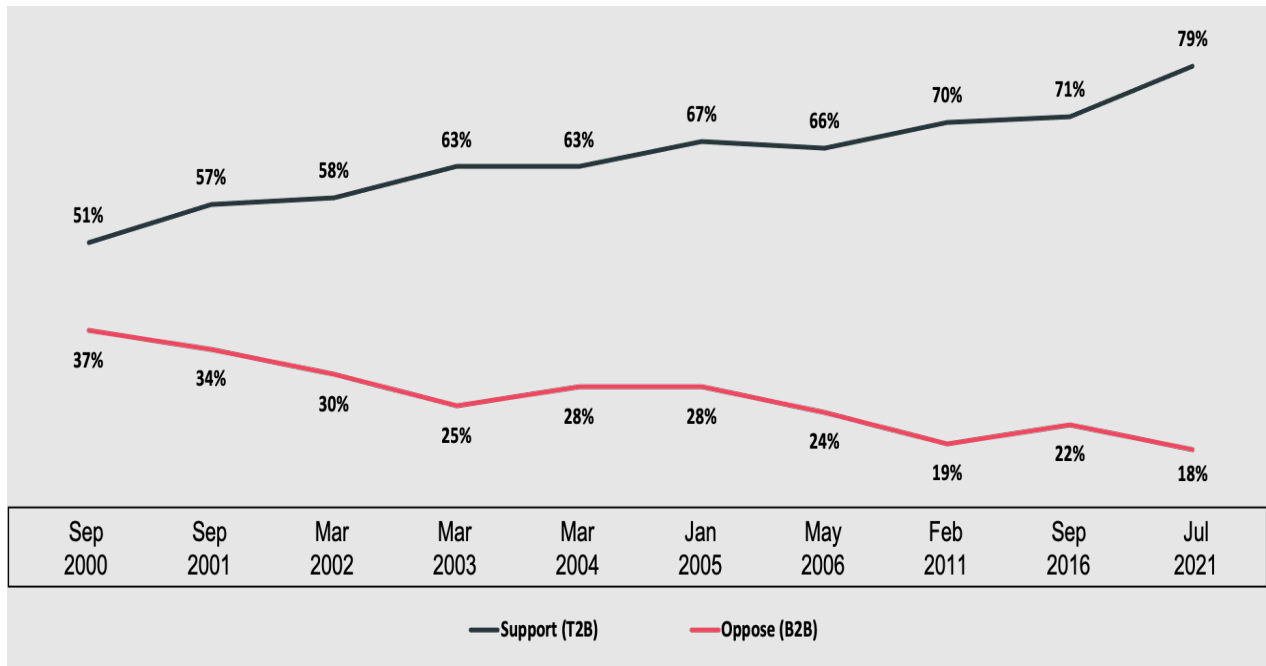


B4. In general, would you say you strongly support, somewhat support, somewhat oppose or strongly oppose the use of products and processes that involve biotechnology? Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

When comparing results across previous waves of the study, as well as other previous research conducted between 2000-2006, support has increased at a steady rate since 2000. Despite a lack of increase in familiarity with biotechnology over the same period, support has largely increased, reaching an all-time high of 79% in the current wave (an increase of 8% from 2016).

Figure 10 – General support for biotechnology – tracking



B4. In general, would you say you strongly support, somewhat support, somewhat oppose or strongly oppose the use of products and processes that involve biotechnology? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “somewhat oppose” or “strongly oppose”.

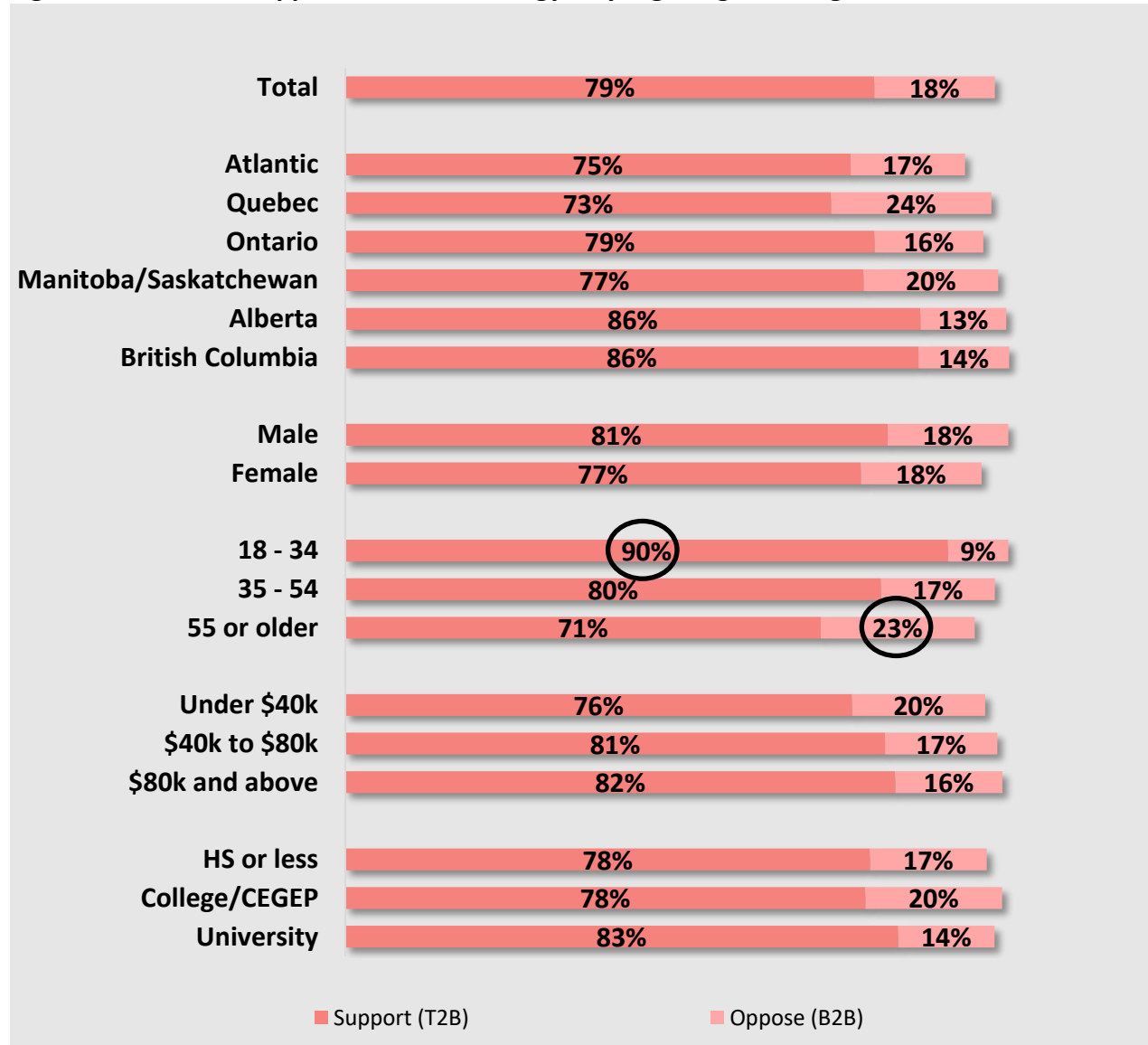
Canadians living in Alberta or British Columbia were more likely to “strongly support” or “somewhat support” biotechnology products and processes compared to those living in Quebec (86% versus 73%).

Men were more likely to “strongly support” biotechnology products and processes compared to women (27% versus 17%).

Results show that the younger the respondent, the greater the level of support for biotechnology products and processes. Those aged 18 to 34 years old were the most likely to “strongly support” or “somewhat support” biotechnology products and processes compared to those 55 years or older (90% versus 71%).

Households earning \$80,000 and above were more likely to “strongly support” the use of products and processes involving biotechnology compared to those earning under \$40,000 (27% versus 17%).

Figure 11 – General support for biotechnology – by region, gender, age, income, and education



B4. In general, would you say you strongly support, somewhat support, somewhat oppose or strongly oppose the use of products and processes that involve biotechnology? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “somewhat oppose” or “strongly oppose”.

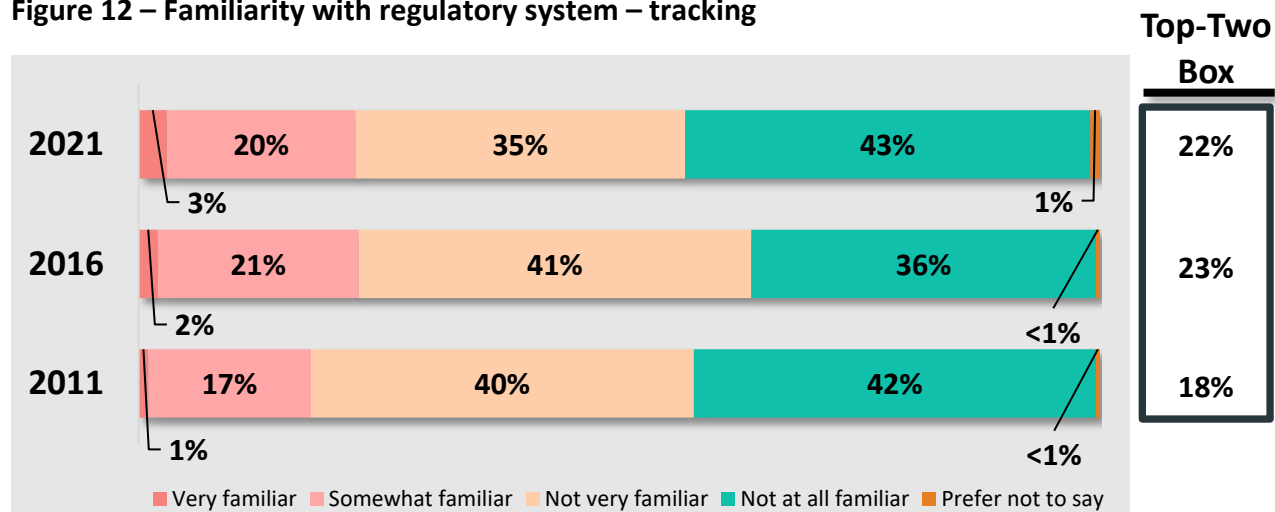
The greater the familiarity with biotechnology, the greater the support for products and processes involving biotechnology. Those who were “very familiar” or “somewhat familiar” were more likely to “strongly support” or “somewhat support” biotechnology compared to those who were not very or not at all familiar (92%, 84% versus 72%).

Familiarity with the regulatory system

Respondents were asked to state how familiar they were with the process by which biotechnology is regulated in Canada. More than one in five (22%) Canadians said they were “very familiar” (3%) or “somewhat familiar” (20%) with the regulatory system. The remaining respondents reported being “not very familiar” (35%) or “not at all familiar” (43%) with the regulatory system.

When comparing these figures across previous waves, results have largely remained the same in the current wave.

Figure 12 – Familiarity with regulatory system – tracking



B5. Would you say that you're very familiar, somewhat familiar, not very familiar, or not at all familiar with the process by which biotechnology is regulated in Canada? Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

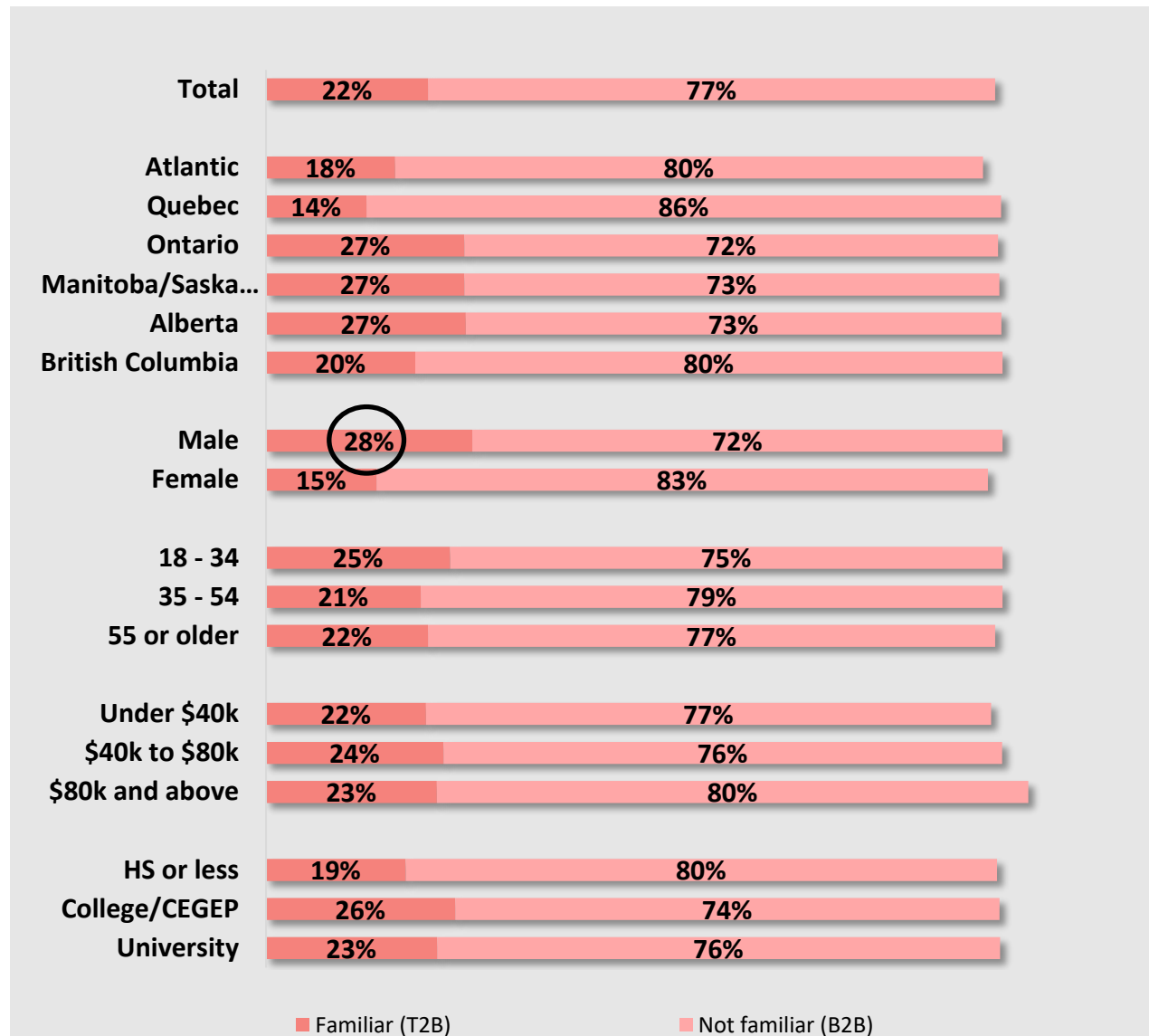
Analysis of sub-group findings reveals that respondents living in Alberta, Manitoba/Saskatchewan and Ontario were more likely to say they were “very familiar” or “somewhat familiar” compared to those living in Quebec (27% versus 14%).

As well, men were more likely to be “very familiar” or “somewhat familiar” compared to women (28% versus 17%).

In general, higher familiarity with biotechnology was linked to higher familiarity with the regulatory process. Those who were “very familiar” with biotechnology were more likely to answer “very familiar” or “somewhat familiar” with the regulatory process compared to those who were not very or not at all familiar with biotechnology (72% versus 6%).

Canadians who indicated they supported biotechnology were more likely to say they were familiar with the regulatory process compared to those who opposed biotechnology (24% versus 18%).

Figure 13 – Familiarity with regulatory system – by region, gender, age, income, and education



B5. Would you say that you're very familiar, somewhat familiar, not very familiar, or not at all familiar with the process by which biotechnology is regulated in Canada? Base: Telephone respondents, n=1033.

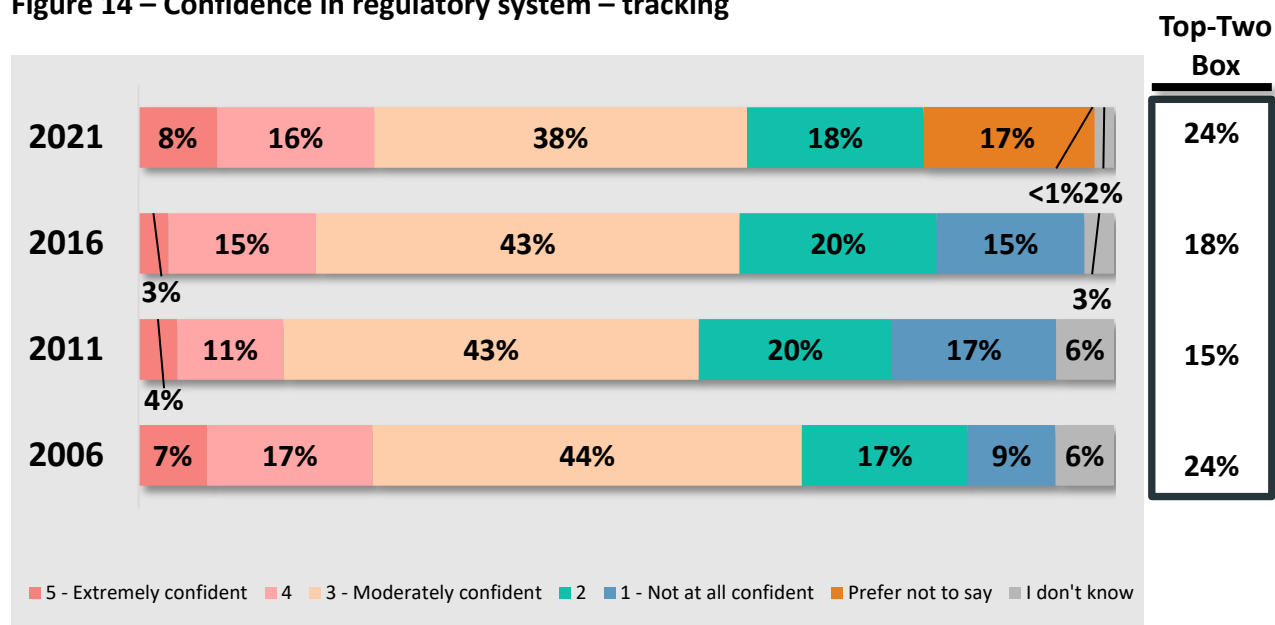
T2B refers to the combination of the 2 highest scores, in this case, those who selected "very familiar" or "somewhat familiar".

B2B refers to the combination of the 2 lowest scores, in this case, those who selected "not very familiar" or "not at all familiar".

Confidence in the regulatory system

Expanding on the understanding of the regulatory system, respondents were asked to rank their confidence in the safety and regulation of biotechnology in Canada. Roughly one quarter (24%) of Canadians are “very confident” (giving a rating of “5 – extremely confident” or “4” on the 5-point scale) in the regulatory system, with nearly one in 10 (8%) indicating they are “extremely confident”. Furthermore, results show confidence is increasing slightly over time, as results returned to those observed in 2006. That said, a greater proportion of respondents (36%) would say they are not very confident (giving a rating of “1 – not at all confident” or “2” on the 5-point scale) than those who say they are confident (giving a rating of “4” or “5” on the 5-point scale).

Figure 14 – Confidence in regulatory system – tracking



B6. On a scale of 1-5, where 1 is not at all confident and 5 is extremely confident, how confident would you say you are in the safety and regulation of biotechnology? Base: Telephone respondents, n=1033.

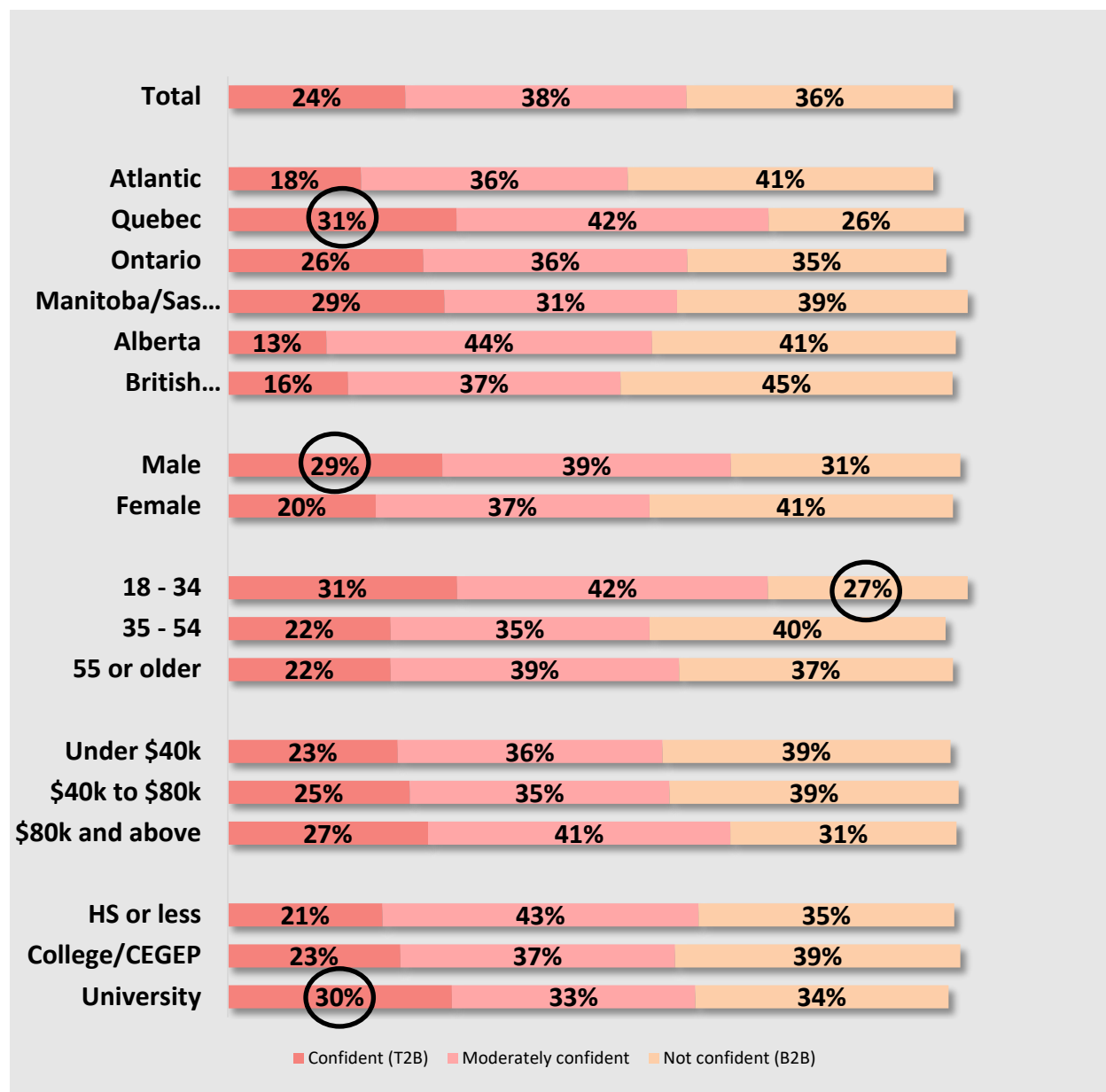
Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “5 – extremely confident” or “4”.

Canadians living in Quebec tended to report higher confidence scores (“5 – extremely confident” or “4”) compared to those living in British Columbia or Alberta (31% versus 16%, 13%).

Men were more likely to say they were confident (“5 – extremely confident” or “4”) compared to women (29% versus 20%).

Respondents aged 35 to 54, and 55 years or older reported lower levels of confidence (“2” or “1 – not at all confident”) compared to those aged 18 to 34 (40%, 37% versus 27%).

Figure 15 – Confidence in regulatory system – by region, gender, age, income, and education



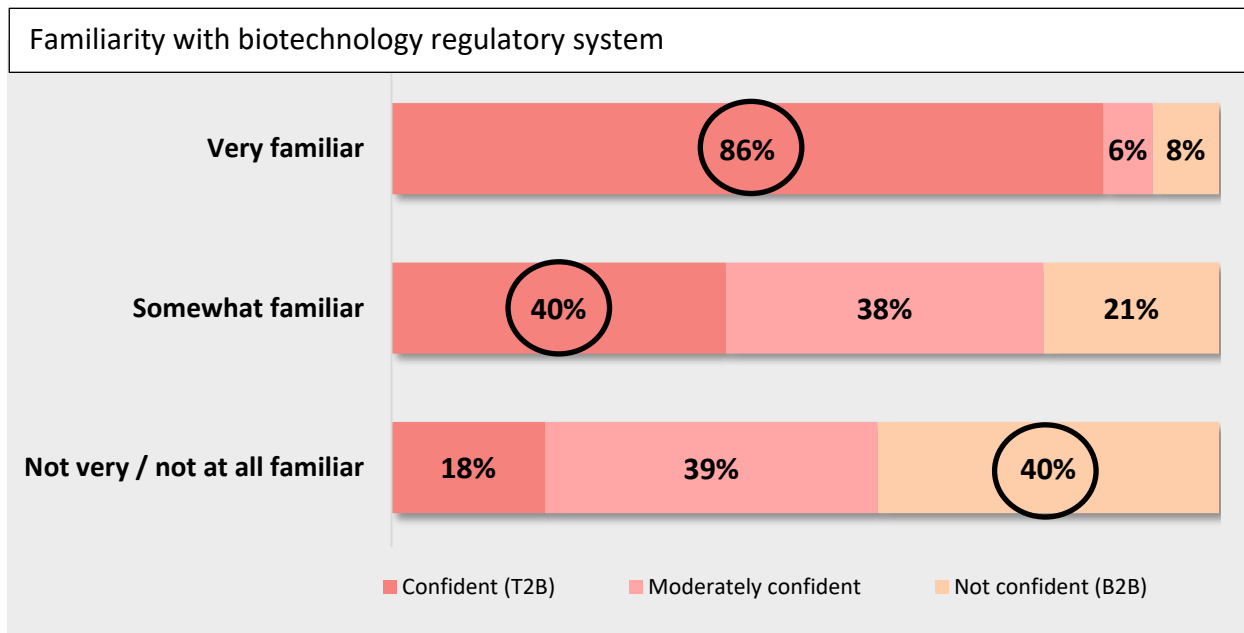
B6. On a scale of 1-5, where 1 is not at all confident and 5 is extremely confident, how confident would you say you are in the safety and regulation of biotechnology? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “5 – extremely confident” or “4”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “2” or “1 – not at all confident”.

Results also show the more familiar respondents are with the biotechnology regulatory system, the more likely they are to feel confident in the regulatory system. As seen in Figure 15 below, of those who reported being “very familiar” with the regulatory system, 86% are also confident in the regulatory system. Confidence in the biotechnology regulatory system gradually decreases to 18% among those who feel they are not very or not at all familiar with the regulatory system. These results support findings observed in the 2016 wave of the study.

Figure 16 – Confidence in regulatory system – by familiarity with regulatory process



B6. On a scale of 1-5, where 1 is not at all confident and 5 is extremely confident, how confident would you say you are in the safety and regulation of biotechnology? Base: Telephone respondents, n=1033.

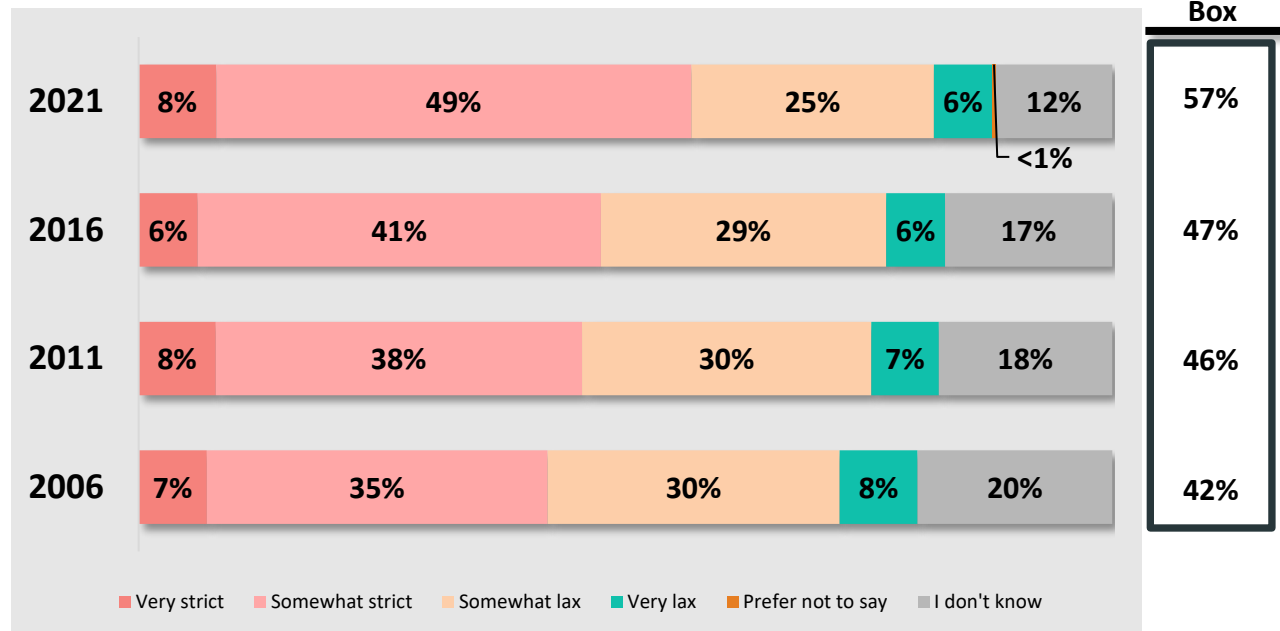
T2B refers to the combination of the 2 highest scores, in this case, those who selected “5 – extremely confident” or “4”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “2” or “1 – not at all confident”.

Perceived strictness of the regulatory approval process

Respondents were asked to rate how strict or lax the rules and systems are in Canada. Nearly three in five (57%) Canadians scored the regulatory process as “very strict” (8%) or “somewhat strict” (49%), the largest percentage observed across all recent waves of study. The extent to which the process is seen as “lax” has seen a parallel decrease over the same period. However, it is important to recognize more than one in ten (12%) simply do not know if the approval processes for biotechnology products are strict or lax.

Figure 17 – Perceived strictness of the regulatory approval process – tracking



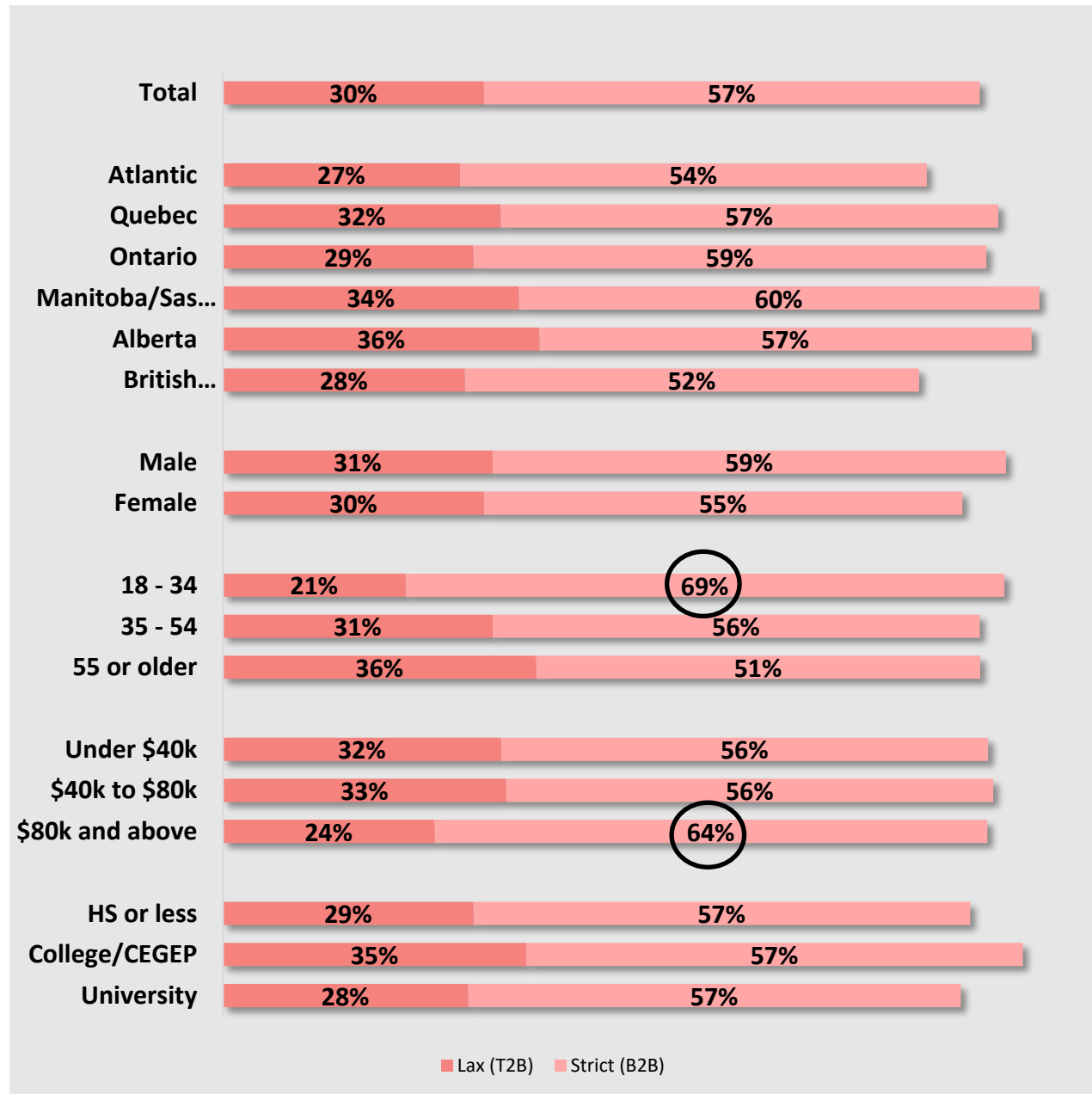
B7. In terms of safety and regulatory approval processes for biotechnology products, do you tend to think that rules and systems in place here in Canada are very strict, somewhat strict, somewhat lax or very lax? Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very strict” or “somewhat strict”.

Respondents living in Manitoba or Saskatchewan were the most likely to rate the regulatory approval process as strict (60%), while those living in British Columbia were the least likely (52%).

In terms of age, the younger the respondents, the more likely they were to say the process is strict. As seen in Figure 17, perceptions of strictness range from 69% among those 18 to 34 years of age to 51% among those 55 years of age and older.

Figure 18 – Perceived strictness of the regulatory approval process – by region, gender, age, income, and education



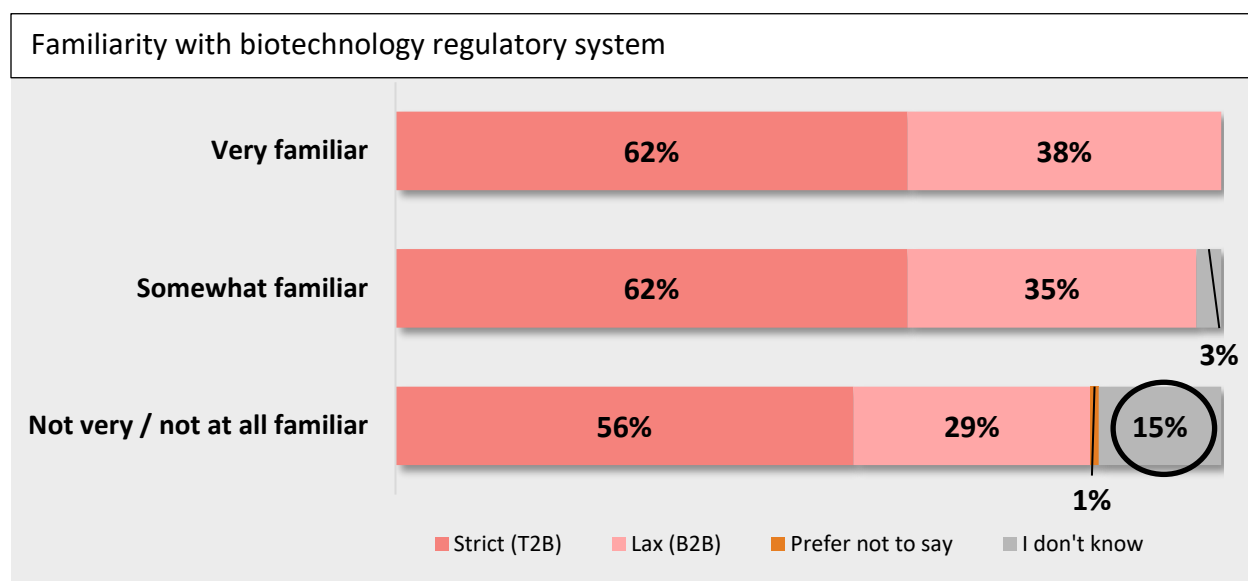
B7. In terms of safety and regulatory approval processes for biotechnology products, do you tend to think that rules and systems in place here in Canada are very strict, somewhat strict, somewhat lax or very lax? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “very strict” or “somewhat strict”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “somewhat lax” or “very lax”.

Results also show those who were at least “somewhat familiar” with the regulatory system were more inclined to consider the process as strict compared to those not very or not at all familiar with the regulatory system (62% versus 56%). That said, an important proportion of those who were not familiar with the regulatory system did not know if this same system is strict or lax (15%).

Figure 19 – Perceived strictness of the regulatory approval process - by familiarity with regulatory process



B7. In terms of safety and regulatory approval processes for biotechnology products, do you tend to think that rules and systems in place here in Canada are very strict, somewhat strict, somewhat lax or very lax? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “very strict” or “somewhat strict”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “somewhat lax” or “very lax”.

Impact of developing new technologies

Canadians were asked to evaluate a series of developing technologies based on their potential impact on improving way of life over the next 20 years. Several technologies directly related to biotechnology were included in the list, while general technologies were included for comparison purposes.

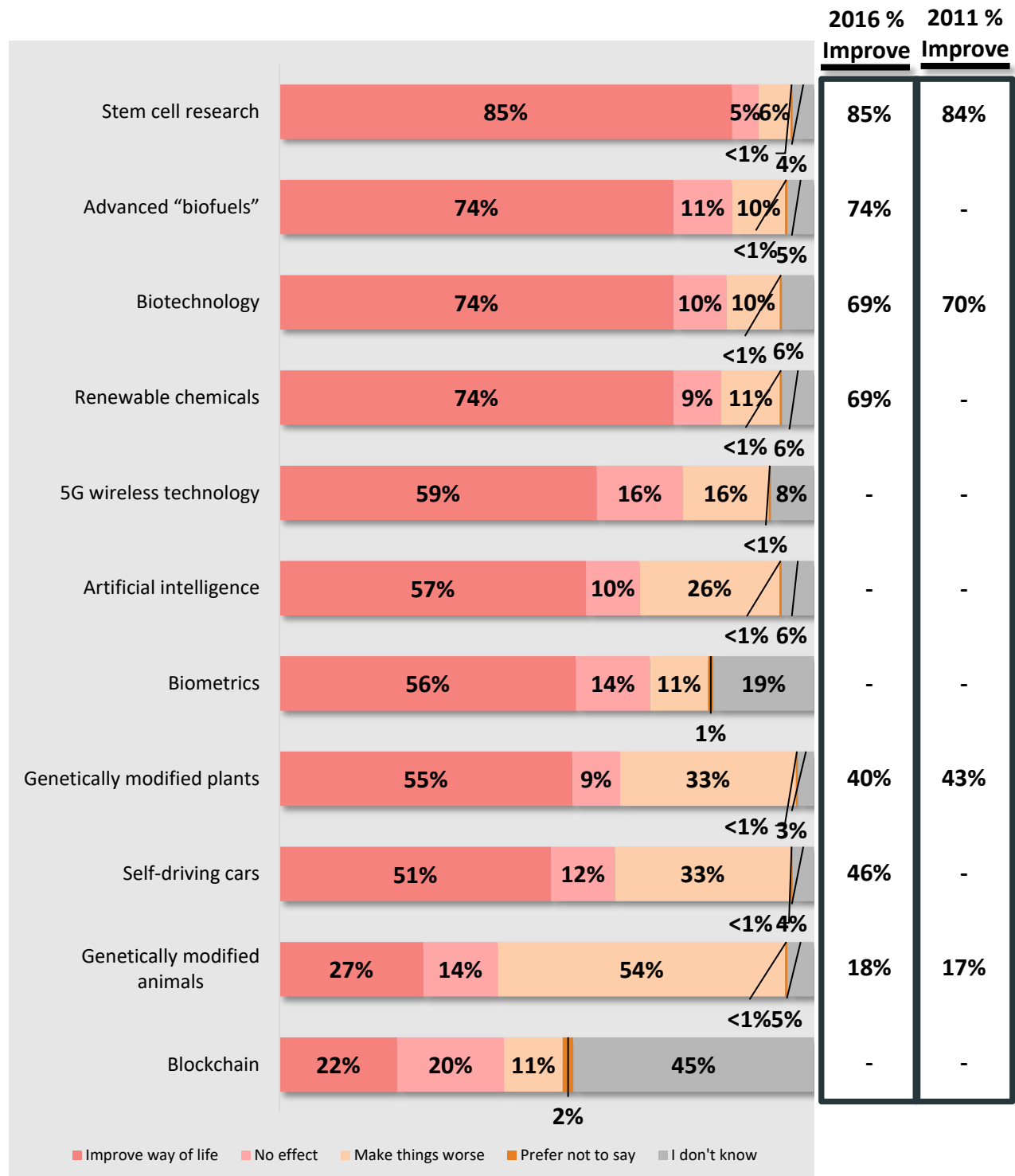
Several items stood out as improving way of life, namely stem cell research, scored favourably by more than four in five (85%) respondents. Roughly three quarters (74%) of respondents felt improvements would come from advanced biofuels, biotechnology, and renewable chemicals. A lower proportion, but still a majority, feel the quality of life will be improved through the development of 5G wireless technology (59%), artificial intelligence (57%), biometrics (56%), genetically modified plants (55%) and self-driving cars (51%).

The proportion who felt life will be improved is the lowest when it comes to genetically modified animals, for which a majority (54%) feel life will in fact be made worse by advancements in this

area. As well, few feel life will be improved through advancements in block chain (22%), although for this technology an important proportion did not know what impact this technology would have over time (45%).

The results for a number of these technologies have been tracked over time. These results remain similar to those observed across previous waves of the study, with increases in perceived improvements for genetically modified plants (+15%), biotechnology (+5%), and renewable chemicals (+5%). Additionally, despite a majority believing that advancements to genetically modified animals will make life worse, there was still a large increase in those believing that this advancement would improve life compared to the 2016 wave (+9%).

Figure 20 – Impact of developing new technologies – improve way of life



B8. The following is a list of areas in which new technologies are currently developing. Based on what you may have seen, read or heard, do you think each one will improve our way of life in the next 20 years, have no effect, or make things worse? Base: Telephone respondents, n=1033.

B. Biofuels and bioproducts

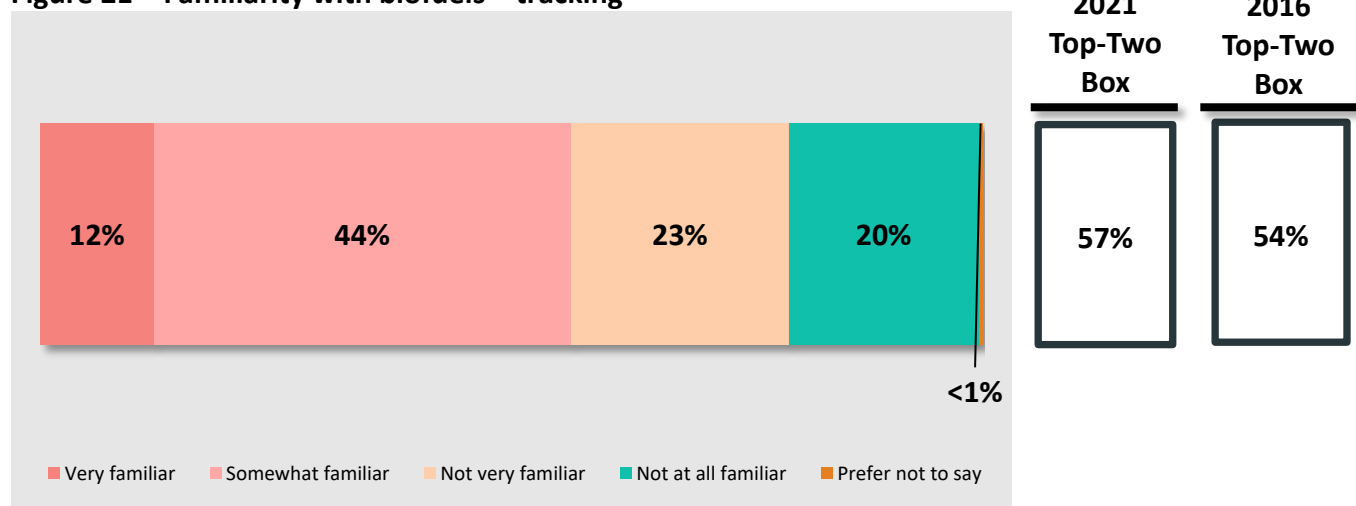
Respondents were asked a series of questions related to biofuels and bioproducts based on the following definition:

This part of the survey focuses on bio-based fuels, or biofuels. Biofuels use biological materials such as plants, wood and waste to produce fuels that can be used for cars, trains, airplanes, or to heat and power buildings.

Familiarity with biofuels

Respondents were asked about their familiarity with biofuels prior to participating in the survey. Familiarity increased slightly in 2021 with nearly three in five (57%) respondents saying they were either “very familiar” or “somewhat familiar” (a 3% increase from the 54% observed in 2016), with most in 2021 reporting they are “somewhat familiar” (44%). Despite this increase, it should be noted that one in five (20%) feel they are “not at all familiar” with biofuels.

Figure 21 – Familiarity with biofuels – tracking



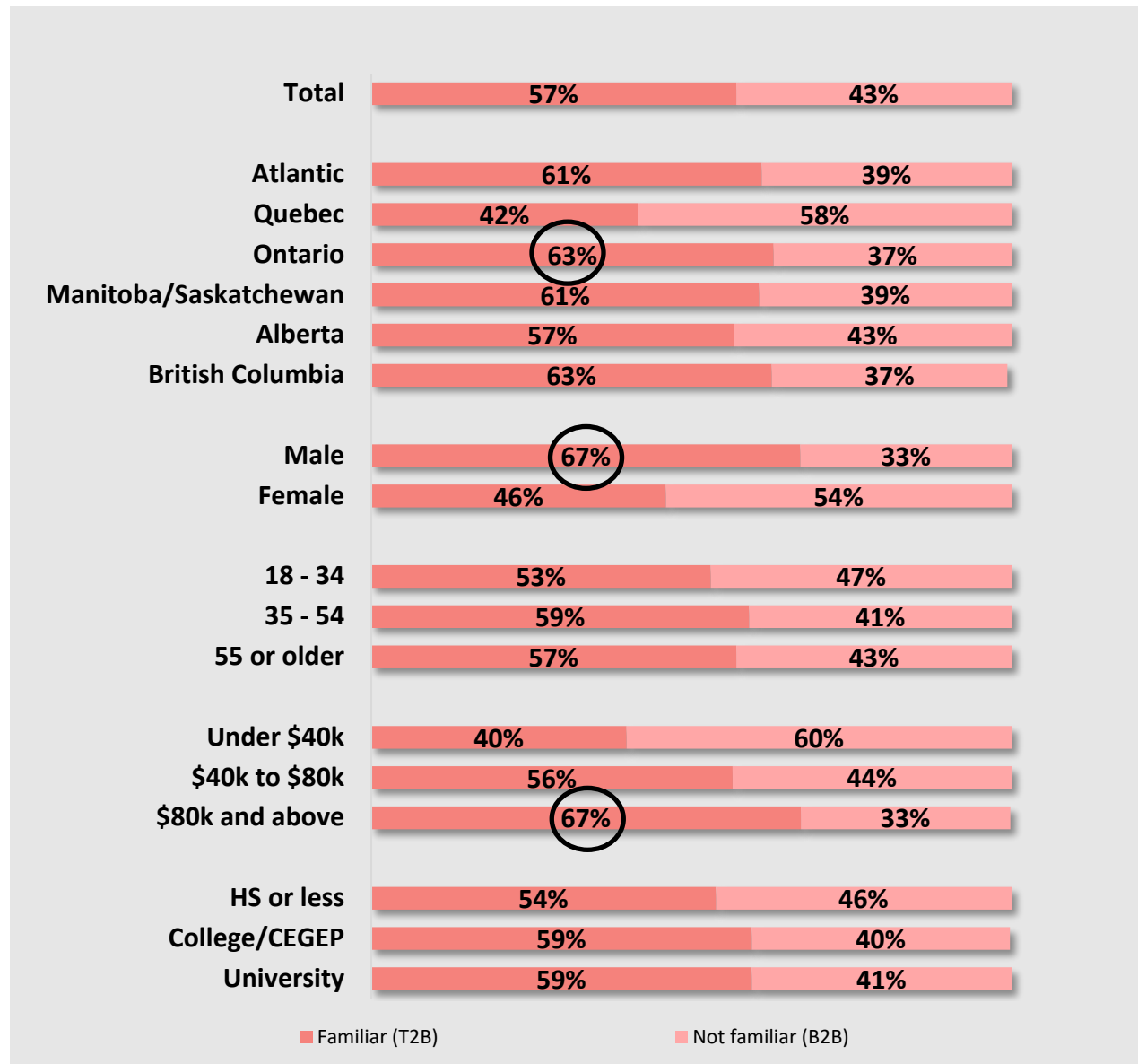
BF1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with biofuels? Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

Canadians living in Ontario were more likely to describe being “very familiar” or “somewhat familiar” compared to those living in Quebec (63% versus 42%).

Men were more likely to be “very familiar” or “somewhat familiar” compared to women (67% versus 46%). A trend was observed that the higher the level of household income, the greater the degree of familiarity with biofuels. Those from households earning \$80,000 and above were more likely to be “very familiar” or “somewhat familiar” (67%) compared to those earning between \$40,000 and \$80,000 (56%) and those earning less than \$40,000 (40%).

Figure 22 – Familiarity with biofuels – by region, gender, age, income, and education



BF1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with biofuels? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “not very familiar” or “not at all familiar”.

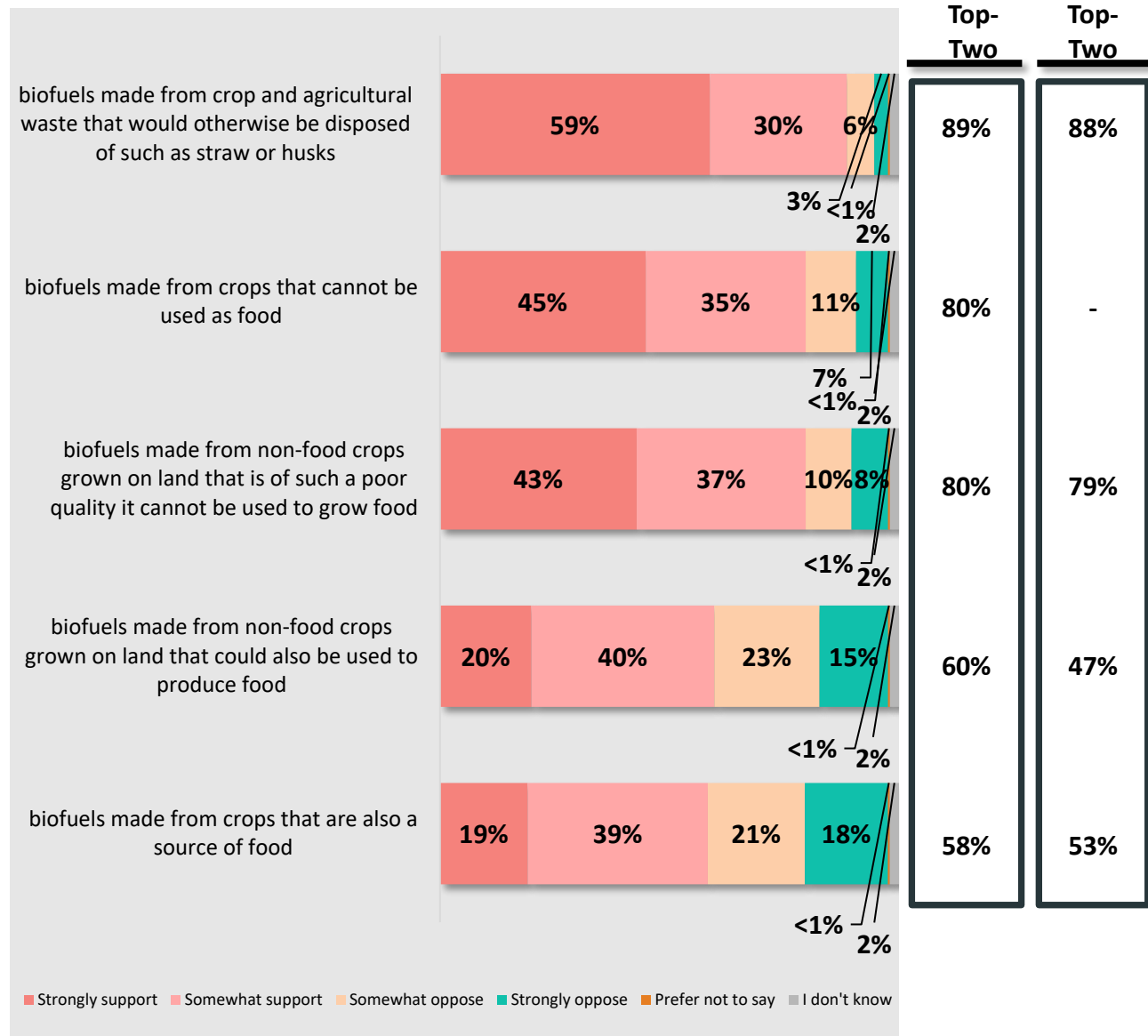
Support for sources of biofuels

Respondents were asked to consider a list of various sources for the production of biofuels and asked how much they support or oppose each method. Support was highest for items involving non-food crops, with roughly nine in ten (89%) respondents expressing they “strongly support” (59%) or “somewhat support” (30%) the use of crop and agriculture waste to produce biofuels. Similarly, four in five (80%) Canadians “strongly support” (45%) or “somewhat support” (35%)

using crops that cannot be used as food and non-food crops grown on land that cannot be used to grow food (80%).

Support was lowest for items involving the use of land or crops that could otherwise be used as food sources. More specifically, roughly three in five respondents “strongly support” or “somewhat support” using biofuels made from non-food crops on land that could produce food (60%) and biofuels made from crops that are also a source of food (58%). Although these are the two least appealing options to respondents, this appeal has increased since the previous wave of the study. Support for biofuels made from non-food crops on land that could produce food has increased by 13% (from 47% in 2016 to 60% in the current wave) while support for biofuels made from crops that are also a source of food has increased by 5% (from 53% in 2016 to 58% in the current wave).

Figure 23 – Support for sources of biofuels – tracking



BF2. Where biofuels offer environmental benefits and income opportunities for farmers, how supportive or opposed are you of the following approaches: telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

Respondents from Quebec were the most likely to somewhat or strongly oppose the use of crops that are also a source of food (52%), non-food crops grown on land that could also be used to produce food (47%), crops that cannot be used as food (24%), and crop and agricultural waste that would otherwise be disposed (15%) for the production of biofuels.

Support for producing biofuels from crop and agricultural waste was highest among respondents living in Atlantic Canada (97%) and British Columbia (96%) with a very large majority indicating they “strongly support” or “somewhat support” this approach.

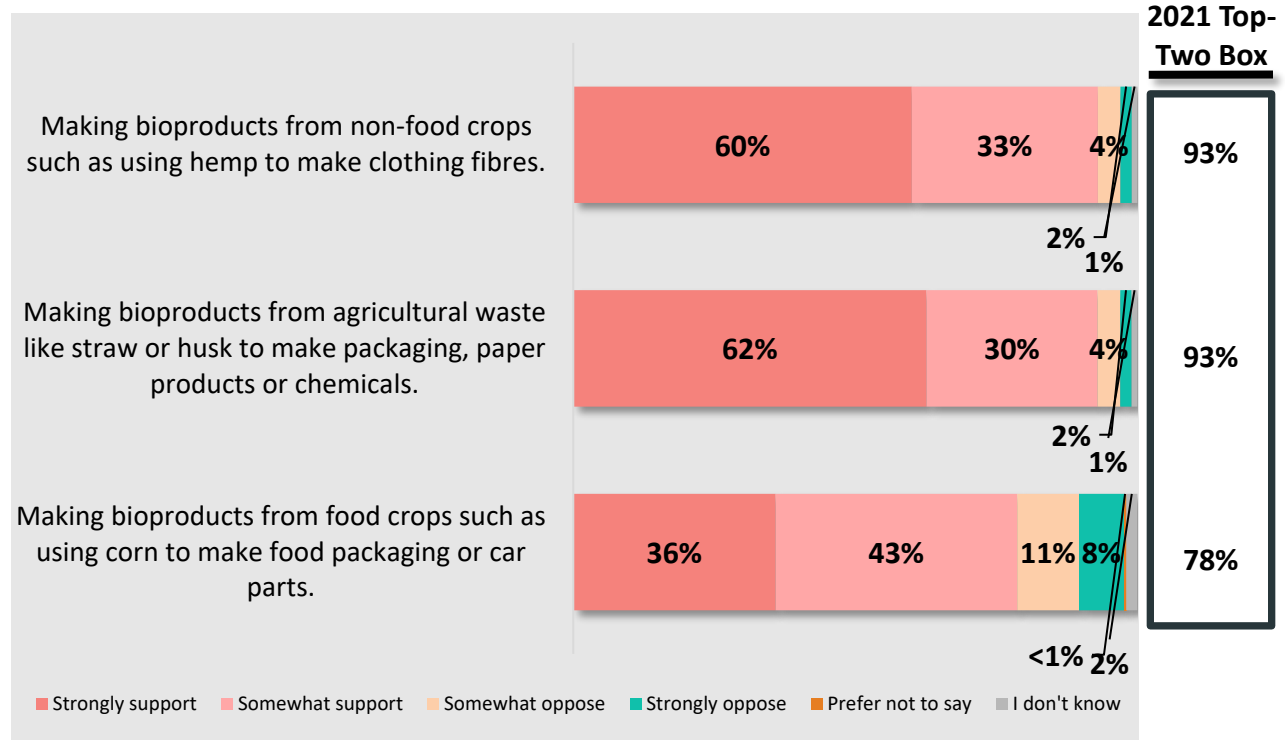
Respondents aged 18 to 34 were more likely to support non-food crops grown on land that could also be used to produce food (69% versus 59% of those 35 to 54, and 55% of those 55 and older) as well as crops that are also a source of food (65% versus 59% of those 35 to 54, and 53% of those 55 and older).

Support for potential applications of bioproducts

In addition to understanding support or opposition towards various approaches to producing biofuels, respondents were asked to indicate how much they support or oppose certain applications of bioproducts. Overall, strong degrees of support were observed, with the highest support for bioproducts that did not involve food crops. More specifically, 93% support making bioproducts from non-food crops, such as using hemp to make clothing fibres, with 60% fully supporting the idea. Similar support was shown for making bioproducts from agricultural waste like straw or husk to make packaging, paper products or chemicals.

Support decreased to 78% and opposition stood at 19% for making bioproducts from food crops, such as using corn to make food packaging or car parts.

Figure 24 – Support for potential applications of bioproducts



BF3. Other than for food and biofuels, agricultural crops can be used to make other kinds of bioproducts. Please indicate if you strongly support, somewhat support, somewhat oppose or strongly oppose the following potential applications: Base: Telephone respondents, n=1033. Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

Compared to women, men were more likely to “strongly support” using agricultural waste to make packaging, paper products or chemicals (67% versus 58%), as well as using non-food crops to make clothing fibres (65% versus 55%).

Support for making bioproducts from food crops tended to decrease as age increases. Those aged 18 to 34 reported the highest support compared to those 35 to 54 and those 55 years of age or older (87% versus 81%, 70%).

Canadians with an annual household income of \$80,000 and above were more likely to “strongly support” or “somewhat support” various applications compared to those earning under \$40,000, including using non-food crops to make clothing fibres (96% versus 90%) and using food crops to make food packaging or car parts (82% versus 71%).

C. Gene-Editing

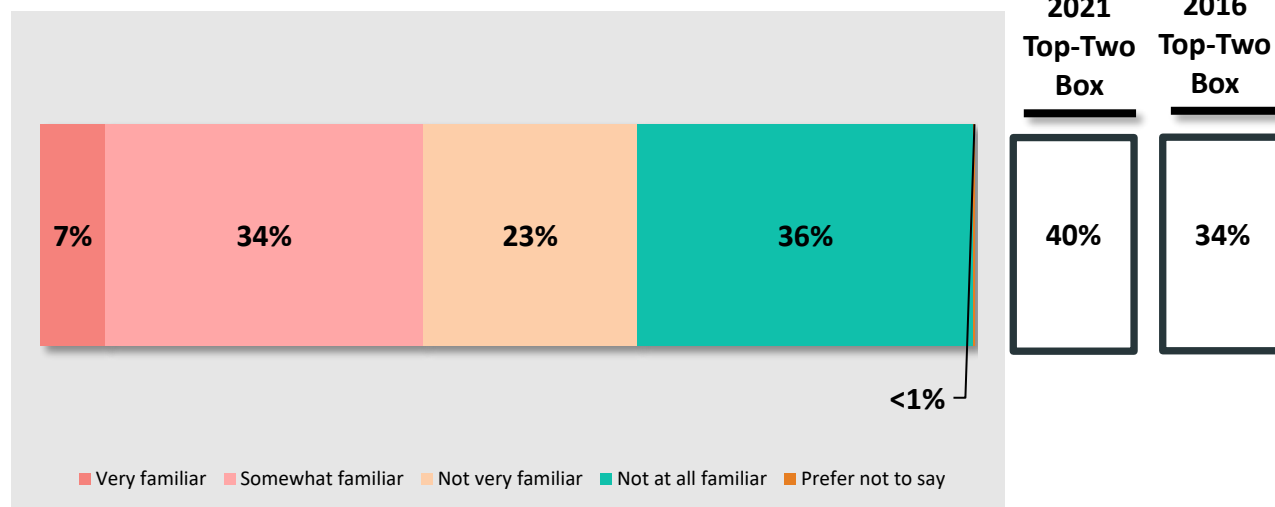
The next survey module explored gene-editing. Respondents were presented with the following definition and asked a series of questions aimed at assessing their attitudes and opinions towards various applications:

This part of the survey focuses on a new type of biotechnology called gene-editing. Gene-editing involves making small changes to a cell's gene structure and does not necessarily involve mixing together DNA from different species of plants or animals. Gene-editing is often used for medical and agricultural purposes.

Familiarity with gene-editing

To assess awareness of gene-editing among Canadians, respondents were asked to describe how familiar they are with the concept overall. Results reveal that two in five (40%) respondents were "very familiar" (7%) or "somewhat familiar" (34%). More than one in three (36%) Canadians were "not at all familiar" with gene-editing. Level of familiarity is higher compared to what was observed in 2016 (34%), but not significantly higher.

Figure 25 – Familiarity with gene-editing – tracking



GE1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with gene-editing? Base: Telephone respondents, n=1033.

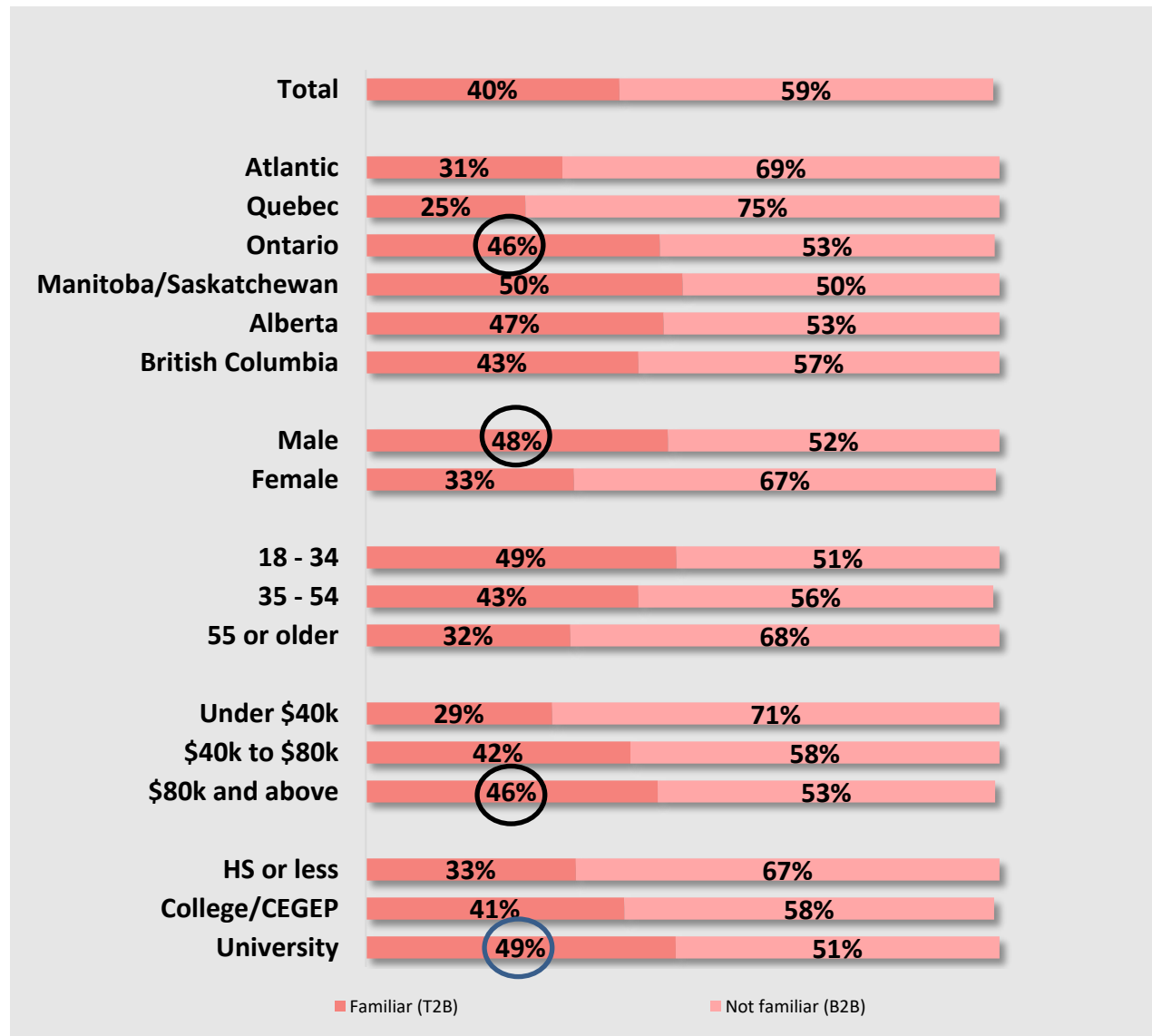
Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected "very familiar" or "somewhat familiar".

Canadians living in Ontario were more likely to be "very familiar" or "somewhat familiar" compared to those living in Quebec (46% versus 25%).

Men were more likely to be “very familiar” or “somewhat familiar” compared to women (48% versus 33%).

Familiarity with gene-editing decreases with age, as those 18 to 34 years and 35 to 54 years or older were more likely to be “very familiar” or “somewhat familiar” compared to those 55 years or older (49%, 43% versus 32%).

Figure 26 – Familiarity with gene-editing – by region, gender, age, income, and education



GE1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with gene-editing? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “not very familiar” or “not at all familiar”.

Support for uses of gene-editing

Respondents were asked to indicate their level of support or opposition for a number of potential uses for gene-editing. Overall, results show, despite a lack of overall familiarity with gene-editing, Canadians showed fairly strong support for many uses of this technology.

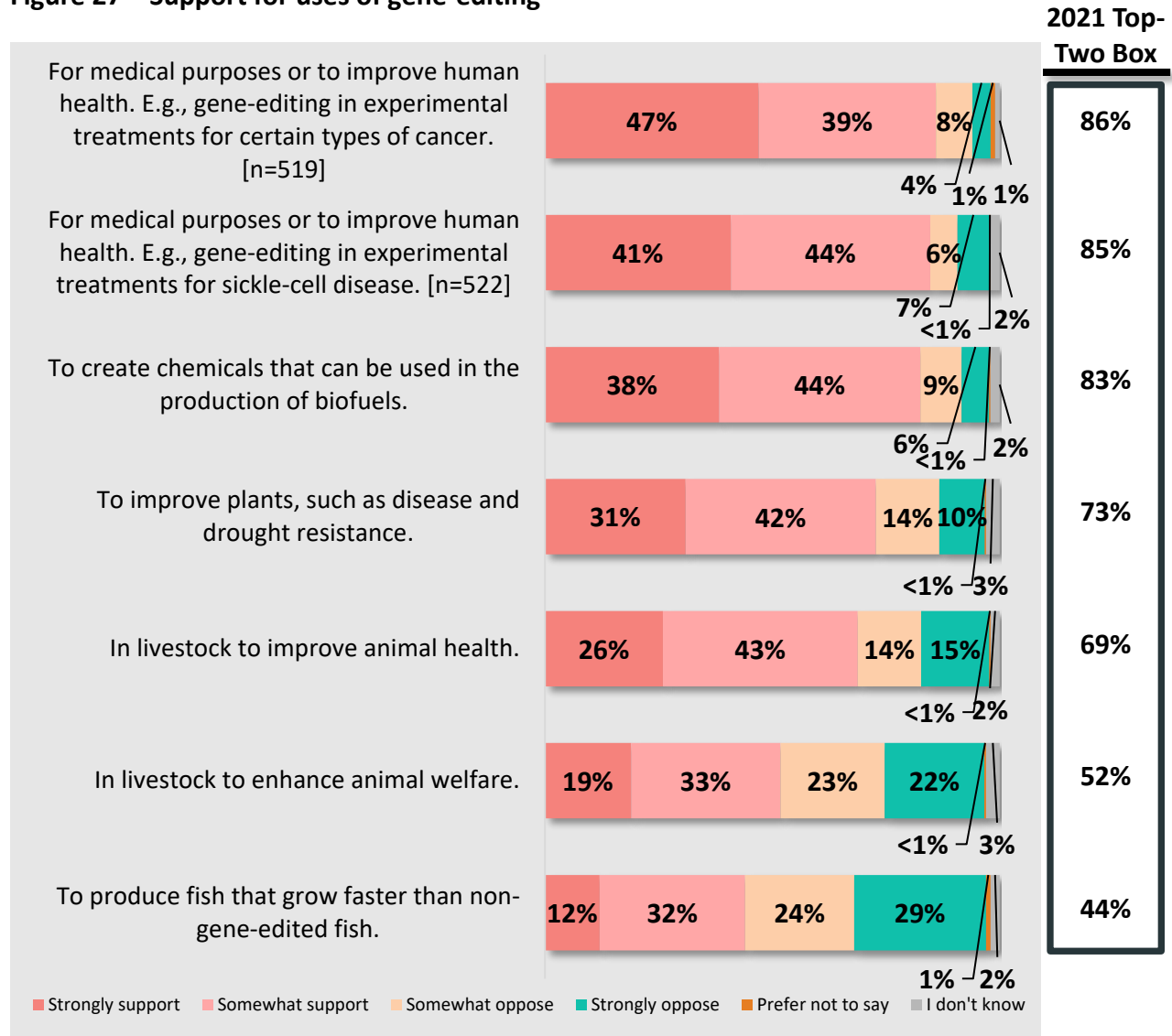
The greatest level of support was for the use of gene-editing in medical or human health improvements, with nearly nine in ten respondents supporting experimental treatments for certain types of cancer (86%) or sickle cell disease (85%). Roughly one quarter (24%) of respondents are opposed to this idea.

Support was similar for using gene-editing to create chemicals for use in the production of biofuels (83%), a concept which was also supported by a majority in the 2016 wave (85%).

Support begins to drop, with an equivalent increase in opposition, when plants and animals are involved. In the first instance, support stands at 73% for improving plants, such as improving their resistance to disease and drought. Support drops further when it comes to using gene-editing to improve animal health (for example, genetically modifying cattle to decrease their chances of getting certain diseases, like tuberculosis) or improve animal welfare (for example, the use of gene-editing to create cattle that are born without horns and therefore do not need to undergo dehorning). In these instances, respondents did make a distinction between the two uses, with stronger support being expressed for improving animal health (69%) compared to improving animal welfare (52%).

Support was lowest for the use of gene-editing that involved producing fish that grow faster than fish that have not been genetically altered. The survey clearly explained that the use of gene-editing could potentially reduce the cost of production and costs of fish to consumers. Despite this, using gene-editing on fish was the only option in the survey where opposition outweighed support (53% versus 44%).

Figure 27 – Support for uses of gene-editing



GE2. Please indicate if you strongly support, somewhat support, somewhat oppose or strongly oppose the following ways in which gene-editing can be used. Base: Telephone respondents, n=1033. Note: two items were randomly selected and presented to half of the sample – the specific sample size is shown in brackets next to those items

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

Canadians living in Atlantic Canada, British Columbia, Ontario, Quebec and Alberta were more likely to “strongly support” or “somewhat support” creating chemicals that can be used for the production of biofuels compared to those living in Manitoba or Saskatchewan (87%, 84%, 83%, 83%, 82% versus 71%).

Men were more likely to “strongly support” or “somewhat support” producing fish that grow faster compared to women (50% versus 39%).

Respondents aged 18 to 34 were more likely to “strongly support” or “somewhat support” almost all of the presented uses of gene-editing compared to those aged 35 to 54 years and 55 and older,

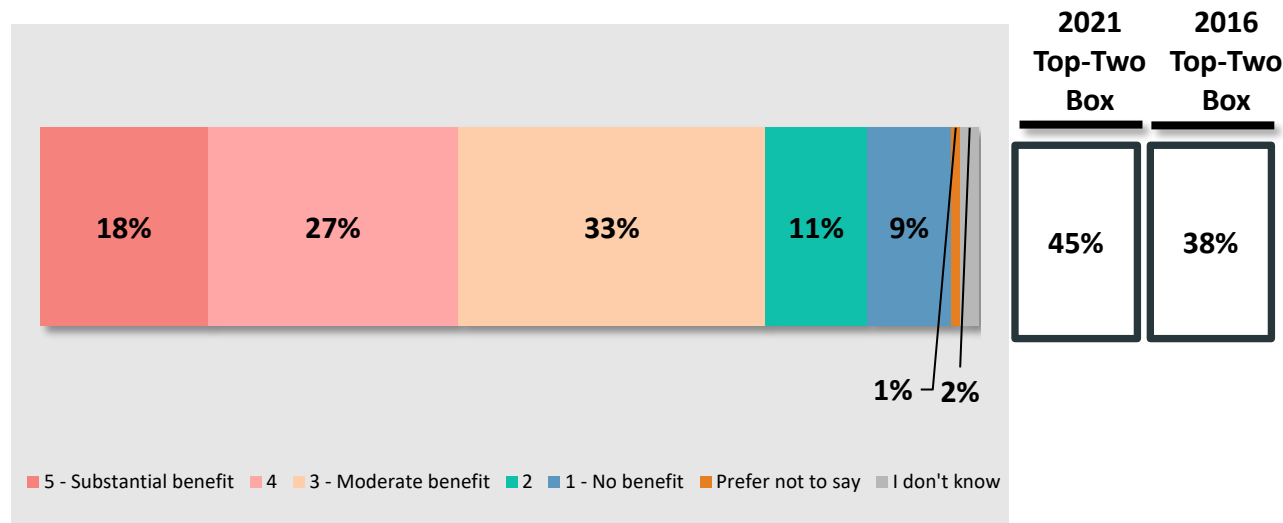
including to create chemicals that can be used in the production of biofuels (90% versus 79%, 81%), to improve plants, such as disease and drought resistance (81% versus 70%, 72%), in livestock to improve animal health (81% versus 63%, 68%), in livestock to enhance animal welfare (68% versus 46%, 50%), and to produce fish that grow faster than non gene-edited fish (55% versus 41%, 41%).

Respondents with a high school education were more likely to “strongly support” or “somewhat support” the use of gene-editing in livestock to enhance animal welfare compared to those with a college or university education (75% versus 66%, 68%).

Perceptions of gene-editing benefiting society

Respondents were then asked how much they think gene-editing benefits society. Results reveal nearly half (45%) of respondents believe gene-editing offers either a strong or a substantial benefit to society by giving a rating of either “4” or “5” on a 5-point scale (where a score of “5” represents “substantial benefit” and a rating of “1” represents “no benefit”). This represents a slight (although not a statistically significant) increase compared to what was observed in 2016, where 38% of respondents gave a similar rating. Among remaining respondents, one third (33%) feel gene-editing offers a “moderate benefit” to society (rating of “3”) and 20% believe it offers nearly no benefit (11%) or “no benefit” (9%).

Figure 28 – Perceptions of gene-editing benefiting society



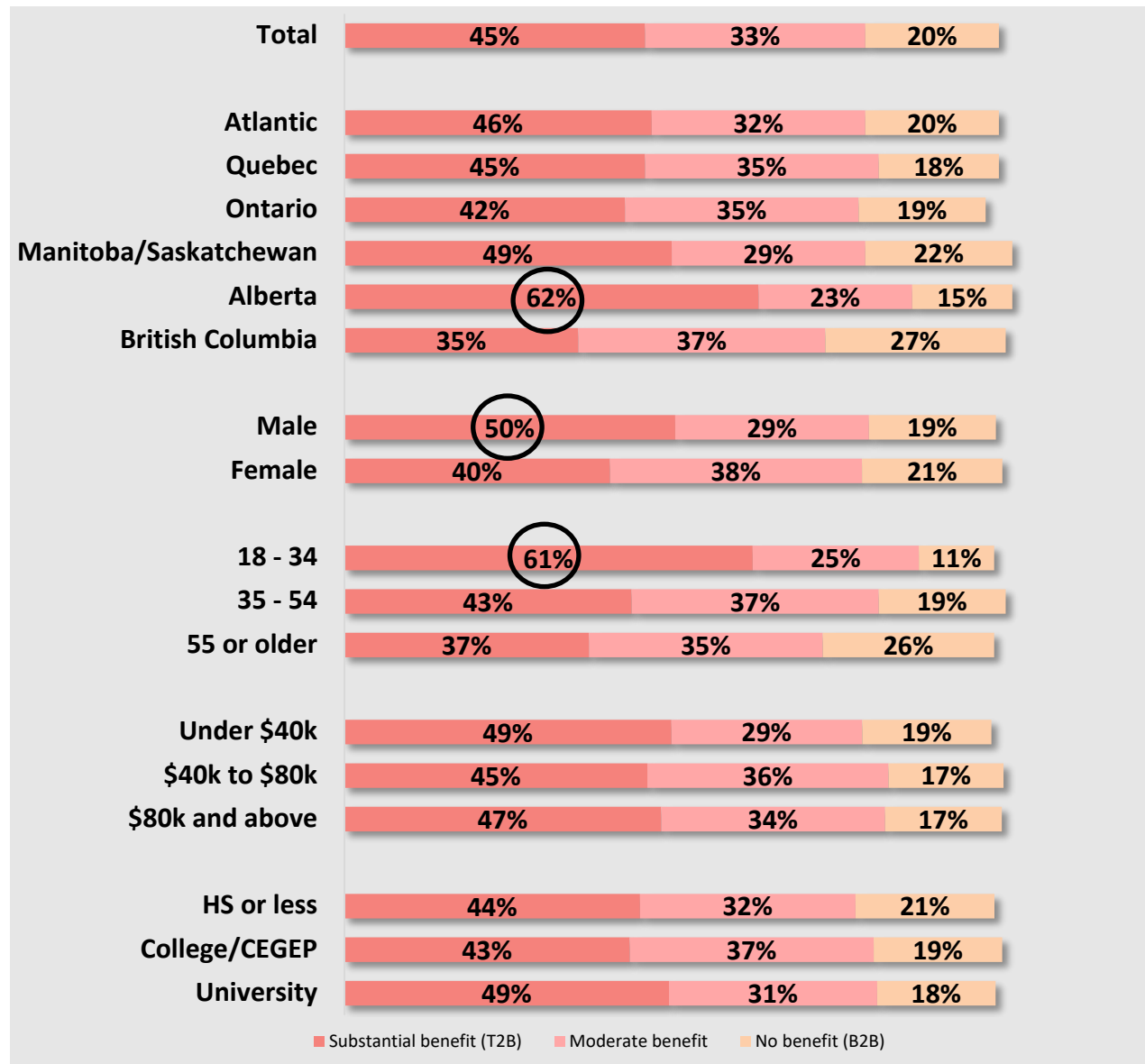
GE3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think gene-editing is to society? Base: Telephone respondents, n=1033.
 Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial benefit” or “4”.

Canadians living in Alberta (62%) were more likely to see a benefit in gene-editing (by giving a score of “5 – substantial benefit” or “4”) compared to those living in Manitoba or Saskatchewan (49%), Atlantic Canada (46%), Quebec (45%), Ontario (42%), or British Columbia (35%).

Men were more likely to believe gene-editing benefits society compared to women (50% versus 40%).

Respondents aged 18 to 34 were more likely to believe gene-editing benefits society compared to those aged 35 to 54 or those 55 years of age or older (61% versus 43%, 37%).

Figure 29 – Perceptions of gene-editing benefiting society – by region, gender, age, income, and education



GE3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think gene-editing is to society? Base: Telephone respondents, n=1033.

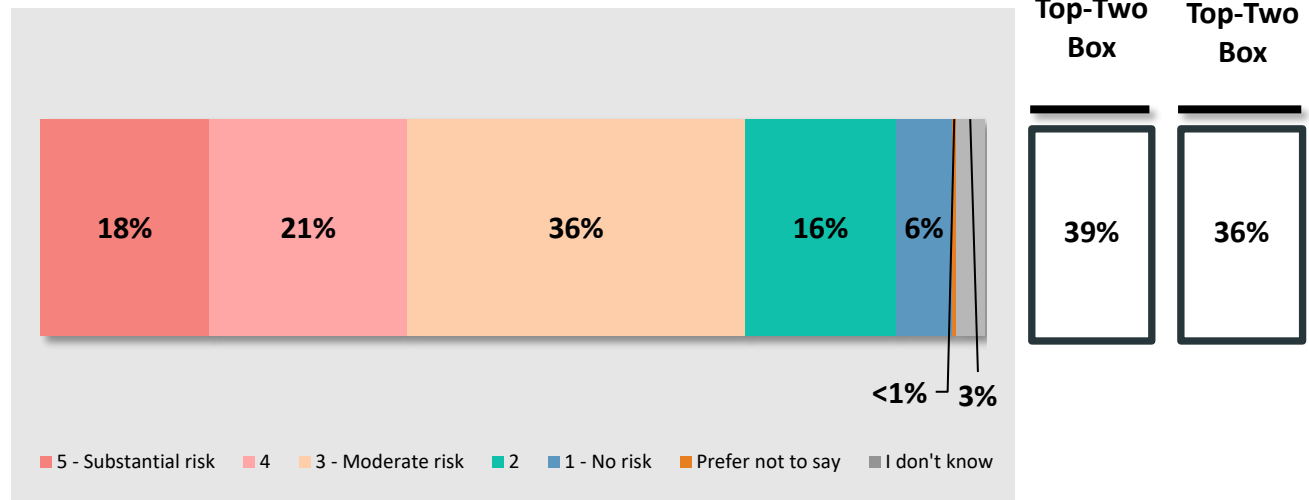
T2B refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial benefit” or “4”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “2” or “1 – no benefit”.

Perceptions of gene-editing posing a risk for society

Results from this research show that although the majority of respondents believe gene-editing offers at least moderate benefits to society, the majority of respondents also believe it poses at least a moderate risk to society (75%). More specifically, nearly two in five Canadians (39%) scored the level of risk as “5 – substantial risk” or “4” (similar to results seen in the previous wave) and another 36% believe gene-editing poses a “moderate risk” (a rating of “3”).

Figure 30 – Perceptions of gene-editing posing a risk for society

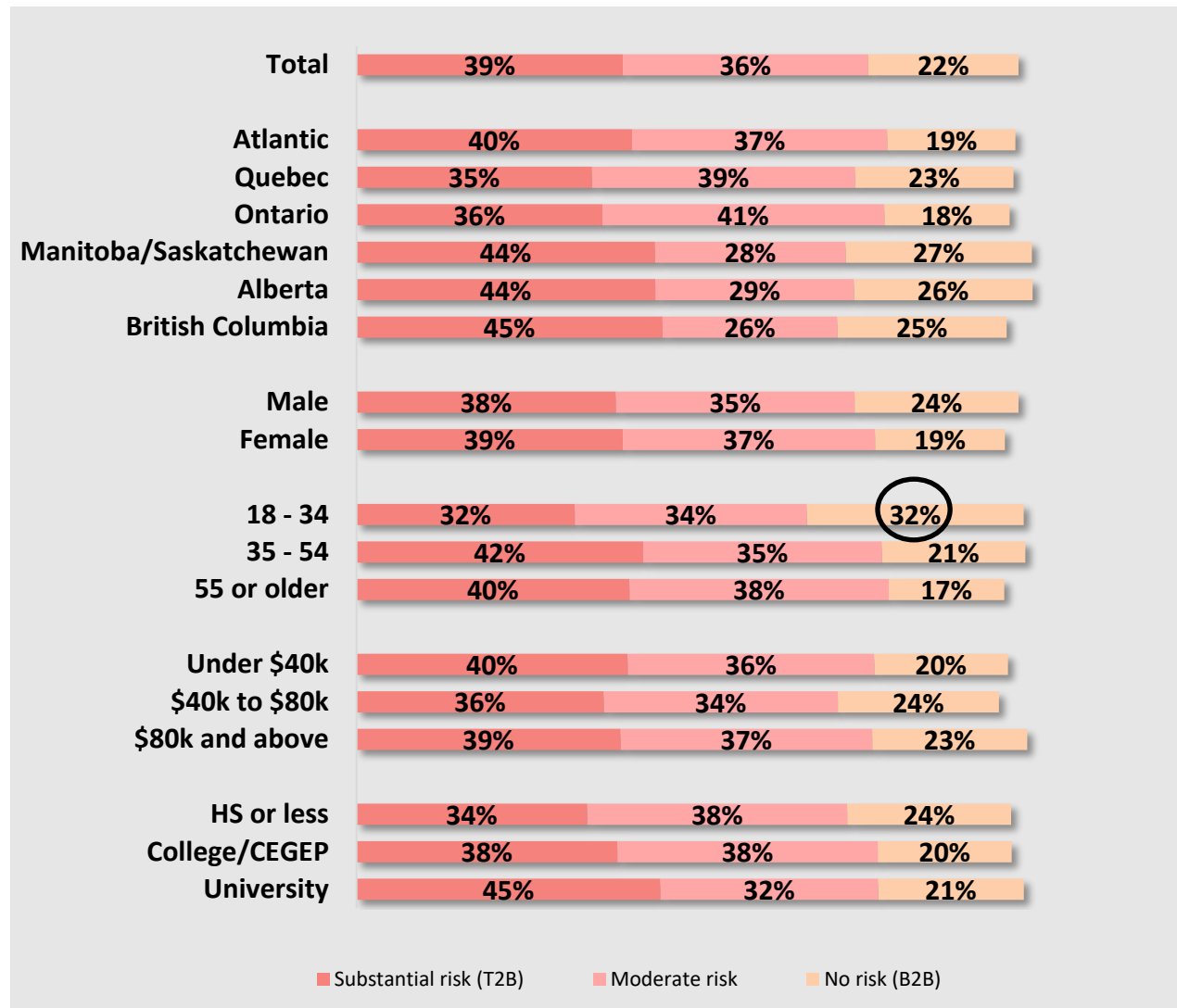


GE4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does gene-editing pose for society? Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial risk” or “4”.

Respondents aged 18 to 34 were more likely to see little to no risk in gene-editing compared to those aged 35 to 54 and those 55 years of age or older (32% versus 21%, 17%).

Figure 31 – Perceptions of gene-editing posing a risk for society – by region, gender, age, income, and education



GE4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does gene-editing pose for society? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial risk” or “4”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “2” or “1 – no risk”.

D. Cellular agriculture

A new module that explored familiarity with and perceptions of cellular agriculture was added in 2021 (this concept was not touched on in prior survey waves). Respondents were presented with the following explanation of cellular agriculture:

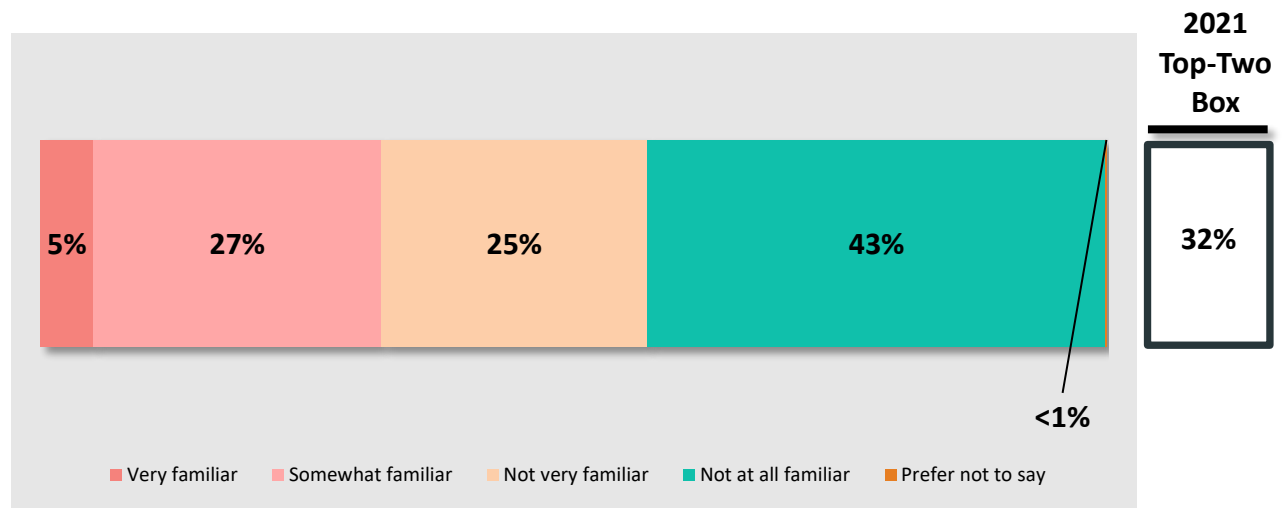
We now have a few questions on cellular agriculture. Cellular agriculture involves making animal products such as meat, seafood, dairy, or leather from animal cell cultures instead of using live animals. By taking cells from an animal and growing them with nutrients, we can obtain products such as meat, leather and milk. Cellular agriculture also includes inserting DNA from an animal into a microorganism like yeast or fungi to make food ingredients like egg or milk protein.

Familiarity with cellular agriculture

When asked to describe their level of familiarity with cellular agriculture, roughly one in three (32%) Canadians were “very familiar” or “somewhat familiar”, while 43% indicated they were “not at all familiar” with this concept.

Compared to familiarity levels observed for gene-editing (40%), biotechnology (52%) and biofuels (57%), this represents the agricultural technology with the lowest level of familiarity.

Figure 32 – Familiarity with cellular agriculture



CA1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with cellular agriculture? Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

Canadians in Manitoba or Saskatchewan were more likely to be “very familiar” or “somewhat familiar” compared to those living in Quebec (46% versus 20%).

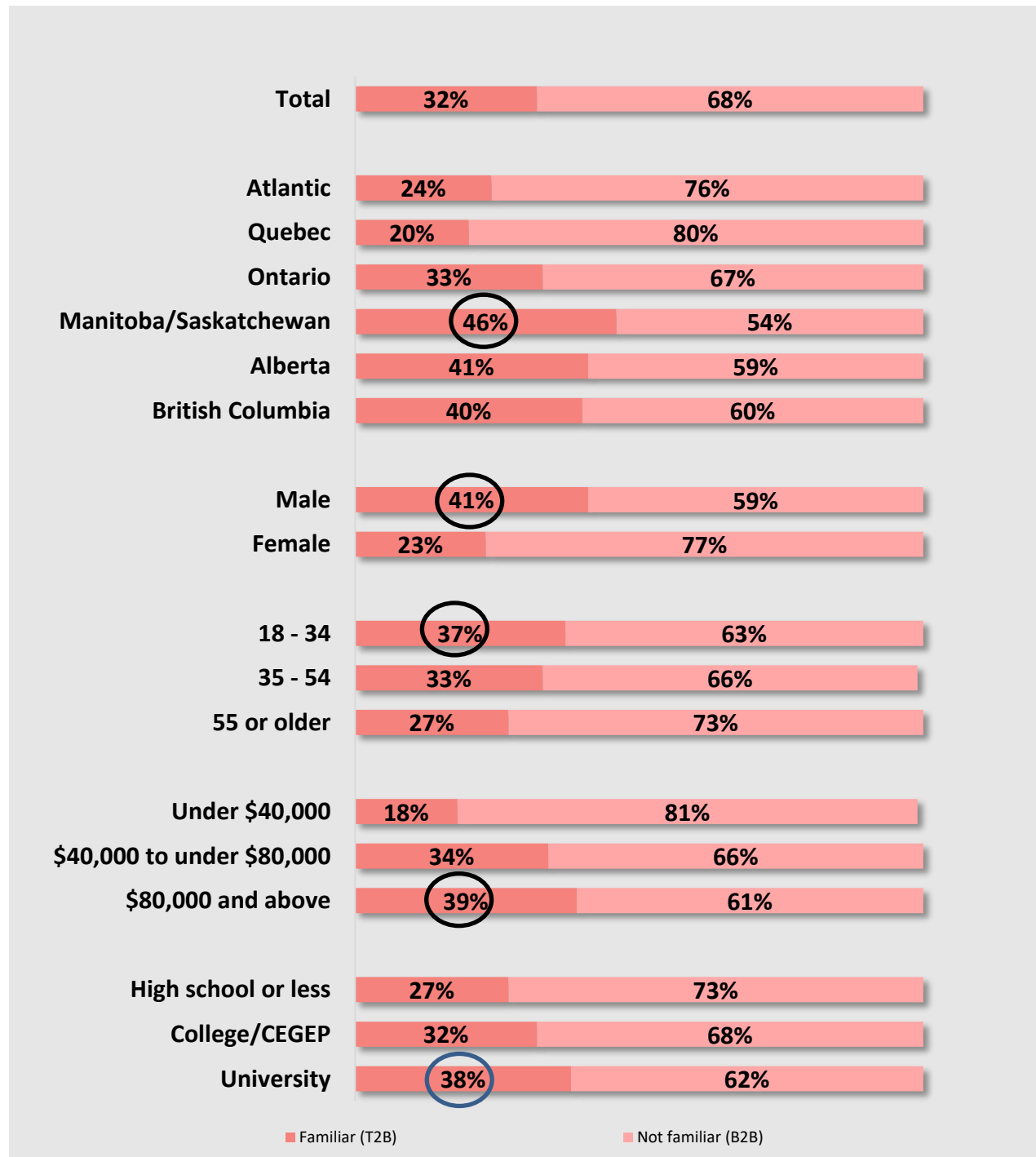
Men were more likely to report being “very familiar” or “somewhat familiar” compared to women (41% versus 23%).

Respondents 55 years of age or older were less likely to report being “very familiar” or “somewhat familiar” compared to those in the two younger age cohorts (27% versus 33%, 37%).

As income increases, familiarity with cellular agriculture increases. Respondents in households with annual incomes of \$80,000 or more were more likely to be “very familiar” or “somewhat familiar” compared to those in households earning less than \$40,000 (39% versus 18%).

Similarly, as education increases, familiarity scores increase. Those with a university education were more likely to be “very familiar” or “somewhat familiar” compared to those with a college or high school education (38% versus 32%, 27%).

Figure 33 – Familiarity with cellular agriculture – by region, gender, age, income, and education



CA1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with cellular agriculture? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

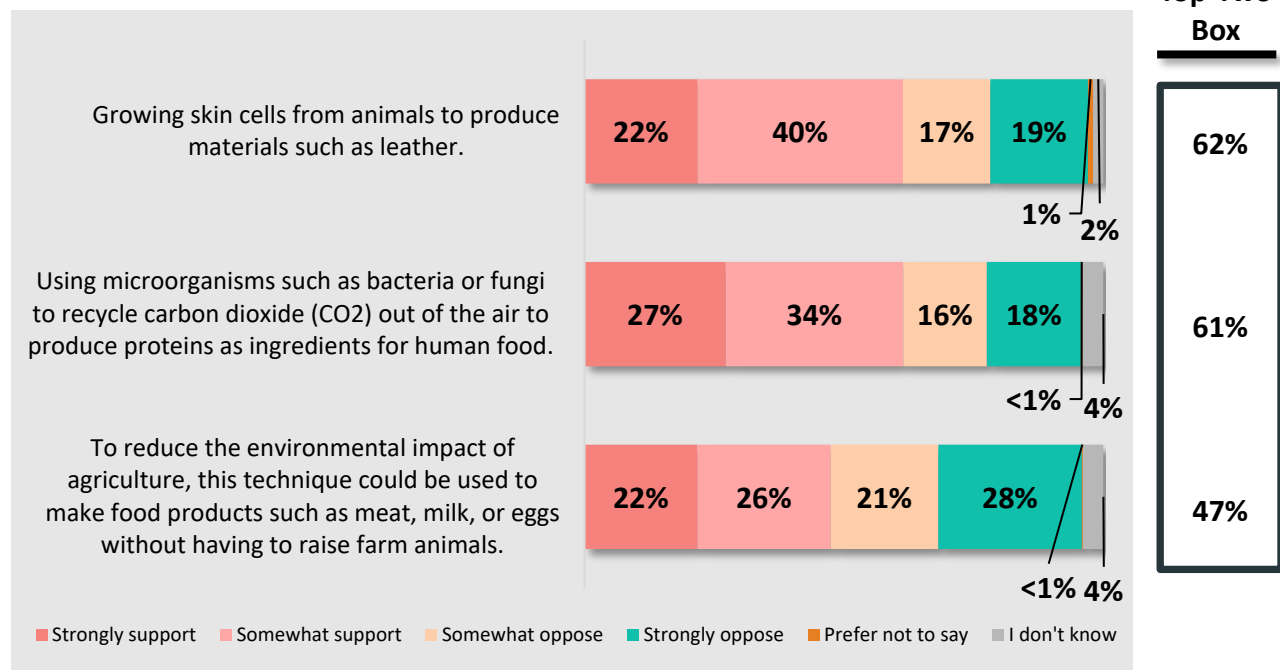
B2B refers to the combination of the 2 lowest scores, in this case, those who selected “not very familiar” or “not at all familiar”.

Support for uses of cellular agriculture

Respondents were then asked to indicate how much they support or oppose various potential applications of cellular agriculture. Similar to what was observed with gene-editing, results show despite low levels of overall familiarity, there are moderate levels of support for the three specific applications explored in this study.

Roughly two in three respondents (62%) “strongly support” (22%) or “somewhat support” (40%) growing skin cells from animals to produce materials such as leather. Fairly similar levels of support were expressed for using microorganisms, such as bacteria or fungi, to recycle carbon dioxide out of the air to produce proteins as ingredients for human food (61% overall support, and 27% strong support). Using cellular agriculture to make food products such as meat, milk, or eggs without having to raise farm animals has similar levels of support (47%) and opposition (49%).

Figure 34 – Support for uses of cellular agriculture



CA2. Do you strongly support, somewhat support, somewhat oppose, or strongly oppose the following ways cellular agriculture can be used?

Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

Respondents in British Columbia were the most likely to support all proposed applications of cellular agriculture, primarily growing skin cells from animals to produce materials (72%) and using microorganisms to produce proteins (71%), while over half supported making food products (55%).

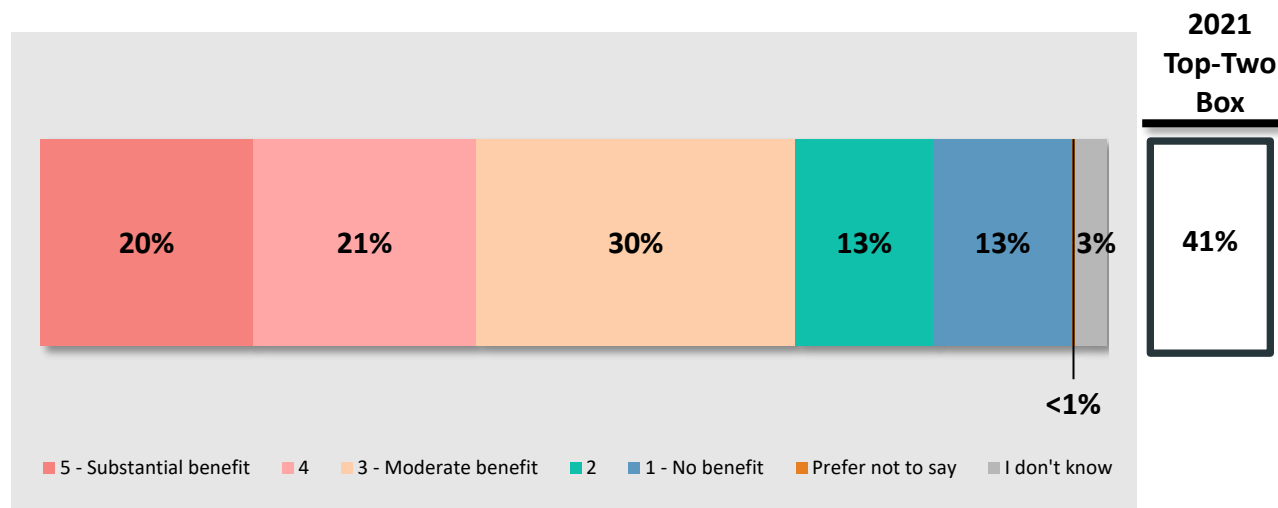
Men and respondents aged 18-34 were more likely to support all applications of cellular agriculture compared to other genders or age groups.

Similarly, respondents from households earning an annual income of \$80,000 or more as well as respondents with a university education were more likely to support all proposed applications of cellular agriculture compared to those earning less than \$40,000 and those with a college or high school education.

Perceptions of cellular agriculture benefiting society

Respondents were then asked how much cellular agriculture benefits society. Results reveal that 41% believe it offers either a strong or substantial benefit to society by giving a rating of either “4” or “5” on a “5-point scale” (where a score of “5” represents “substantial benefit” and a rating of “1” represents “no benefit”). Among remaining respondents, nearly one third (30%) feel cellular agriculture offers a “moderate benefit” to society (rating of “3”) and 26% believe it offers nearly no benefit (rated a “2”) or “no benefit”.

Figure 35 – Perceptions of cellular agriculture benefiting society



CA3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think cellular agriculture is to society? Base: Telephone respondents, n=1033.

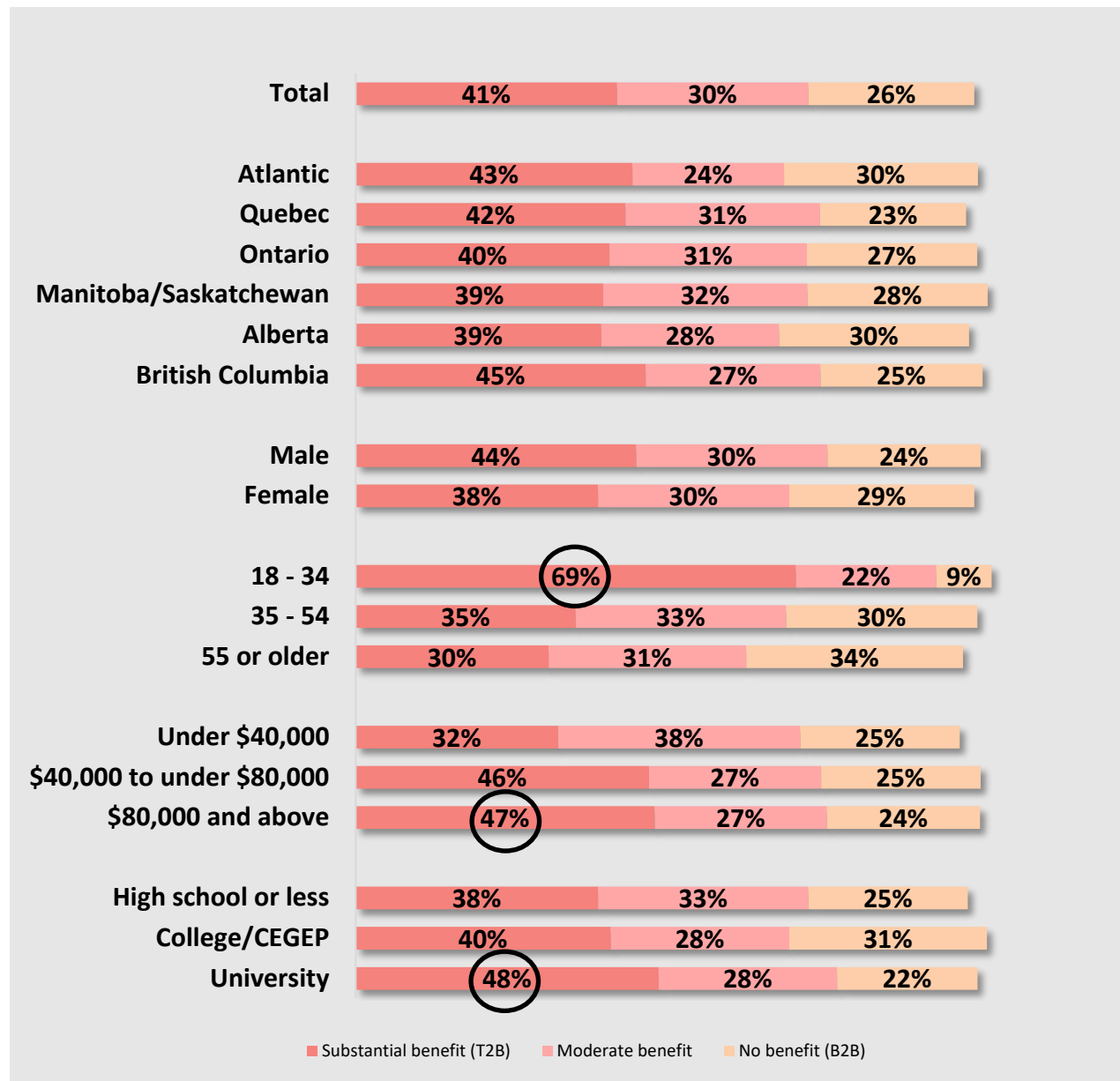
Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial benefit” or “4”.

Respondents aged 18 to 34 were more likely to see a benefit in cellular agriculture compared to those 35 to 54 years and those 55 years of age or older (69% versus 35%, 30%).

Respondents from households with an annual income of \$80,000 and above were more likely to see a benefit compared to those earning under \$40,000 (47% versus 32%).

Similarly, those with a university education were more likely to see a benefit compared to those with a high school education (48% versus 38%).

Figure 36 – Perceptions of cellular agriculture benefiting society – by region, gender, age, income, and education



CA3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think cellular agriculture is to society? Base: Telephone respondents, n=1033.

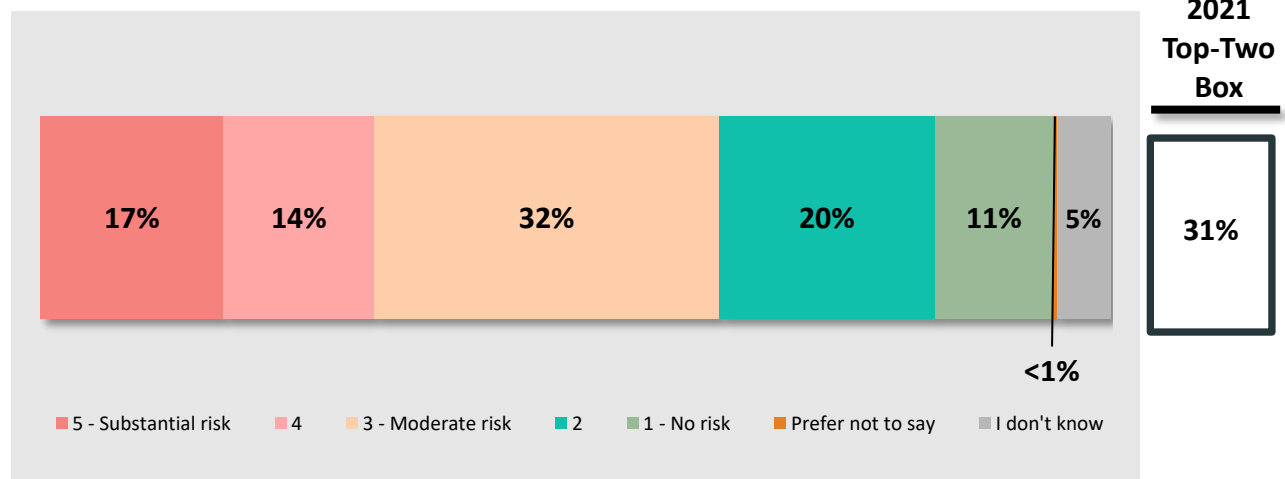
T2B refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial benefit” or “4”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “2” or “1 – no benefit”.

Perceptions of cellular agriculture posing a risk for society

Similar to the trend observed for gene-editing, results from this research show that although the majority of respondents believe cellular agriculture offers at least moderate benefits to society, the majority of respondents also believe it poses at least a moderate risk to society. More specifically, 31% scored the level of risk as “5 – substantial risk” or “4” and another 32% believe cellular agriculture poses a “moderate risk” (a rating of “3”). A very similar proportion (31%) believe it poses little to no risk.

Figure 37 – Perceptions of cellular agriculture posing a risk for society



CA4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does cellular agriculture pose for society? Base: Telephone respondents, n=1033.

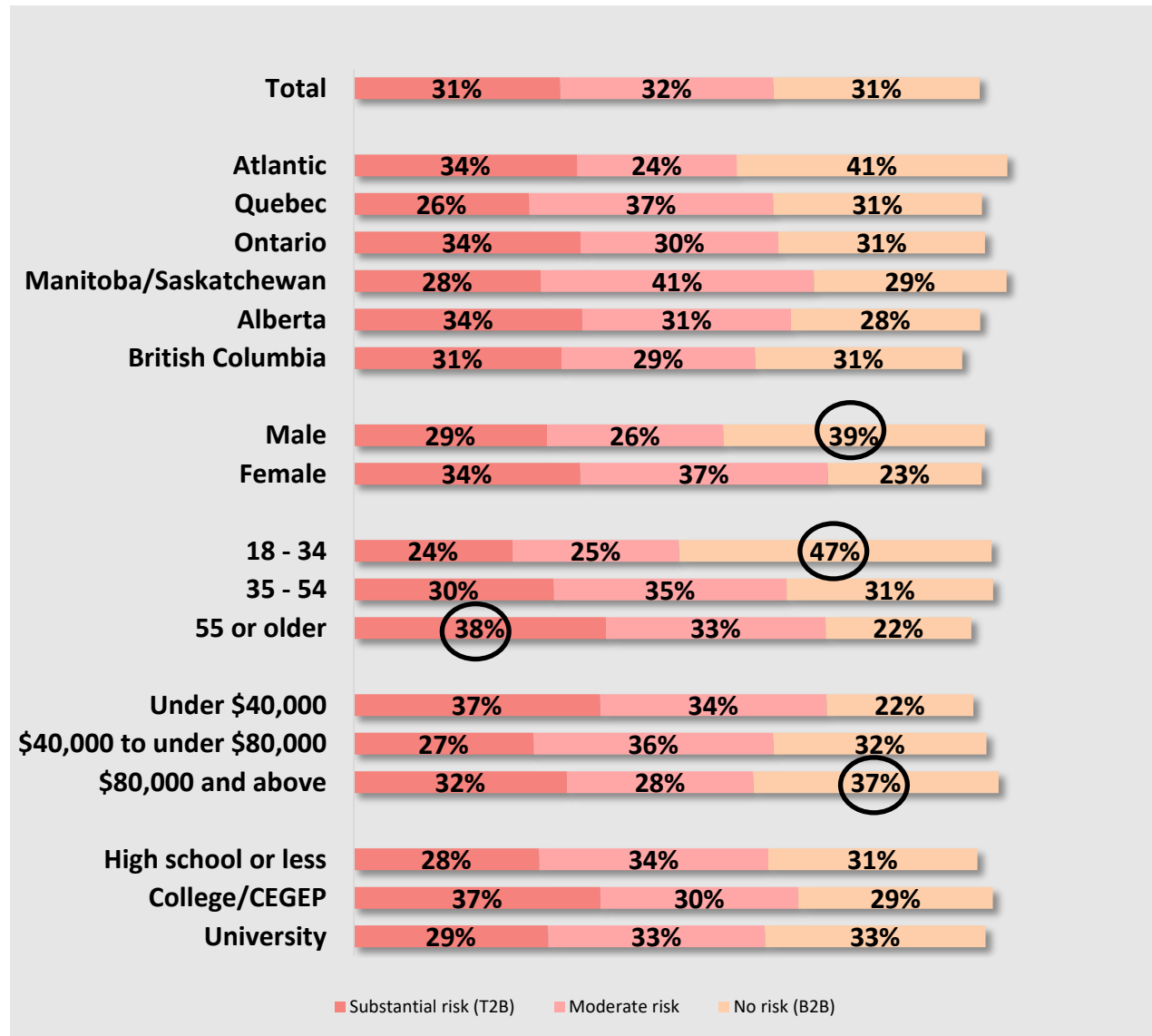
Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial risk” or “4”.

Men were more likely to see little to no risk compared to women (39% versus 23%).

Perceptions of risk increased as age increases, with respondents aged 55 or older more likely to see a risk compared to those 35 to 54 years and those 18 to 34 years old (38% versus 30%, 24%).

Canadians from households earning less than \$40,000 were more likely to see a substantial risk compared to those from households earning \$40,000 or more (25% versus 14%).

Figure 38 – Perceptions of cellular agriculture posing a risk for society – by region, gender, age, income and education



CA4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does cellular agriculture pose for society? Base: Telephone respondents, n=1033.

T2B refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial risk” or “4”.

B2B refers to the combination of the 2 lowest scores, in this case, those who selected “2” or “1 – no risk”.

Attitudes related to cellular agriculture

To conclude the module on cellular agriculture, respondents were asked to state their level of agreement with various statements on nutrition, regulation and potential impact of cellular agriculture.

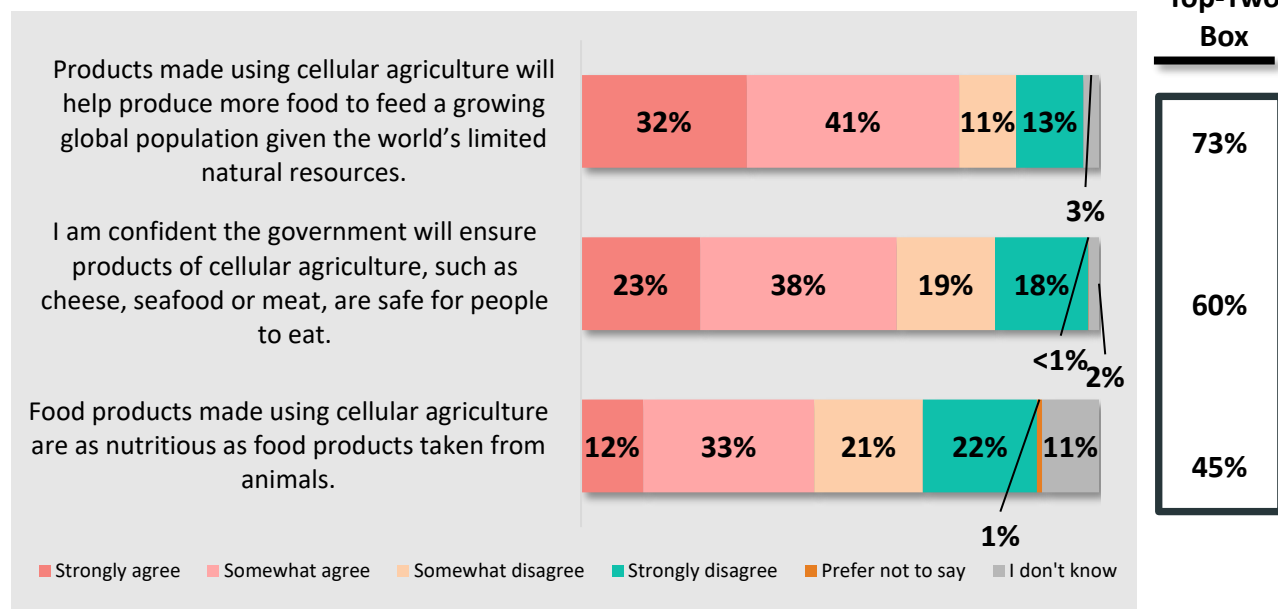
Results reveal that nearly three quarters (73%) of respondents believe products made using cellular agriculture will help produce more food to feed a growing global population given the world’s limited natural resources. Furthermore, 60% are confident the government will ensure products of cellular agriculture, such as cheese, seafood or meat, are safe for people to eat. Although the majority agree with this sentiment, 19% somewhat disagree and 18% strongly disagree. Finally, a minority of respondents (45%) agree that food products made using cellular agriculture are as nutritious as food products taken from animals. For this particular statement, there are nearly twice as many who “strongly disagree” (22%) than there are who “strongly agree” (12%).

Respondents aged 18 to 34 were most likely to agree with all three statements compared to respondents in other age groups.

As well, men were more likely than women to agree that food products made using cellular agriculture are as nutritious as products taken from animals (51% versus 39%).

Respondents in Quebec and those earning a household income of \$80,000 or more were most likely to be confident that the government will ensure the safety of food products. Conversely, respondents in Ontario were the most likely to disagree that food products made using cellular agriculture are as nutritious as products taken from animals (50%).

Figure 39 – Attitudes related to cellular agriculture



CA5. Do you strongly agree, somewhat agree, somewhat disagree or strongly disagree with the following statements regarding cellular agriculture? Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly agree” or “somewhat agree”.

E. Underlying attitudes towards agricultural technologies

As a final exercise, respondents were presented with a list of statements covering a range of attitudes and opinions towards agricultural technologies that have been tracked from previous waves of the research.

A few statements were designed to understand where respondents see Canada on the global stage and as a leader in the field of agriculture and food biotechnology research. Nearly all respondents (90%) believe Canada should be among the world's leaders in this area, with the majority of respondents (55%) strongly agreeing with this sentiment. This strong overall level of support is similar to what was observed in 2016 (88%). Although most would like to see Canada among the world's leaders, a significantly lower proportion believe Canada is in fact among the world's leaders. More specifically, 72% agree Canada is a world leader, with 21% strongly agreeing. Again, the results are very similar to what was observed in 2016 (69%).

Respondents continue to demonstrate an awareness of the risk these technologies may pose but are accepting of the inevitability of their future use. Nearly nine in ten (88%) respondents "strongly agree" or "somewhat agree" that all we can do is ensure the uses of technologies like biotechnology are as safe as possible. This result is consistent with 83% observed in 2016.

There was a noteworthy increase in agreement that these technologies are going to be developed somewhere in the world, so it is better they are developed in Canada than somewhere else. Subsequently, 85% agree with this sentiment in 2021 compared to 76% in 2016. Consistent with this logic, the results show three in ten (30%) respondents "strongly agree" or "somewhat agree" that they would rather these technologies be developed elsewhere.

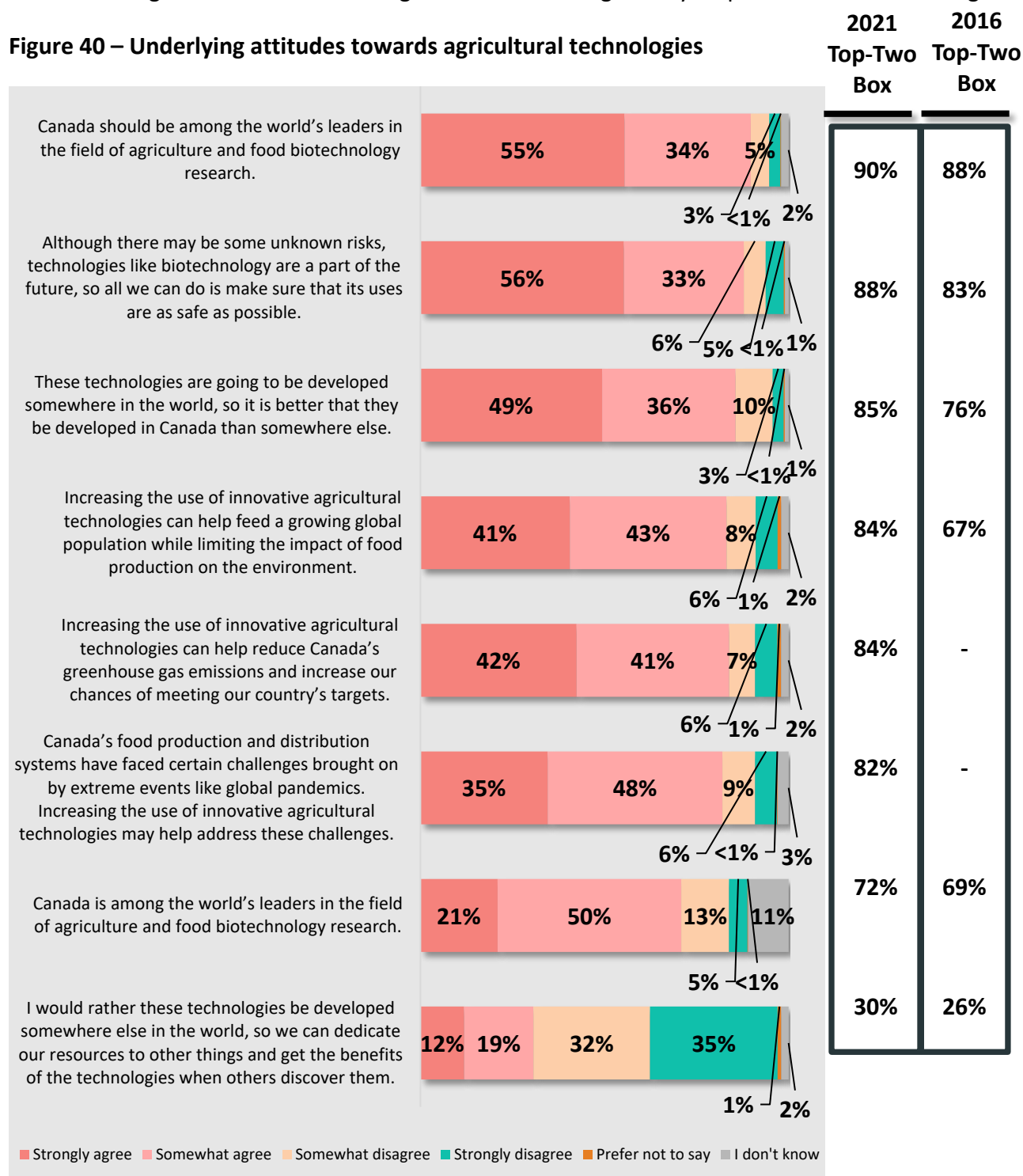
The survey explored how much respondents believe agricultural technologies could play a role in achieving certain goals, such as, feeding a growing global population, helping the environment and mitigating certain challenges brought on by extreme events like global pandemics.

Firstly, 84% agree overall, and 41% strongly agree that increasing the use of innovative agricultural technologies can help feed a growing global population while limiting the impact of food production on the environment. This result represents a significant increase in agreement compared to what was observed in 2016 (67%).

A similar proportion (84%) agree that increasing the use of innovative agricultural technologies can help reduce Canada's greenhouse gas emissions and increase our chances of meeting our country's targets.

Finally, 82% agree overall, and 35% strongly agree, that Canada’s food production and distribution systems have faced certain challenges brought on by extreme events like global pandemics and that increasing the use of innovative agricultural technologies may help address these challenges.

Figure 40 – Underlying attitudes towards agricultural technologies



UA1. Please indicate whether you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with each of the following statements: Base: Telephone respondents, n=1033.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly agree” or “somewhat agree”.

Respondents from Alberta were the most likely to agree that these technologies are going to be developed somewhere in the world, so it is better they are developed in Canada (95%).

Those living in British Columbia were the most likely to agree that these technologies could help feed a growing global population while limiting the impact on the environment (91%).

Men were more likely to agree that increasing the use of innovative agricultural technologies may help address certain challenges brought on by extreme events like global pandemics compared to women (86% versus 79%).

Respondents aged 18 to 34 were more likely to agree with several statements compared to those aged 35 to 54 years and those 55 years of age or older. Primarily, that these technologies could help address certain challenges brought on by extreme events like global pandemics (92% versus 78%, 81%), could help feed a growing global population while limiting the impact on the environment (90% versus 80%, 84%), and could help reduce Canada's greenhouse gas emissions increasing our chances of meeting targets (90% versus 83%, 81%).

Those aged 55 years of age or older were more likely to agree that these technologies should be developed somewhere else in the world compared to those in the two younger age cohorts (36% versus 29%, 24%).

Focus group findings

The following is a summary of findings from 10 online focus groups conducted with a total of 73 adult Canadians from across the country. The topics mostly aligned with those examined in the survey.

A. Biotechnology

Among focus group participants, many were aware of the term “biotechnology.” For the most part, however, this awareness was quite general, and familiarity was not very deep or detailed.

Often what came to mind for participants were general terms like “biology and technology together”, “environmentally friendly,” “GMOs” or “genetic modification,” “organic products,” or “improving plants and crops.” Some participants also mentioned they believed that assistive medical equipment or biodegradable items fell into the biotechnology category. Some provided more detailed examples, such as the modification of plants and crops specifically to make them climate, weather, draught, disease or pest-resistant, or biofuels and cars running on canola.

Once initial familiarity was explored, participants were provided the following description of biotechnology:

Biotechnology is used in many areas, such as health, natural resources, manufacturing and agriculture. Biotechnology involves engineering living organisms, such as plants and animals, or parts of living organisms to produce useful products, such as, medicines or creating plants that are not affected by pests or insects.

Based on what participants knew about biotechnology and on this description, support towards using biotechnology to create products was high. Few participants were opposed to biotechnology in general. Rather, those who were not generally supportive often said they were neutral or not sure about it because they did not feel familiar enough with biotechnology, or they held mixed views on biotechnology, mostly because they had some questions or concerns about certain aspects of it. This is in line with the survey findings, which showed that close to 90% of respondents either held positive or neutral views.

Those who supported the use of biotechnology would often point to health care applications, improving crop productivity and environmental considerations. In the health care area, vaccine development was mentioned. From a productivity and environmental perspective, fighting climate change, being able to feed a changing world with a growing population, fewer people farming, and less farmable land were also considerations that translated into support. Moreover, there was some sense that “we have been doing this for centuries,” with participants pointing to

selective breeding and crossbreeding of everyday foods (maize/corn, bananas, tomatoes, certain types of apples), proving to them that this is something familiar and safe.

As was seen from the survey data, when it comes to biotechnology in general and the various applications discussed, younger participants tended to have more positive views than those in the older cohorts. They were often more likely to focus on possible benefits for the future and more optimistic that biotechnology could contribute to a better future for people and the planet.

Those who had some concerns would often point to ethical questions about changing or hindering nature (“What if we ‘cross the line’?”). There was also uncertainty about outcomes, with questions raised about how biotechnology would affect the natural balance and biodiversity, or about long-term effects on humans, animals and the environment. Some also wondered about costs and affordability. A few were concerned about patents and the biotechnology industry not behaving in the best interest of Canadians.

“It needs to be good for humans.” Participant, 35+

“There’s a fine line if it changes nature too much.” Participant, 18-34

B. Biofuels

Focus group discussions on the topic of biofuels revealed quite a high level of awareness, with some familiarity. In general, it was known as a renewable source of energy and as plants being used for fuel. Specifically, in each group, at least one if not a few participants had heard of collecting and reusing restaurant grease for fuel for vehicles or about using canola for fuels such as ethanol.

“I’ve seen diesel trucks going to restaurants to collect grease that they use for fuel.” Participant, 35+

Once initial familiarity was explored, participants were provided the following description of biofuels:

Biofuels use biological materials such as plants, wood and waste to produce fuels that can be used for cars, trains, airplanes, or to heat and power buildings.

Most participants see biofuels as beneficial. When discussing the benefits, many pointed out its environmental benefits, for example saying biofuels used renewable resources instead of finite fossil fuels and that manufacturing it caused less environmental harm. Some also thought biofuels burn cleaner than fossil fuels. The idea of waste diversion or recycling, in the case of fryer grease, was also seen as a benefit. Taken altogether, there was a sense that the use of biofuels is a credible strategy to help lower greenhouse gas emissions.

“It’s good to redirect from landfills.” Participant, 35+

When discussing the pros and cons of biofuels, often participants explained that the overall benefit of biofuels depended on a handful of factors. For instance, some felt the feasibility of biofuels depended on how many and which resources or energy sources are used to convert crops to biofuel – for these participants, there was a concern about whether the environmental cost of producing biofuels offset or outweighed the environmental benefits of using biofuels. Some also felt its feasibility depended on where and how the crops were grown, with some options being more likely to be supported than others. For instance, there were concerns raised regarding using consumable crops for fuel, clearing land and deforestation, and using wood that could otherwise be used for other purposes. That said, most of these concerns were hypothetical – none of the participants had seen, read or heard anything that would suggest that their concerns are based on experience or fact.

Participants were asked to react to the following five natural sources that can be used to make biofuels:

- a) Biofuels made from crops that are also a source of food – an example would be ethanol which can be made from corn or sugarcane
- b) Bioproducts made from crops that are normally not used as food (such as using hemp for clothing)
- c) Biofuels made from non-food crops grown on land that could also be used to produce food
- d) Biofuels made from non-food crops grown on land that is of such a poor quality it cannot be used to grow food
- e) Biofuels made from crop and agricultural waste that would otherwise be disposed of such as straw or husks

When discussing these options, as was seen from the survey results, many struggled with using crops and land that could otherwise be used as food, especially since there was a sense that there were other feasible ways to produce biofuels. There were also some concerns about the extent to which farmers would switch from growing consumable crops to crops used exclusively for biofuel purposes.

As such, the options that held the highest levels of support included: making biofuels from crops not normally used as food (such as hemp); using land that could not be used to produce food; and using crop and agricultural waste (such as straw or husks) which was seen as not just practicing smart recycling, but also having the added benefit of reducing waste and impact on landfills.

“There needs to be a balance...cutting forests isn’t good.” Participant, 35+

“Use plant waste instead...not just growing it for fuel.” Participant, 35+

While familiarity was similar across age groups and across the country, support for some of the options that were seen as “less than ideal” across the board tended to be higher in the Atlantic provinces and lower in the West and North.

A few participants did question the reuse of crop and agricultural waste for biofuel purposes – they were under the impression that crop growers and farmers were already making good use of those materials (for example, to fertilize) and as such, they would want to make sure the benefits of using those materials for biofuel outweighed the benefits associated with their current use.

C. Gene-editing

There was some awareness of and familiarity with gene-editing across the groups, with about half of participants being able to describe it to a certain extent, some more accurately than others. This is in line with the survey results, where four in ten (41%) said they were familiar with gene editing.

What came to mind when asked to describe what they knew included: GMOs, hybrid crops, CRISPR, a specific company, changing DNA, cloning, and medical applications.

“I know about CRISPR, it’s really fascinating.” Participant, 35+

In each group, it was also mentioned by a few that gene-editing was something that had been around for a long time and that many of the things we eat are the product of gene-editing. However, participants appeared to confuse gene-editing with other agricultural technologies through the examples they gave. The examples given that participants believed to be products that had somehow been genetically edited included seedless watermelons, orange carrots, types of apples, tomatoes with longer shelf life, strains of cannabis and hotter hot peppers.

Once initial familiarity was explored, participants were provided the following description of gene-editing:

Gene-editing involves making small changes to a cell’s gene structure and does not necessarily involve mixing together DNA from different species of plants or animals. Gene-editing is often used for medical and agricultural purposes.

Based on what they know of gene-editing and on this description, participants were asked whether the use of gene-editing would be something they would support or oppose. This exercise led to a mix of optimism, support, concern and hesitancy when it came to gene-editing.

Those who were optimistic and supportive felt this way for several reasons. Many felt this has been common practice for a long time and there have not been any negative effects but rather only positive outcomes such as “better” food that is more nutritious or has longer shelf life. As well, many were supportive of medical applications such as vaccines (mRNA) and fighting congenital diseases. Others pointed to fighting hunger, global food supply and food security, with gene-editing helping crops have higher yields, becoming more nutritious, being more resilient to pests and diseases, as well as able to adapt to our changing climate (for example, ability to grow on more arid land or under warmer circumstances).

“Our current vaccines use this so it’s good.” Participant, 35+

“Food with more nutrients is fighting malnourishment.” Participant, 35+

On the other hand, there were those who were either on the fence or hesitant about gene-editing or certain aspects of it, and a few participants were opposed under virtually all circumstances. One of the main concerns was the general sense that we were “messing with mother nature.”

“I don’t really know about it so I’m not too confident.” Participant, 35+

While gene-editing for medical purposes was most often seen as a reason for support, there were also those who were concerned that this would be used for the wrong reasons and to the wrong end, for example “selectively breeding” humans for certain traits (blue-eyed children) or certain perceived strengths. These examples raised ethical concerns. Some participants mentioned they had seen movies or documentaries about human or “health” applications that scared them or made them uncertain about gene-editing.

“I’ve heard about changing humans...like their hair colour or eye colour...where does this end?” Participant, 18-34

As well, there were some participants who felt gene-editing was all still quite new and the long-term effects on human health and on the environment (“natural balance”) were unknown.

Another concern raised by a few participants was the potential for industry to abuse this technology. They were concerned that businesses would only have their own best interests in mind instead of consumers’ interests or those using/exposed to their products and would end up endangering human health rather than helping people.

The following gene-editing uses were explored with participants:

- a) For medical purposes to improve human health (gene-editing in experimental treatments for cancer or sickle-cell disease)

- b) To improve animal health or welfare
- c) To improve plants, such as disease and drought resistance
- d) To help the food production system lessen its impact on the environment

Even though the term “experimental” left some participants somewhat uneasy, the use of gene-editing for medical purposes such as in experimental treatments for cancer or sickle-cell disease was widely supported. This finding is consistent with the survey findings where over four in five participants were supportive of using gene-editing to treat cancer (86%) or sickle-cell disease (85%).

“Anything for cancer, or health, or people in pain is good.” Participant, 35+

There was also broad support for using it to improve plants, such as for disease and drought resistance. This application was seen as beneficial for consumers, farmers and the agricultural industry because it could make products better and cheaper. The same positive attitudes were found when discussing gene-editing to help the food production system lessen its impact on the environment.

Improving animal health or welfare with gene-editing was also largely supported, although participants were more likely to have a few underlying concerns regarding this application. The main concern was that because of human consumption, there would be potential for negative effects on human health (such as being carcinogenic or causing new allergies). Concerns over the unknown long-term impact were raised in this context.

“Could it have long-term side effects for people who eat it?” Participant, 18-34

Some also said it may unbalance the natural food chain, or it could have negative effects on animal health. This was also seen in the survey, where the application of gene-editing to produce fish that grow faster, and which would potentially be eaten or become part of the natural food chain, received the lowest levels of support and highest levels of opposition among the specific gene-editing applications explored in the survey.

Across groups, most participants approve of the development of gene-editing if it is tightly controlled and regulated, meaning that more than the usual levels of government regulations and controls should be in place for participants to be comfortable and supportive.

D. Cellular Agriculture

As was seen in survey results, awareness of cellular agriculture trails far behind awareness of the other applications tested. In fact, awareness was nearly non-existent across all focus groups. To help participants better understand cellular agriculture, the following description was provided:

Cellular agriculture involves making animal products such as meat, seafood, dairy, or leather from animal cell cultures instead of using live animals. By taking cells from an animal and growing them with nutrients, we can obtain products such as meat, leather and milk. Cellular agriculture also includes inserting DNA from an animal into a microorganism like yeast or fungi to make food ingredients like egg or milk protein.

Providing an explanation and examples helped somewhat, but some participants still could not wrap their heads around the concept and the technology, leaving them with many questions. A few continued to confuse this with various plant-based “meat” products readily available in certain restaurants and in grocery stores. Participants were left uncertain, uncomfortable or opposed to the idea in general as the novelty and the many unknowns made them err on the side of caution. The potential benefits do not do much to shift this opinion. This is not an uncommon phenomenon with new or unknown foods or technologies in general.

“Theoretically this is awesome...but I’m not sure how it would work.” Participant, 18-34

The main areas of concern were often of a general sense, with participants for example saying: “it doesn’t sound right,” “it’s not natural,” or “my meat comes from an animal.” It raised many questions about unknown or potential risks, mainly surrounding the long-term impact on our bodies and human health, nutritional equivalence, cost for consumers, taste equivalence, and the impact on traditional industries in Canada (agriculture, farming and aquaculture).

“Is this something that creates more emissions?” Participant, 18-34

“I think it is a good idea...but I won’t eat it and I won’t give it to my children.” Participant, 35+

“Maybe if it’s sustainable...but it shouldn’t kill any industries.” Participant, 35+

“I’m worried about farmers.” Participant, 18-34

Some participants saw some potential benefits, including that meat produced using cellular agriculture might be healthier than eating animals raised in unethical ways or unsanitary environments, raised with antibiotics or containing contaminants (such as mercury in fish); it could help the global food supply, especially in countries that cannot easily access cattle or meat; it may

be manipulated to be more nutritional and contain fewer allergens than conventional meat; it would be good for the environment and help reduce greenhouse gas emissions as there is no need to raise cattle and no need to transport animals and meat; it would be good for restoration and rebalancing of ecosystems, particularly oceans where overfishing and resource depletion would be combated; and it would reduce reliance on having to kill animals for protein.

Participants were presented with the following ways in which cellular agriculture can be used:

- a. To reduce the environmental impact of agriculture, this technique could be used to make food products such as meat, milk, or eggs without having to raise farm animals
- b. To help preserve our aquatic ecosystems, this technique could be used to grow cellular versions of fish and seafood products
- c. Growing skin cells from animals to produce materials such as leather

Reflecting survey results, there was more enthusiasm for the idea of growing skin cells from animals to produce materials such as leather. The core reason for acceptance of this option was that it is not ingested and does not impact human health. It was often compared to the use of artificial leather for products – revealing once again that there is some misunderstanding about cellular agriculture and that it is not necessarily understood that the products would be genetically animal-based.

While positioning this technology as a way to protect the environment and aquatic ecosystems has some appeal, at the same time, others argued there are other or better ways of achieving that goal, however, they did not mention any specific alternatives.

“It is better for oceans; we could build up our stock. It is better than GMO fish that are released and mixed with regular ones.” Participant, 18-34

Participants also brought up that without more information, only stating the benefits was misleading and felt like information about potential risks was purposely omitted.

Ultimately, the general level of discomfort and the perceived risks outweighed potential benefits for the majority of participants, although there was more openness to seeing potential positive outcomes among participants from Atlantic Canada than from other areas of the country. In the end, however, there were significant concerns over whether these types of products would be as safe for consumption by humans or animals, and as nutritious as when they come directly from animals, which again echoes survey findings.

Assuming this type of food was available on store shelves one day, there was strong support for clear labelling, as everyone agreed they would want to know what they are eating. Generally, more information and transparency are welcomed and expected.

E. Summary

Participants were asked which of the three biotechnologies discussed they believed would be most advantageous or holds the most promise for them or for society.

Familiarity seems to increase comfort, with most believing **biofuels** hold the most promise in terms of benefiting them personally or “the world” moving forward. It is the technology that is most widely understood in terms of how it works and what the benefits and drawbacks are, making it less scary. Moreover, and most important to many, is that it is not something that people are eating. The environmental benefits and low level of drawbacks or risks, especially if the most-supported options in terms of how and where to grow the crop for biofuels and which crops will be used are prioritized, all served as key considerations.

“The crop-waste route is great!” Participant, 35+

“We aren’t ingesting this, it’s not food for animals or humans.” Participant, 35+

Gene-editing was the second most popular technology, especially in terms of medical applications and in the context of strict regulation. Again, there is some element of comfort drawn from the perception that this has been going on for decades.

“It is versatile...it has the most opportunities for the future.” Participant, 18-34

Although not very well understood, some participants also felt there was promise in **cellular agriculture** and would like more information on the topic. There was some appeal for its potential positive impacts on the environment and food security; however, participants would have to be convinced first that it was properly studied and there would be no long-term ill effects on human health and the environment.

“It’s three birds with one stone...helps climate change, food insecurity and the economy.”
Participant, 18-34

To summarize, questions that were asked about all technologies which influenced opinions and decisions about support or opposition were related to each application’s long-term effects on human health, on the environment, on industries and, to a lesser extent, on cost for consumers.

F. Regulations

As shown in the survey results, there is very limited understanding and awareness of any regulation governing biotechnology in Canada. Most participants assume there is a governing body, and it is likely at the federal level. However, participants were unclear which federal government department is actually responsible for these regulations.

“I don’t know what’s actually happening.” Participant, 18-34

Mirroring survey results, confidence in the regulatory system is mixed among participants. There is some trust based mostly on the impression that there is no reason to believe regulation is not being done properly. There is also some sense that Canada does a good job, or a better job than lesser developed countries or than the U.S., at being truly independent regulators in general and that biotechnology regulations are likely no different.

However, a fair share of participants was skeptical and voiced some concerns, including worries about the influence of “big business” on regulations and on the safety of biotechnology products in general (including mentions of specific company names). Some participants also voiced their general distrust of government, which in some cases was influenced by its handling of the COVID-19 pandemic and vaccines. There were participants who felt they had many unanswered questions and a need for more information in order to shape their opinions. There was strong interest in research and facts, greater transparency on the topic and a balanced, unbiased discussion about the pros and cons of each technology.

“Our regulations need to be strong and not influenced by other countries or by corporations.”
Participant, 35+

“The government needs to be transparent...show the good and the bad, pros and cons and share lots of information, not do a sales job.” Participant, 18-34

Research methodology

Summary: The study consisted of two phases of research: first a national telephone and online survey with Canadian households followed by a series of online focus groups.

Quorus was responsible for coordinating all aspects of the research project including designing and translating the research instruments, coordinating all aspects of participant recruitment, related logistics, data collection and delivering required reports. The research approach is outlined in greater detail below.

Quantitative research

This phase of the research project consisted of a survey with Canadian adults, at least 18 years old. Approximately half of all data was collected using an online panel of households, and the other half via a stratified random sample of Computer Assisted Telephone Interviewing (CATI) interviews which involved a blend of landline and cellphone numbers for a representative final sample.

For the purposes of this research, the two data collection methodologies helped assess the consistency of the tracking data previously collected through telephone interviews, while assessing the robustness of the online sample in order to evaluate a full transition to an online-only approach in the future. Results and methodological considerations related to the online survey are discussed in greater detail further in this report in the section titled “Online Survey Results.”

Data collection took place from June 25th to July 16th, 2021, resulting in a total of 2,042 completed surveys.

- A total of 1,033 responses were completed over the telephone resulting in margin of error of +/-3.1%.
- A total of 1,009 completions were obtained online. A margin of error could not be calculated for the online results due to the use of a non-probability sample, as respondents were only selected from those who had registered to participate in online surveys through a panel.

The telephone survey response rate was 3.6%, and the online survey participation rate was approximately 15%.

Call Disposition – Telephone Survey

Empirical Calculation for Data Collection	Landline	Cell Phone	Total
Total Numbers Attempted	47,817	54,343	144,238
Invalid Numbers	24,737	61,152	85,889
No service	12,512	49,783	62,295
Not residential	62	162	224
Fax / Modem	12,163	11,207	23,370

Empirical Calculation for Data Collection	Landline	Cell Phone	Total
Off Target	565	500	1,065
Language barrier	274	232	506
Not qualified	283	197	480
Quota attained	8	71	79

Empirical Calculation for Data Collection	Landline	Cell Phone	Total
Effective Sample	22,515	34,762	57,277
Incomplete interviews	21,940	34,304	56,224
Refusal	5,967	5,548	11,515
No response	10,931	18,461	29,392
Answering machine	3,472	6,622	10,094
Line busy	471	2,711	3,182
Incomplete	82	89	171
Fixed appointment	1,017	873	1,890
Complete Interviews	575	458	1,033

Empirical Calculation for Data Collection	Landline	Cell Phone	Total
Response Rate	4.9%	2.7%	3.6%

A pretest was conducted in both official languages to assess the flow of the survey, comprehension of the questions, language, data integrity, and particularly the length of the survey.

Pre-Test Details	English	French
Total Sample	26	28
CATI	10	11
Online	16	17

Soft quotas were utilized to ensure comparability with previous research waves, including provincial distribution, 50/50 gender split in each province, and ensuring that no specific age cohort was under-represented. Respondents completing the telephone survey would be broken down based on phone ownership type, involving a combination of traditional wireline telephone numbers and a sub-quota of cellphone only households.

CATI Breakdown	Sample
Total Sample	1,033
Wireline	561
Cellphone	472
Cellphone only household	330

This report features subgroup comparisons based on region, urban setting, gender, age, household income, and education.

The sample frame for the telephone survey (n=1,033) was:

Sample Frame			
Segments	Total (n=1,033)	Segments	Total (n=1,033)
Region		Income	
Atlantic	102	Under \$40,000	179
Quebec	239	\$40,000 to under \$80,000	263
Ontario	342	\$80,000 and above	476
MB/SK	103	Education	
Alberta	113	High school or less	261
BC	134	College/CEGEP	227
Urban setting		University	536
Urban	487	Age	
Suburban	405	18-34	123
Rural	132	35-54	307
Gender		55 or older	603
Male	528		
Female	499		

After data collection was completed, distributions were verified, and the data was appropriately weighted to ensure that the final distributions within the final sample mirror those of the Canadian population according to 2016 Census data.

Weighting by age

Age	Telephone Unweighted	Telephone Weighted	Online Unweighted	Online Weighted	2015 Canada Population Estimates
18-34	11.9%	24.1%	27.3%	27.3%	28.8%
35-54	29.7%	37.2%	36.7%	34.1%	34.4%
55+	58.4%	38.6%	36.1%	38.6%	36.7%

Weighting by gender

Gender ²	Telephone Unweighted	Telephone Weighted	Online Unweighted	Online Weighted	2015 Canada Population Estimates
Male	51.1%	48.6%	49.6%	48.6%	49.2%
Female	48.3%	50.8%	49.7%	50.9%	50.8%

Weighting by region

Region	Telephone Unweighted	Telephone Weighted	Online Unweighted	Online Weighted	2015 Canada Population Estimates
Atlantic	9.9%	6.8%	10.0%	6.8%	6.8%
Quebec	23.1%	23.5%	22.9%	23.5%	23.3%
Ontario	33.1%	38.4%	33.2%	38.4%	38.5%
MB/SK	10.0%	6.5%	10.0%	6.5%	6.5%
Alberta	10.9%	11.2%	11.0%	11.2%	11.4%
BC	13.0%	13.6%	12.9%	13.6%	13.6%

Quorus designed the survey instrument in English to ensure the research objectives were addressed, the tracking questions were included, and the results obtained were comparable to those from previous years. Quorus collaborated with AAFC to design and finalize the questions and finalize the overall survey instrument. While having the same questions in both the telephone and online versions of the questionnaire, Quorus ensured the former was worded for completion led by the interviewers, while the latter was worded for self-completion.

Similar to previous public opinion research of this nature conducted by AAFC, the survey instruments consisted of mostly closed-ended questions. The CATI questionnaire had an average survey duration of 24 minutes, while the online version took roughly 12 minutes to complete.

Respondents had the choice to complete the interview in English or French. Quorus was responsible for translating the questionnaires into French.

² Other gender categories were not included in this weighting due to a low sample size (<1%)

Respondents were informed of their rights under the *Privacy Act*, *Personal Information Protection and Electronic Documents Act* and *Access to Information Act* and these rights were protected throughout the research process. This includes: informing respondents of the purpose of the research; identifying the sponsoring department or Government of Canada as a whole; and that their participation was voluntary.

Finally, all research work was conducted in accordance with the professional standards, the *Standards for the Conduct of Government of Canada Public Opinion Research-Online Surveys*, the *Standards for the Conduct of Government of Canada Public Opinion Research-Telephone Surveys*, and the *Standard on Web Accessibility*.

Respondent profile – telephone surveys (unweighted results)

Respondent Profile			
Segments	Total (n=1,033)	Segments	Total (n=1,033)
Region		Population	
Newfoundland	2%	Near the center of a large city	25%
Nova Scotia	4%	In the suburbs of a large city	25%
Prince Edward Island	<1%	In a small city or large town	22%
New Brunswick	4%	In a small town, or village	14%
Quebec	23%	In a rural area, or remote village	13%
Ontario	33%	Prefer not to say	1%
Manitoba	6%	Born in Canada	
Saskatchewan	4%	Yes	79%
Alberta	11%	No	21%
British Columbia	13%	Prefer not to say	<1%
Yukon	-	Minority groups	
Nunavut	-	An Indigenous person, First Nations, Métis or Inuk (Inuit) or Non-Status	5%
Northwest Territories	-	A member of an ethno-cultural or a visible minority group	9%
Specific ethno-cultural/minority groups		A member of the gender and/or sexual diverse community	3%
White or Caucasian	15%	None of the above	83%
South Asian	15%	Prefer not to say	1%
Chinese	7%	Gender	
Black	15%	Male	51%
Filipino	1%	Female	48%
Hispanic, Latino or Spanish origin	6%	Trans/Non-binary/Other	<1%
Middle Eastern or North African	7%	Prefer not to say	<1%
Southeast Asian	11%	Disability status	
West Asian	3%	Yes	14%
Korean	-	No	85%
Japanese	1%	Prefer not to say	<1%
First Nations	2%	Household income	
Other	8%	Under \$20,000	6%
Prefer not to say	9%	\$20,000 to just under \$40,000	11%
Age		\$40,000 to just under \$60,000	13%
18-24	4%	\$60,000 to just under \$80,000	13%
25-34	8%	\$80,000 to just under \$100,000	11%
35-44	15%	\$100,000 to just under \$150,000	17%
45-54	15%	\$150,000 and above	17%
55-64	23%	Prefer not to say	11%
65-74	22%	Education level	
75 or older	14%	Grade 8 or less	1%
Anglophone minority		Some high school	5%
Yes	10%	High school diploma or equivalent	17%
No	90%	Registered Apprenticeship or other trades certificate or diploma	2%
Prefer not to say	-	College, CEGEP or other non-university certificate or diploma	22%
Francophone minority		University certificate or diploma below bachelor's level	9%
Yes	8%	Bachelor's degree	25%
No	92%	Post graduate degree above bachelor's level	17%
Prefer not to say	1%	Prefer not to say	1%

Respondent profile – online surveys (unweighted results)

Respondent Profile			
Segments	Total (n=1,009)	Segments	Total (n=1,009)
Region		Population	
Newfoundland	2%	Near the center of a large city	29%
Nova Scotia	4%	In the suburbs of a large city	35%
Prince Edward Island	1%	In a small city or large town	18%
New Brunswick	3%	In a small town, or village	11%
Quebec	23%	In a rural area, or remote village	7%
Ontario	33%	Prefer not to say	<1%
Manitoba	7%	Born in Canada	
Saskatchewan	3%	Yes	81%
Alberta	11%	No	19%
British Columbia	13%	Prefer not to say	<1%
Yukon	-	Minority groups	
Nunavut	-	An Indigenous person, First Nations, Métis or Inuk (Inuit) or Non-Status	3%
Northwest Territories	-	A member of an ethno-cultural or a visible minority group	15%
Specific ethno-cultural/minority groups		A member of the gender and/or sexual diverse community	6%
White or Caucasian	16%	None of the above	76%
South Asian	18%	Prefer not to say	2%
Chinese	25%	Gender	
Black	17%	Male	50%
Filipino	5%	Female	50%
Hispanic, Latino or Spanish origin	5%	Trans/Non-binary/Other	1%
Middle Eastern or North African	5%	Prefer not to say	-
Southeast Asian	9%	Disability status	
West Asian	1%	Yes	14%
Korean	5%	No	85%
Japanese	1%	Prefer not to say	1%
First Nations	-	Household income	
Other	2%	Under \$20,000	4%
Prefer not to say	1%	\$20,000 to just under \$40,000	15%
Age		\$40,000 to just under \$60,000	15%
18-24	11%	\$60,000 to just under \$80,000	14%
25-34	16%	\$80,000 to just under \$100,000	14%
35-44	17%	\$100,000 to just under \$150,000	18%
45-54	20%	\$150,000 and above	10%
55-64	17%	Prefer not to say	9%
65-74	10%	Education level	
75 or older	10%	Grade 8 or less	<1%
Anglophone minority		Some high school	3%
Yes	14%	High school diploma or equivalent	18%
No	85%	Registered Apprenticeship or other trades certificate or diploma	6%
Prefer not to say	1%	College, CEGEP or other non-university certificate or diploma	25%
Francophone minority		University certificate or diploma below bachelor's level	8%
Yes	6%	Bachelor's degree	27%
No	92%	Post graduate degree above bachelor's level	13%
Prefer not to say	1%	Prefer not to say	<1%

Qualitative research

The research methodology consisted of 10 online focus groups with Canadians aged 18 and older representing different regions across the country and a variety of specific populations. The focus groups were conducted online from December 8 and 15, 2021. The groups took an average of 90 minutes. Quorus was responsible for coordinating all aspects of the research project including designing and translating the recruitment screener and the moderation guide, coordinating all aspects of participant recruitment, coordinating the online focus group platform and related logistics, moderating all sessions, and delivering required reports at the end of data collection.

Eight focus groups were completed with members of the general population located in four parts of Canada:

- Ontario / Nunavut
- Quebec
- Atlantic Canada
- Western Canada / Yukon / Northwest Territories

In each of these regions, participants were segmented into two age groups: 18 to 34, and 35 years of age and older.

The two remaining focus groups were dedicated to individuals living in official language minority communities (OLMC) in Ontario and Quebec. These individuals were identified using the following questions:

- **For respondents living in Ontario:** Do you consider yourself to be a member of a Francophone minority community? A member of a Francophone minority community refers to Francophones who are outside of Quebec or New Brunswick.
- **For respondents living in Quebec:** Do you consider yourself to be a member of an Anglophone minority community? A member of an Anglophone minority community refers to Anglophones who are living in the province of Quebec.

Across all focus groups, recruitment efforts aimed for a mix across age, gender, employment status, urban and rural populations, and education level with some representation of visible minorities. For sessions that covered more than one province or territory, efforts aimed for representation from each individual province and territory within the given region. Finally, across all focus groups, recruitment efforts aimed to have at least two individuals who believe they are either very or somewhat familiar with agricultural practices and technologies. These last criteria were determined using the following question:

Generally speaking, how familiar are you with agricultural practices and technologies?

- Not at all
- Not very
- Somewhat
- Very

Participants invited to participate in the focus groups were recruited by telephone from the general public as well as from an opt-in database.

In the design of the recruitment screener, specific questions were inserted to clearly identify whether participants qualify for the research program and to ensure a good representation across demographic dimensions.

In addition to the general participant profiling criteria noted above, additional screening was done to ensure quality respondents, such as:

- No participant (nor anyone in their immediate family or household) may work in an occupation that has anything to do with the research topic area, in related government departments/agencies, nor in advertising, marketing research, public relations or the media (radio, television, newspaper, film/video production, etc.), nor may respondents themselves ever have worked in such occupations.
- No participants acquainted with each other may be knowingly recruited for the same study, unless they are in different sessions that are scheduled separately.
- No participants may be recruited who have attended a qualitative research session within the past six months.
- No participant may be recruited who has attended five or more qualitative research sessions in the past five years.
- No participant should be recruited who has attended, in the past two years, a qualitative research session on the same general topic as defined by the researcher/moderator.

Data collection consisted of online focus groups, each lasting one and a half hours. For each focus group, Quorus recruited 8 participants to achieve 6 to 8 participants per focus group.

All focus groups were held in the evenings on weekdays using the Zoom web conferencing platform, allowing the client team to observe the sessions in real-time. The research team used the Zoom platform to host and record sessions (through microphones and webcams connected to the moderator and participant's electronic devices, specifically, laptops and tablets) enabling client remote viewing. Recruited participants were offered an honorarium of \$100 for their participation.

The recruitment of focus group participants followed the screening, recruiting and privacy considerations as set out in the *Standards for the Conduct of Government of Canada Public Opinion Research—Qualitative Research*. Furthermore, recruitment respected the following requirements:

- All recruitment was conducted in the participant’s official language of choice, English and French, as appropriate.
- Upon request, participants were informed on how they can access the research findings.
- Upon request, participants were provided with Quorus’ privacy policy.
- Recruitment confirmed each participant had the ability to speak, understand, read and write in the language in which the session was to be conducted.
- Participants were informed of their rights under the *Privacy and Access to Information Acts* and ensured those rights were protected throughout the research process. This included: informing participants of the purpose of the research, identifying both the sponsoring department or agency and research supplier, informing participants the study will be made available to the public six months after field completion through Library and Archives Canada, and informing participants that their participation in the study is voluntary and the information provided will be administered according to the requirements of the *Privacy Act*.

At the recruitment stage and at the beginning of each focus group, participants were informed that the research was for the Government of Canada. Participants were informed of the recording of their session in addition to the presence of Government of Canada observers. Quorus ensured that prior consent was obtained at the recruitment stage.

Focus group sessions were led by two different moderators from Quorus. Moderators rotated the order of the technologies being discussed (biofuels, gene-editing and cellular agriculture) across the groups in order to avoid recency bias.

A total of 10 online focus groups were conducted with 73 Canadians, as per the table below:

Location	Language	Segment	Date and Time	Participants
Ontario / Nunavut	English	18-34	December 8, 5:30 pm EST	8
		35+	December 8, 7:30 pm EST	7
Quebec	French	18-34	December 9, 5:30 pm EST	7
		35+	December 9, 7:30 pm EST	6
Atlantic	English	18-34	December 14, 5:30 pm AST	8
		35+	December 15, 5:30 pm AST	7
West Canada / Yukon / NWT	English	18-34	December 14, 5:00 pm PST	8
		35+	December 15, 5:00 pm PST	7
OLMC in Quebec	English	18+	December 13, 5:30 pm EST	8
OLMC in Ontario	French	18+	December 13, 7:30 pm EST	7
Total	-	-		73

Qualitative research disclaimer

Qualitative research seeks to develop insight and direction rather than quantitatively projectable measures. The purpose is not to generate “statistics” but to hear the full range of opinions on a topic, understand the language participants use, gauge degrees of passion and engagement, and to leverage the power of the group to inspire ideas. Participants are encouraged to voice their opinions, irrespective of whether or not that view is shared by others.

Due to the sample size, the special recruitment methods used, and the study objectives themselves, it is clearly understood that the results discussed in in this report are exploratory in nature. The findings are not, nor were they intended to be, projectable to a larger population.

One cannot suggest or to infer that few (or many) real world users would behave in one way simply because few (or many) participants behaved in this way during the focus group sessions. This kind of projection can only be done through is strictly the prerogative of quantitative research.

Online Survey Results

Online Survey Results – Key Considerations

The findings described in the survey research findings are from the telephone phase of the research only and do not include the questionnaires completed online. This was done to ensure the tracking data provided a direct ‘apples to apples’ comparison over the years as the telephone results were the focus of the report in 2011 and 2016.

Throughout this section, a significantly higher proportion of respondents selected the “prefer not to say” or “don’t know” option compared to what was observed in the telephone survey results. One of the most important differences between the two modes of data collection is the known availability of the option to select “prefer not to say” or “don’t know” when self-completing the online survey – as those response options are clearly offered on the screen. Although the option is available for the telephone interviewer if needed, the option is not proactively offered to telephone survey respondents. Both of these approaches are common practice in the research industry.

Online studies that are technical and focus on topics not well known to the target audience tend to have a higher percentage of respondents selecting the “prefer not to say” and “don’t know” response options.

Another factor that likely influenced the difference in the results between telephone and online data is the potential for telephone respondents to exhibit social desirability bias. Telephone respondents may feel some degree of social pressure to accept various elements of biotechnology, as they may not want to show to their interviewer how little they know about the given topic. This effect does not exist online, where the anonymity of the data collection process makes it easier for the respondent to indicate they do not know anything about a given topic.

Finally, the role the interviewer plays cannot be overlooked. They are trained to reassure respondents that the survey is not a test of their knowledge, but rather an opportunity to get general impressions. This in many ways encourages telephone respondents to provide an opinion, even if it is an educated guess, rather than defer to the “Don’t know” option. This type of reassurance is provided by the interviewer throughout a telephone survey. This behaviour was also witnessed in the focus groups, where participants would often offer up an opinion or a reaction but only after some prompting by the moderator. An online respondent may feel inclined to see the questions as a test of their knowledge even though text is provided at the onset of the survey clearly indicating this is not the case and they are encouraged to provide general impressions.

In the end, the trends observed in online results in 2016 continued to be observed among 2021 online results, with similar scores across nearly all response options, particularly “don’t know” responses. As with the previous wave, the largest occurrence of “don’t know” responses was found when evaluating potential uses of various technologies and when asked various questions pertaining to technologies that are not well known.

We believe that if the research subject matter (specifically, awareness and perceptions of innovative agricultural technologies) and data collection methodology (specifically, a combination of telephone and online surveys) remain the same in future waves, the differences between the results obtained from telephone and online respondents will also persist. In other words, we do not expect results from these two data collection methodologies to converge over time.

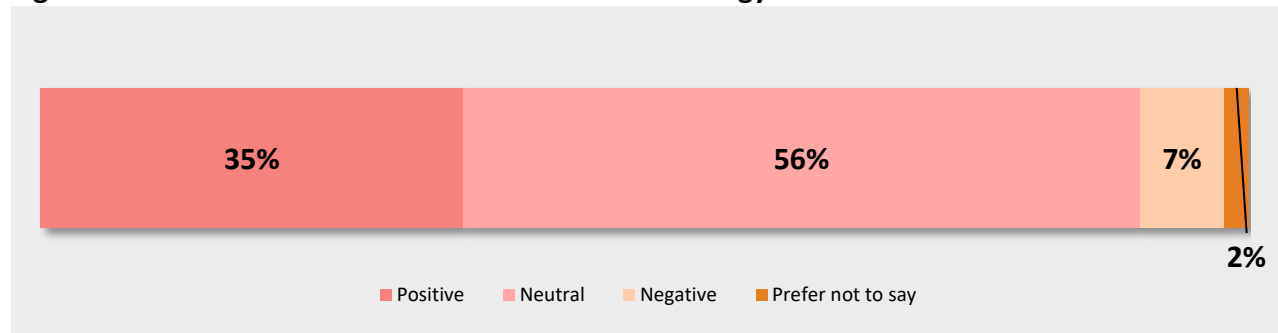
The decision to use a telephone or an online data collection approach for future waves of this study rests entirely on what AAFC wants to measure since both online and telephone approaches generate accurate results of public opinion related to innovative agricultural technologies. The telephone survey obtains a more thoughtful perspective since the respondent cannot easily select a “don’t know” response choice and is encouraged by the interviewer to share an impression they might have on some of the questions. This largely explains why the average duration of the telephone interviews is significantly longer than the average amount of time it took online respondents to complete their survey. Online participants are providing a more immediate or automatic reaction to the questions, which in many ways also captures an honest view on the subject matter.

A. Biotechnology

Several trends were observed when comparing online results to telephone results, as well as when comparing the online results obtained in 2016:

When comparing general reactions to biotechnology between telephone and online respondents, online respondents chose the neutral option slightly more (56% versus 51%), a trend also observed in 2016.

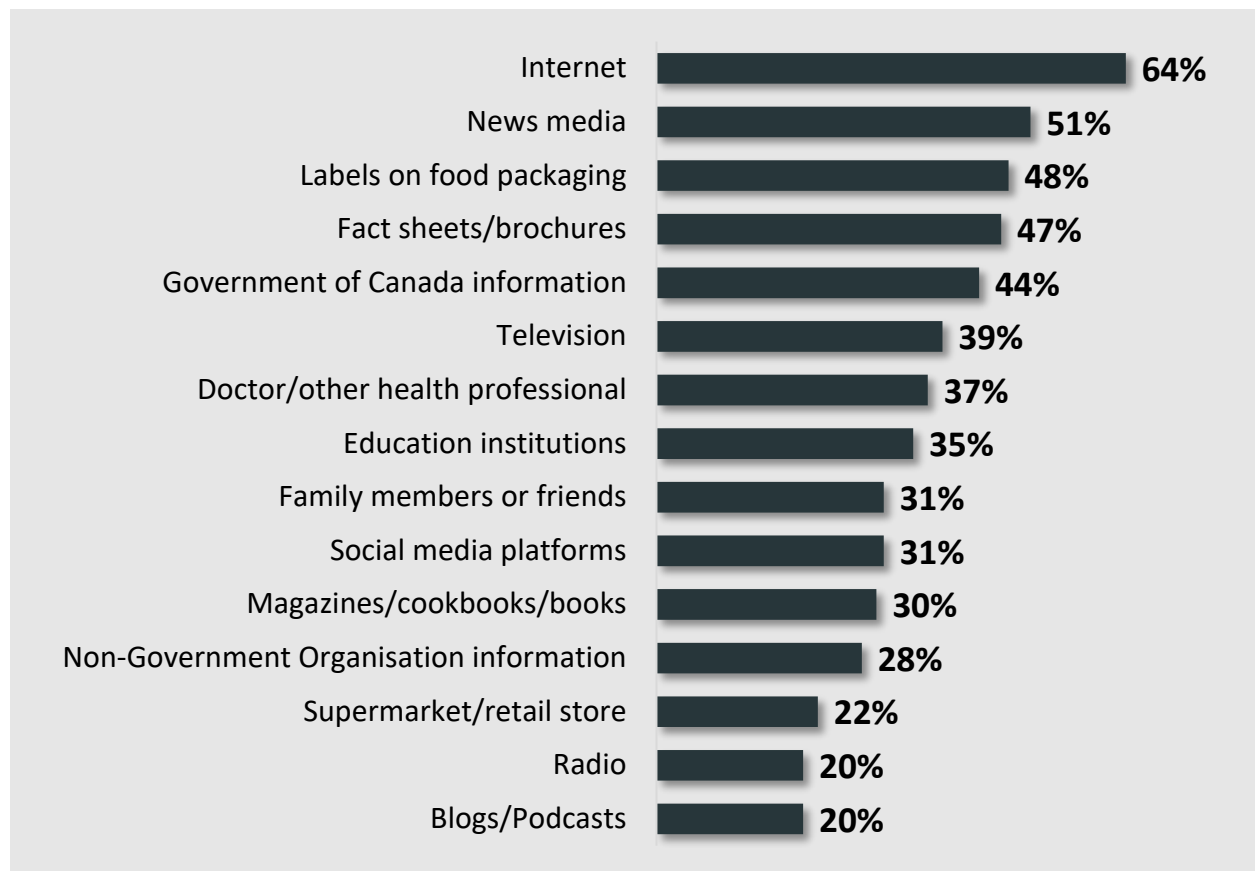
Figure 41 – General reactions to the term “biotechnology”



B1. This part of the survey focuses on biotechnology. Generally, when you hear the word biotechnology, do you have a positive, neutral, or negative reaction? Base: Online respondents, n=1009.

Online respondents reported using fewer information sources when seeking information on biotechnology compared to telephone respondents. This trend was also observed in 2016.

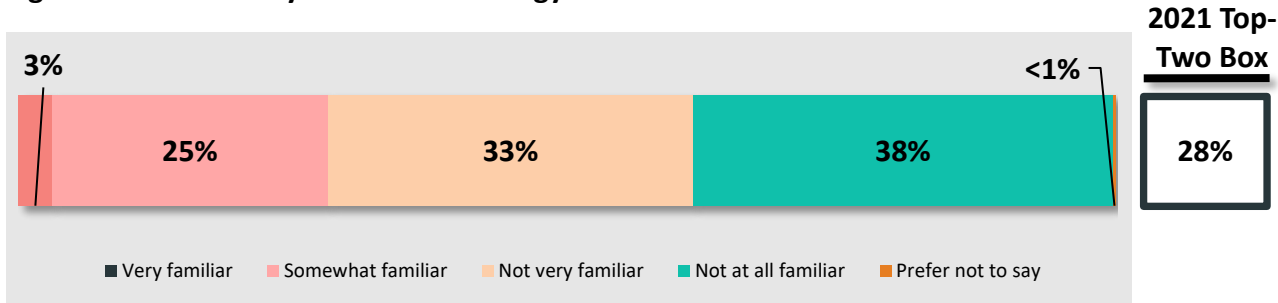
Figure 42 – Use of information sources about biotechnology



B2. Which of the following sources do you use or consult to get information on biotechnology? Base: Online respondents, n=1009.

Online respondents were more likely to report being unfamiliar with biotechnology compared to those over the phone (71% versus 48%). These findings are consistent with the previous wave (57% giving a bottom 2 box score compared to 43% over the phone in 2016).

Figure 43 – Familiarity with biotechnology

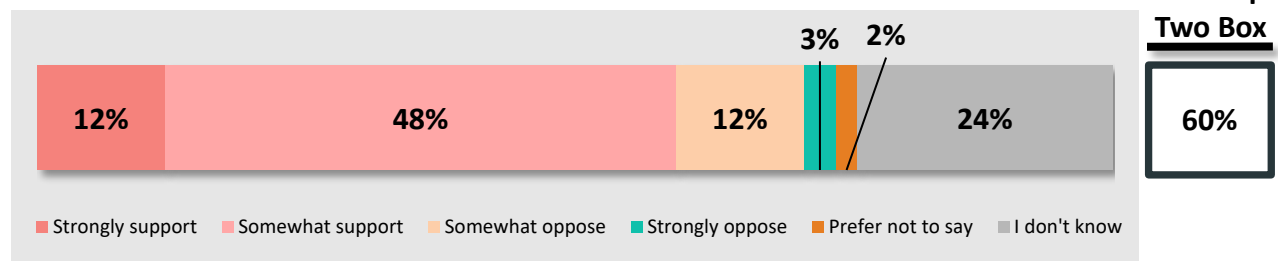


B3. Before participating in this survey, would you say you were very familiar, somewhat familiar, not very familiar, or not at all familiar with biotechnology? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

The level of support for biotechnology products and process was lower among online respondents as they were more likely to select “Don’t know”, while the percentage of those opposed remained close.

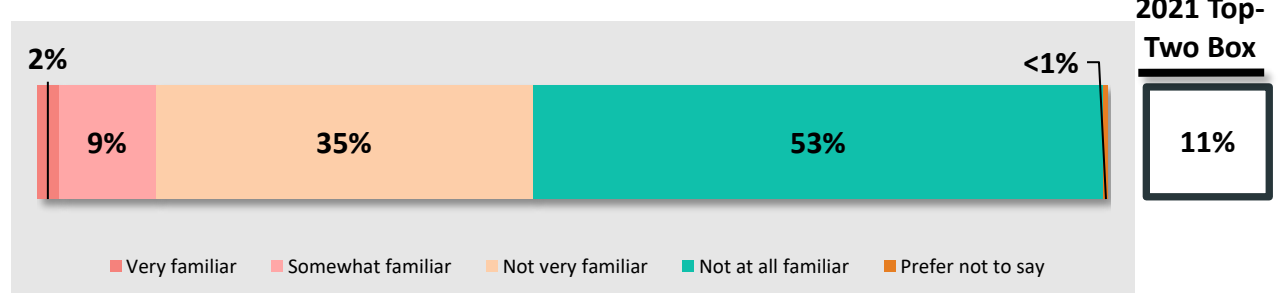
Figure 44 – General support for biotechnology



B4. In general, would you say you strongly support, somewhat support, somewhat oppose or strongly oppose the use of products and processes that involve biotechnology? Base: Online respondents, n=1009.
 Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

Results for familiarity with the regulatory system were lower among online respondents, with a greater degree of “not at all familiar” responses compared to telephone respondents (53% versus 43%).

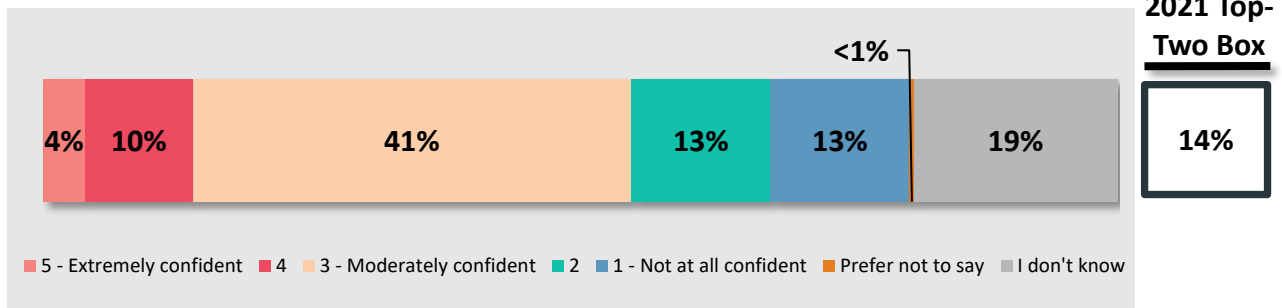
Figure 45 – Familiarity with regulatory system



B5. Would you say that you’re very familiar, somewhat familiar, not very familiar, or not at all familiar with the process by which biotechnology is regulated in Canada? Base: Online respondents, n=1009.
 Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

As seen in the 2016 results, online respondents scored similar levels of confidence in the biotechnology regulatory system compared to telephone respondents. Online results were impacted by higher “don’t know” scores compared to telephone scores (19% versus 2%), despite proportionally similar results across scores on the 5-point confidence scale.

Figure 46 – Confidence in regulatory system

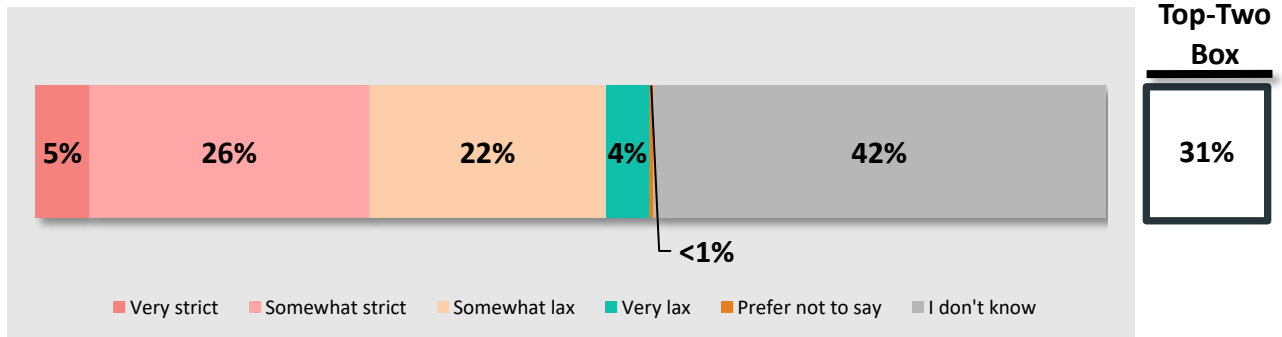


B6. On a scale of 1-5, where 1 is not at all confident and 5 is extremely confident, how confident would you say you are in the safety and regulation of biotechnology? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “extremely confident” or “somewhat confident”.

Results related to the perceived strictness of the safety and regulatory processes for biotechnology products in Canada were largely influenced by the proportion of online respondents who selected “don’t know”. More specifically 42% selected “don’t know” online compared to only 12% over the telephone.

Figure 47 – Perceived strictness of the regulatory approval process

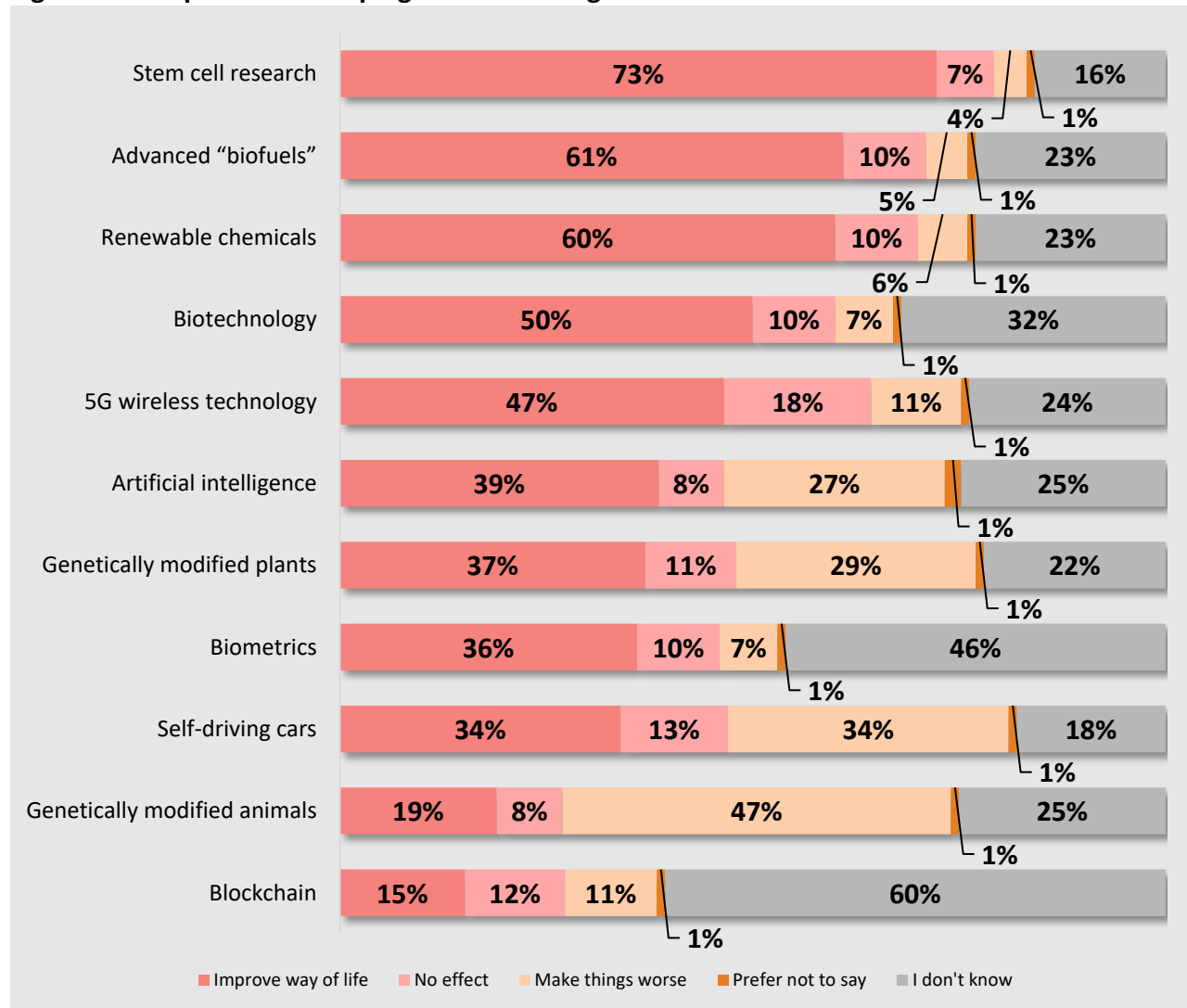


B7. In terms of safety and regulatory approval processes for biotechnology products, do you tend to think that rules and systems in place here in Canada are very strict, somewhat strict, somewhat lax or very lax? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very strict” or “somewhat strict”.

Online respondents were less likely to specify that all technologies presented would “improve way of life” compared to telephone respondents. This is likely due to the presence of the “don’t know” option. In particular, “don’t know” scores were highest in block chain (60%), biometrics (46%), and biotechnology (32%).

Figure 48 – Impact of developing new technologies



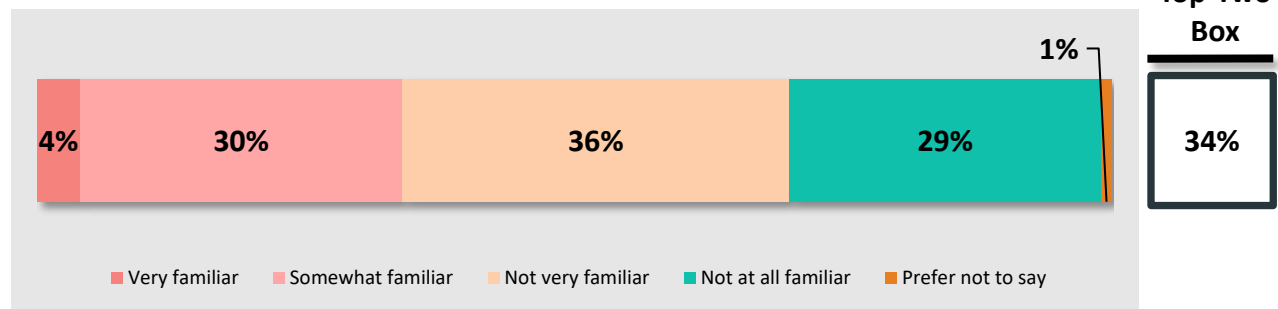
B8. The following is a list of areas in which new technologies are currently developing. Based on what you may have seen, read or heard, do you think each one will improve our way of life in the next 20 years, have no effect, or make things worse? Base: Online respondents, n=1009.

B. Biofuels and bioproducts

Similar trends were observed for biofuels when comparing online results to telephone results. These differences in responses between modes of research (online and telephone) were also seen in 2016.

Telephone respondents were much more likely to indicate they are familiar with biofuels compared to online respondents (57% scoring “very familiar” or “somewhat familiar” versus 34%). This trend is almost identical to what was also observed in 2016 (54% versus 38%).

Figure 49 – Familiarity with biofuels

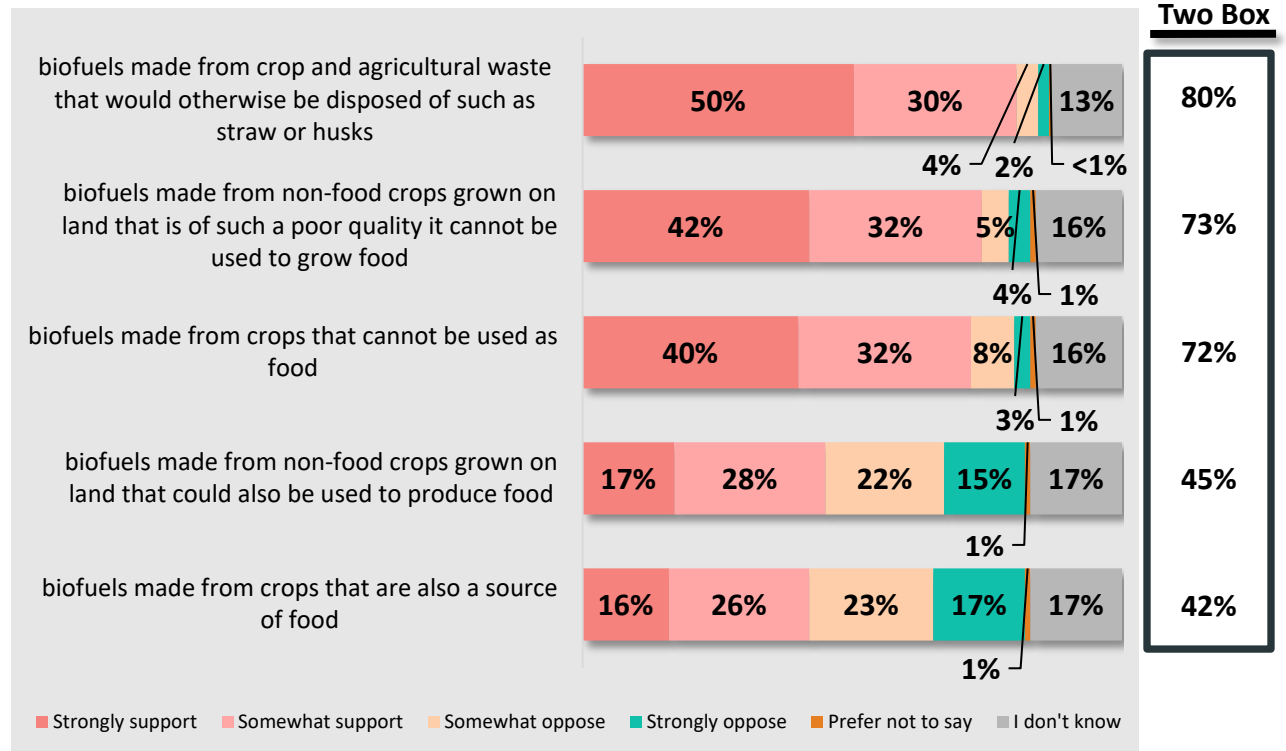


BF1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with biofuels? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

Support for certain sources of biofuels among online respondents was similar to those among telephone respondents. Online respondents had a combination of lower support scores with a larger proportion of “don’t know” responses, a trend also observed in 2016.

Figure 50 – Support for sources of biofuels

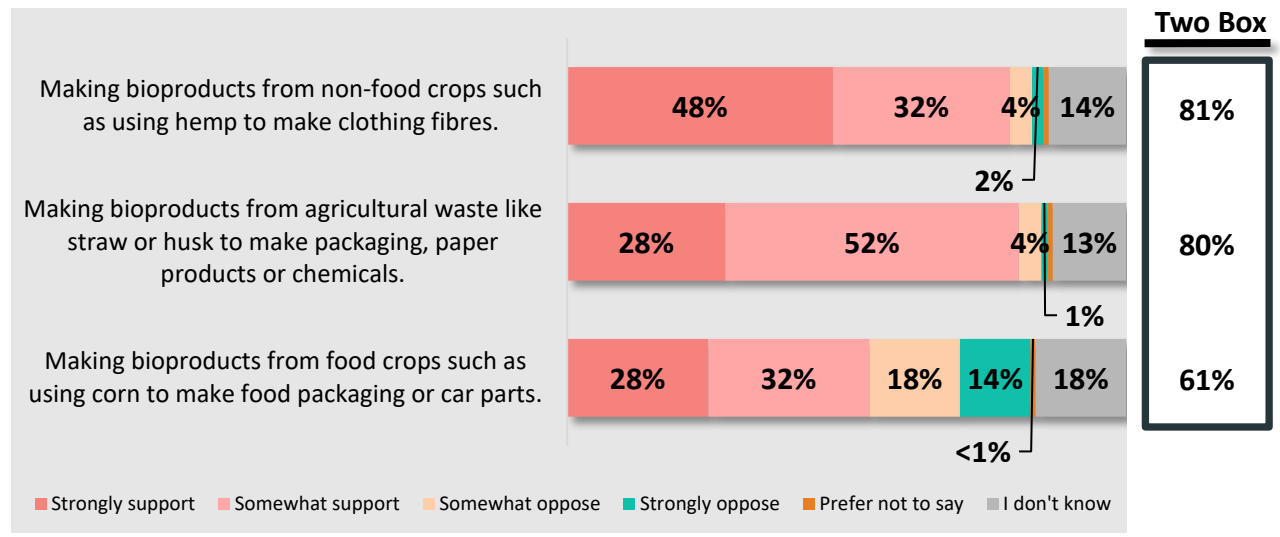


BF2. Where biofuels offer environmental benefits and income opportunities for farmers, how supportive or opposed are you of the following approaches: Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

Regardless of data collection mode, level of support was similar for all applications of bioproducts. Again, online respondents were much more inclined to select “Don’t know” for each potential application.

Figure 51 – Support for potential applications of bioproducts



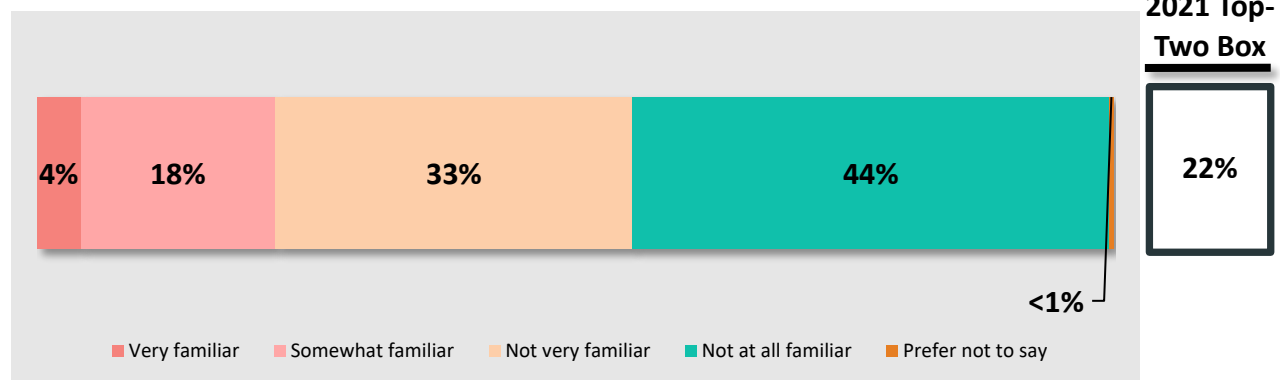
BF3. Other than for food and biofuels, agricultural crops can be used to make other kinds of bioproducts. Please indicate if you strongly support, somewhat support, somewhat oppose or strongly oppose the following potential applications: Base: Online respondents, n=1009. Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

C. Gene-Editing

Various trends were observed among online respondents when compared to telephone respondents, with several similarities to results from 2016:

Similar to results from online respondents in 2016, online respondents in 2021 were less likely to be “very familiar” or “somewhat familiar” with gene-editing compared to telephone respondents (22% versus 40%).

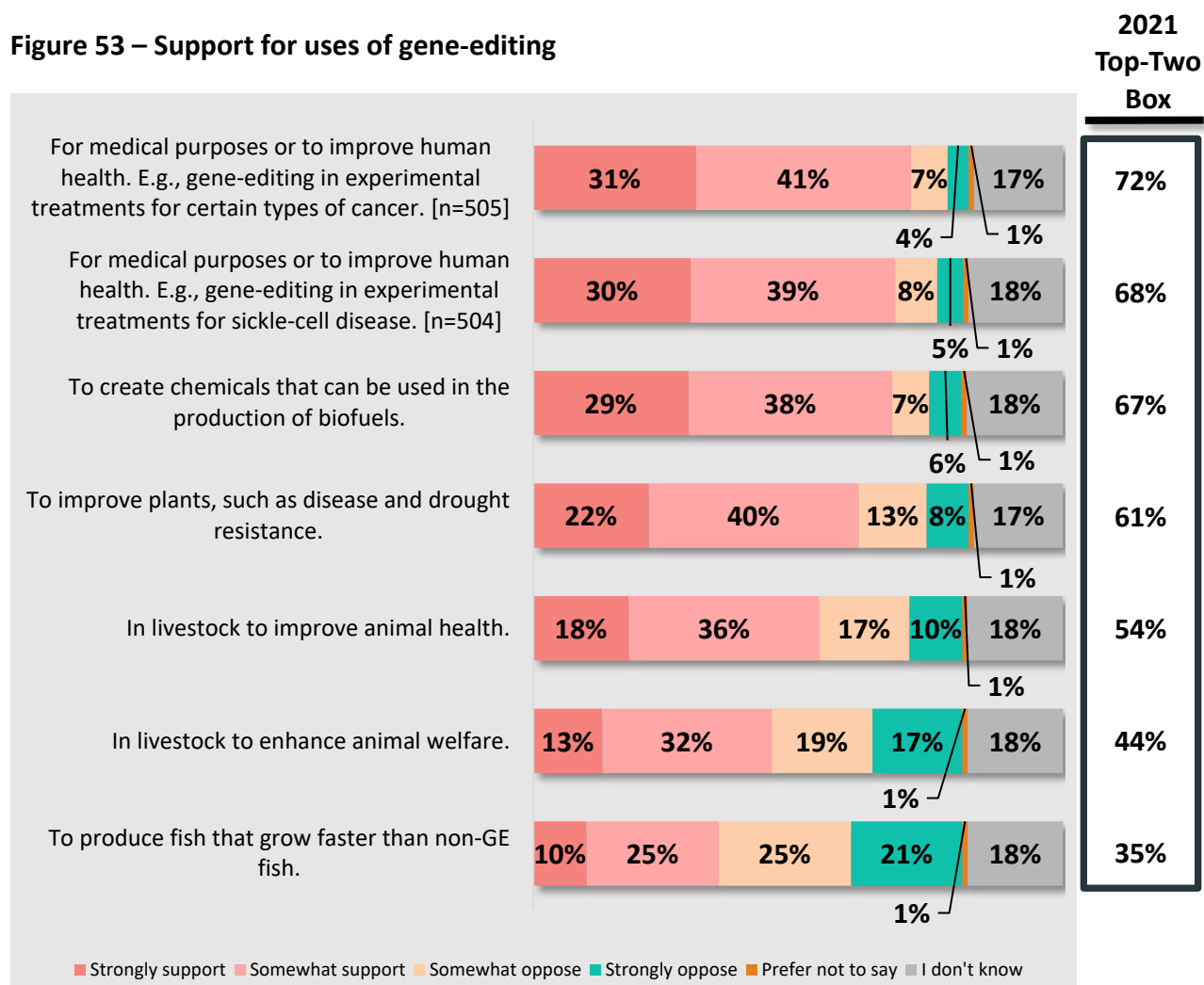
Figure 52 – Familiarity with gene-editing



GE1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with gene-editing? Base: Online respondents, n=1009. Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

As well, online respondents were less familiar with each of the potential uses of gene-editing compared to telephone respondents, with a higher degree of “don’t know” responses.

Figure 53 – Support for uses of gene-editing

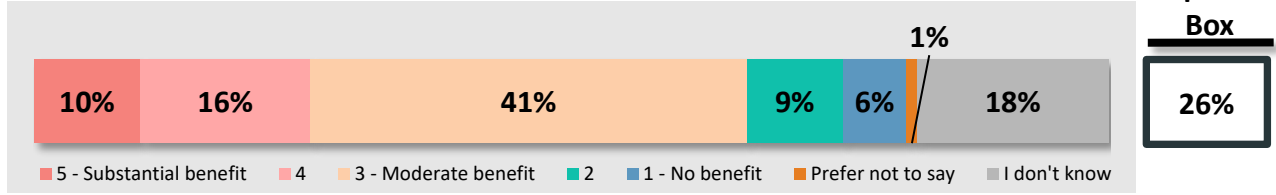


GE2. Please indicate if you strongly support, somewhat support, somewhat oppose or strongly oppose the following ways in which gene-editing can be used. Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

In terms of gauging the potential benefit of gene-editing to society, online respondents were more likely to report neutral scores compared to telephone respondents (41% versus 33%). Online respondents were also much more likely to select “don’t know” (18% versus 2%). Both of these trends were also observed in 2016.

Figure 54 – Perceptions of gene-editing benefiting society

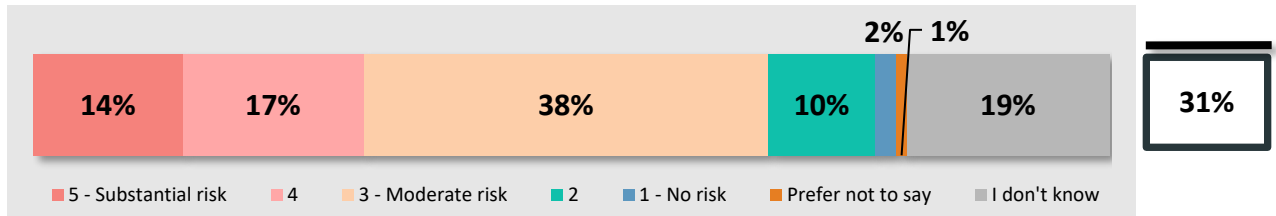


GE3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think gene-editing is to society? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial benefit” or “4”.

Unlike the previous question which assessed the benefit of gene-editing, when asked about the risk of gene-editing, online respondents reported similar proportions across the 5-point scale compared to telephone respondents. Ratings along the 5-point scale were mostly lower for online responses but still similar to telephone responses. The main difference was the scores for “don’t know” were much higher among online respondents, as observed in 2016.

Figure 55 – Perceptions of gene-editing posing a risk for society



GE4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does gene-editing pose for society? Base: Online respondents, n=1009.

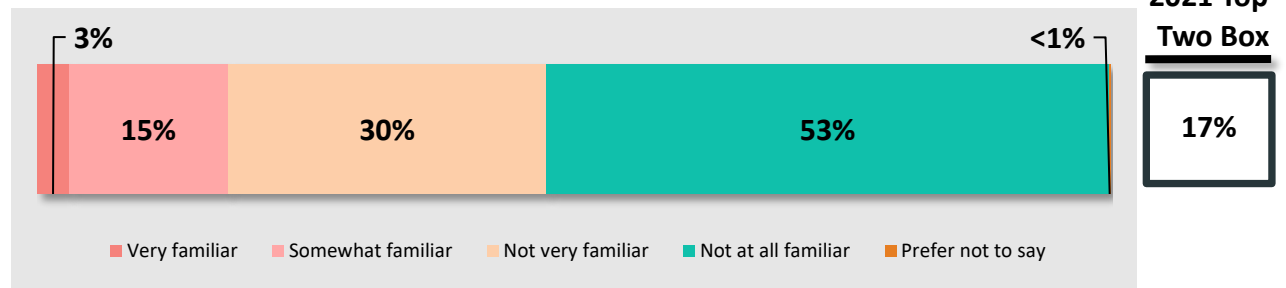
Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

D. Cellular agriculture

Since cellular agriculture was a newly introduced module, online results were only compared with the 2021 telephone results, revealing the following findings:

Online respondents were less likely to indicate they are “very familiar” or “somewhat familiar” compared to telephone respondents (17% versus 32%).

Figure 56 – Familiarity with cellular agriculture

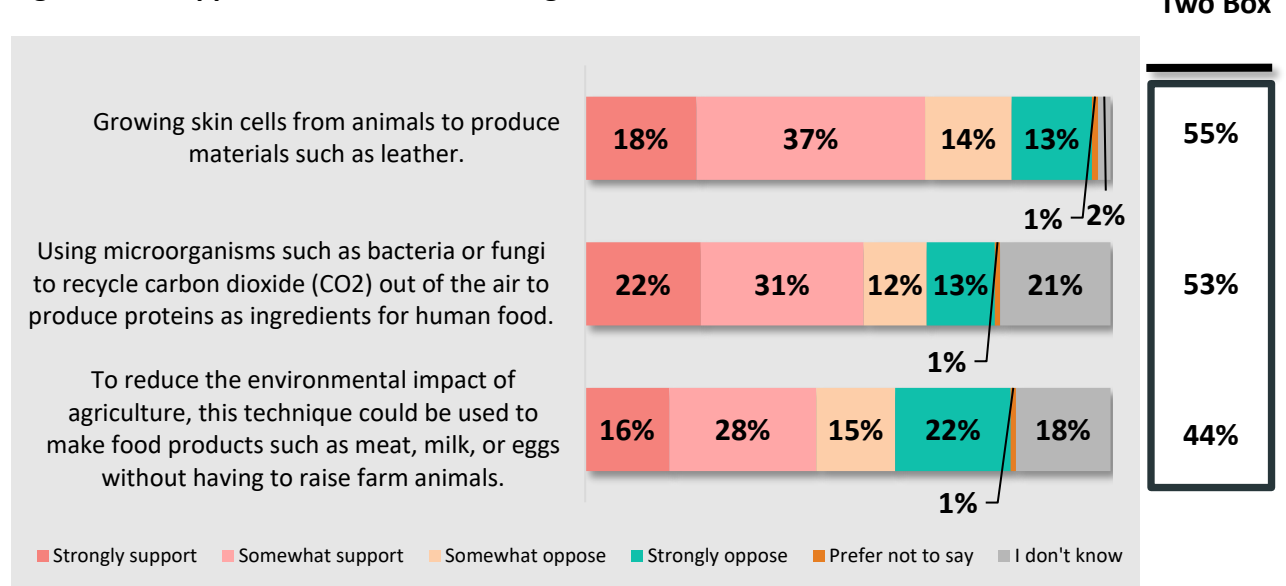


CA1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with cellular agriculture? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “very familiar” or “somewhat familiar”.

Compared to telephone respondents, online respondents were more likely to report “don’t know” for two out of the three potential uses of cellular agriculture. That said, participants in both data collection modes assigned the same rankings when it came to their support for the various uses of cellular agriculture that were presented.

Figure 57 – Support for uses of cellular agriculture

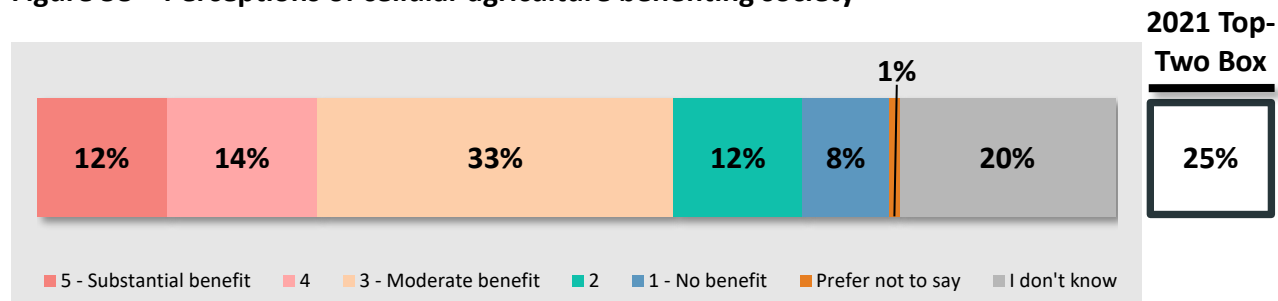


CA2. Do you strongly support, somewhat support, somewhat oppose, or strongly oppose the following ways cellular agriculture can be used? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly support” or “somewhat support”.

In terms of gauging the potential benefit of cellular agriculture to society, online respondents were less likely to score cellular agriculture as “5 – substantial benefit” or “4” compared to telephone respondents (25% versus 41%). Conversely, scores for “don’t know” and the mid-point (“moderate benefit”) were more common among online respondents.

Figure 58 – Perceptions of cellular agriculture benefiting society

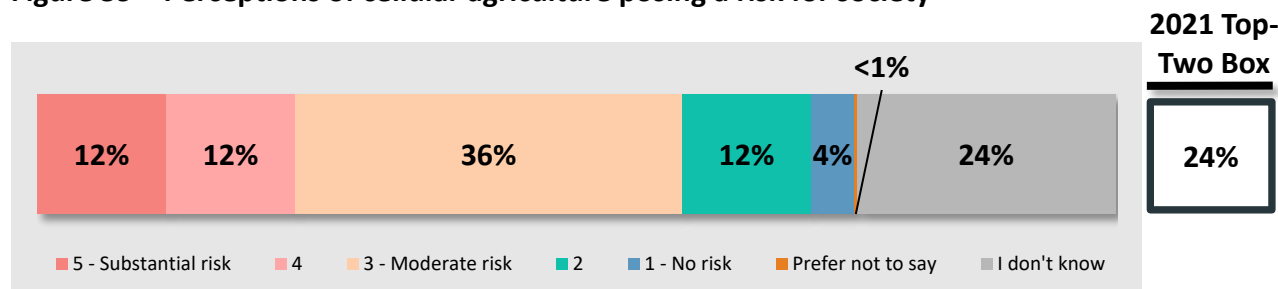


CA3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think cellular agriculture is to society? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial benefit” or “4”.

The same trend was observed with perceived risk; as online respondents were less likely to score “5 – substantial risk” or “4” compared to telephone respondents (24% versus 31%). Results also show a higher proportion of online respondents selecting the mid-point in the scale (36% versus 32%) and the “don’t know” option (24% versus 5%).

Figure 59 – Perceptions of cellular agriculture posing a risk for society

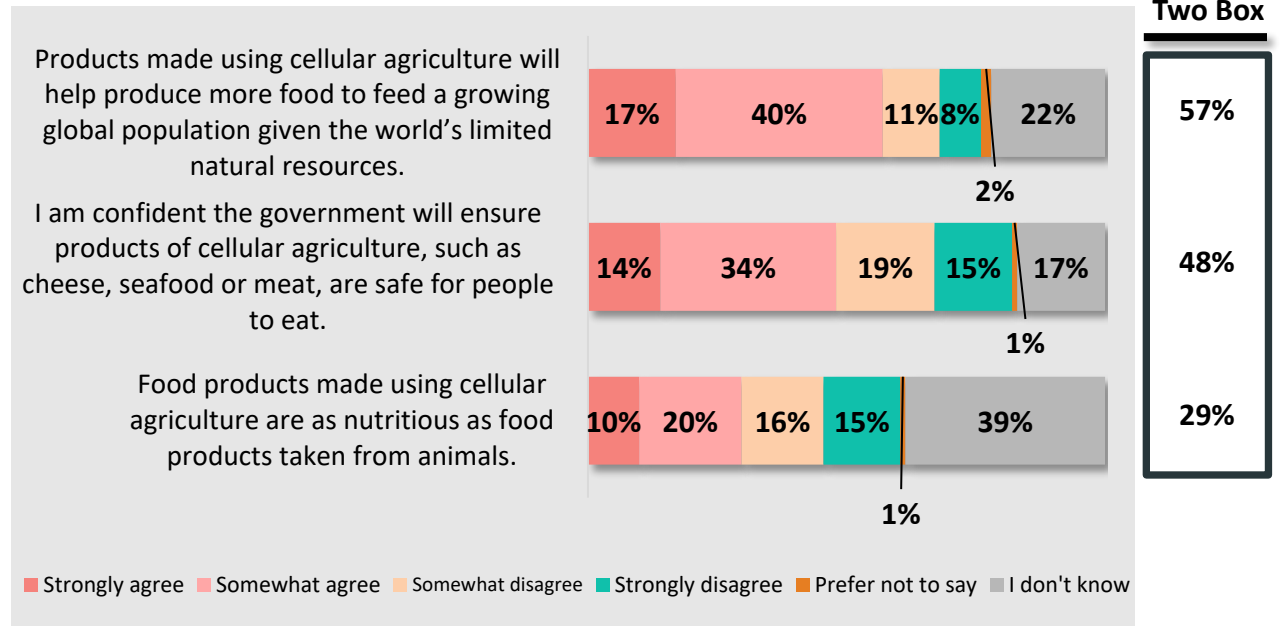


CA4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does cellular agriculture pose for society? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “5 – substantial risk” or “4”.

Online respondents were less likely to “strongly agree” with each of the statements regarding cellular agriculture compared to telephone respondents, with an increase in “don’t know” responses. That said, the overall trend is similar to what was observed among telephone respondents; in other words, both sets of respondents agreed on the same issues.

Figure 60 – Attitudes related to cellular agriculture



CA5. Do you strongly agree, somewhat agree, somewhat disagree or strongly disagree with the following statements regarding cellular agriculture? Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected “strongly agree” or “somewhat agree”.

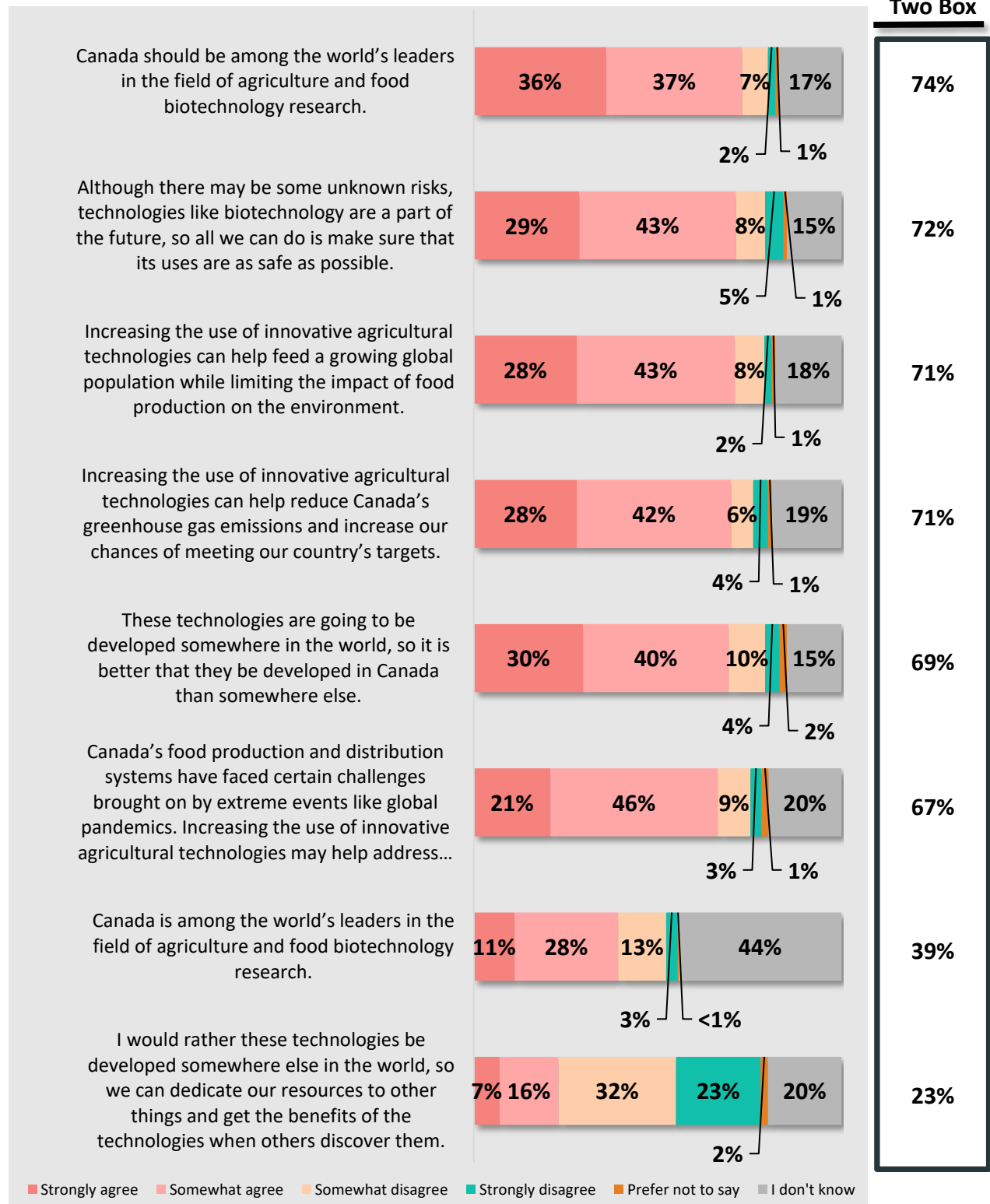
E. Underlying attitudes towards agricultural technologies

When considering the various statements presented to better understand underlying attitudes of Canadians regarding innovative agricultural technologies, two key trends are worth highlighting when comparing online and telephone-based results.

First, telephone respondents and online respondents were most likely to agree with the same statements or positions. In other words, the two respondent groups agree and disagree on the same issues.

Second, as has been seen throughout the 2021 research results, online respondents were generally more inclined to select the “don’t know” option for each of the statements presented. This has the general effect of reducing the proportions of respondents who agree or disagree with any given statement. Despite this generalized decrease in proportions, overall agreement trends are the same for both online and telephone responses.

Figure 61 – Underlying attitudes towards agricultural technologies



UA1. Please indicate whether you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with each of the following statements: Base: Online respondents, n=1009.

Top-Two Box refers to the combination of the 2 highest scores, in this case, those who selected "strongly agree" or "somewhat agree".

Appendices

Questionnaires

Innovative Agricultural Technologies 2021 POR Questionnaire

CATI Version

Introduction

Hello/Bonjour good afternoon/evening [pause], the Government of Canada is conducting a research survey on various new technologies and would like to get your input. The survey is not a test of your knowledge, we simply seek your candid opinions. Would you prefer that I continue in English or French? Préférez-vous continuer en français ou en anglais?

My name is _____ of Quorus Consulting Group, the market research firm hired to conduct the survey. The survey takes about 15 minutes to complete. The information provided will be managed according to the requirements of the Privacy Act, the Access to Information Act, and any other pertinent legislation. The survey is registered with the Canadian Research Insights Council through their Research Verification Service. Your participation is voluntary and completely confidential. Your answers will remain anonymous. The final report on the survey will be available through Library and Archives Canada. May I continue?

Quota control variables

S1. And, just to confirm, have I reached you on a landline phone or a cell phone?

Landline	1
Cell phone	2
Don't know / Refused [Thank and terminate]	9

S1A. [Ask only if cell phone at S1] For your safety, are you currently driving?

Yes [Schedule callback]	1
No	2
Don't know / Refused [Thank and terminate]	9

S1B. [Ask only if cell phone at S1] Does your household have a landline?

Yes	1
No	2
Don't know / Refused [Do not read]	9

A1. Which of the following age groups do you belong to? Read list

Under 18 years of age	0	[Thank and terminate]
18-24	1	
25-34	2	
35-44	3	
45-54	4	
55-64	5	
65-74	6	
75 or older	7	
I don't know/no answer [Do not read]	9	[Thank and terminate]

A2. What is your gender? Do not read list

Male	1
Female	2
Trans/Non-binary/Other	3
Prefer not to say	9

A3. In which province or territory do you live? Do not read list

Newfoundland and Labrador	1
Nova Scotia	2
Prince Edward Island	3
New Brunswick	4
Quebec	5
Ontario	6
Manitoba	7
Saskatchewan	8
Alberta	9
British Columbia	10
Yukon	11
Nunavut	12
Northwest Territories	13
Prefer not to say [Thank and terminate]	98
Do not currently live in Canada [Thank and terminate]	99

Programming note: rotate the order of modules 1 to 4; do not rotate the order of the questions inside each module unless otherwise indicated

Module 1: Biotechnology

B1. This part of the survey focuses on biotechnology. Generally, when you hear the word biotechnology, do you have a positive, neutral, or negative reaction?

Positive	3
Neutral	2
Negative	1
Prefer not to say [Do not read]	9

Biotechnology is used in many areas, such as health, natural resources, manufacturing and agriculture. Biotechnology involves engineering living organisms, such as plants and animals, or parts of living organisms to produce useful products, such as, medicines or creating plants that are not affected by pests or insects.

B2. Which of the following sources do you use or consult to get information on biotechnology?

- a. Labels on food packaging
- b. Doctor/other health professional
- c. Fact sheets/brochures
- d. Television
- e. Radio
- f. Magazines/cookbooks/books
- g. Social media platforms (for example, Instagram, Facebook, Twitter, etc.)
- h. Blogs/Podcasts
- i. Internet (for example, online publications, Google searches, etc.)
- j. News media, including newspapers, news websites, etc.
- k. Supermarket/retail store
- l. Education institutions (for example, school, college, university)
- m. Government of Canada information
- n. Non-Government Organisation information
- o. Family members or friends

Yes	1
No	2
I don't know/no answer [Do not read]	9

B3. Before participating in this survey, would you say you were very familiar, somewhat familiar, not very familiar, or not at all familiar with biotechnology?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say [Do not read]	9

B4. In general, would you say you strongly support, somewhat support, somewhat oppose or strongly oppose the use of products and processes that involve biotechnology?

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

B5. Would you say that you're very familiar, somewhat familiar, not very familiar, or not at all familiar with the process by which biotechnology is regulated in Canada?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say [Do not read]	9

B6. On a scale of 1-5, where 1 is not at all confident and 5 is extremely confident, how confident would you say you are in the safety and regulation of biotechnology?

Extremely confident	5
	4
Moderately confident	3
	2
Not at all confident	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

B7. In terms of safety and regulatory approval processes for biotechnology products, do you tend to think that rules and systems in place here in Canada are very strict, somewhat strict, somewhat lax or very lax?

Very strict	4
Somewhat strict	3
Somewhat lax	2
Very lax	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

B8. The following is a list of areas in which new technologies are currently developing. Based on what you may have seen, read or heard, do you think each one will improve our way of life in the next 20 years, have no effect, or make things worse? (Randomize) **Repeat scale only if needed**

- a. Self-driving cars
- b. Artificial intelligence
- c. Biotechnology
- d. Stem cell research
- e. Block chain
- f. Biometrics
- g. Genetically modified plants, such as crops, fruits and vegetables
- h. Advanced "biofuels" (for example, cellulosic ethanol, bio-jet fuel, renewable natural gas)
- i. Renewable chemicals made from waste carbon dioxide or biomass energy
- j. Genetically modified animals
- k. 5G wireless technology

Improve way of life	3
No effect	2
Make things worse	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

Module 2: Biofuels/bioproducts

This part of the survey focuses on bio-based fuels, or biofuels. Biofuels use biological materials such as plants, wood and waste to produce fuels that can be used for cars, trains, airplanes, or to heat and power buildings.

BF1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with biofuels?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say [Do not read]	9

BF2. Where biofuels offer environmental benefits and income opportunities for farmers, how supportive or opposed are you of the following approaches (Randomize):

- biofuels made from crops that are also a source of food
- biofuels made from crops that cannot be used as food
- biofuels made from non-food crops grown on land that could also be used to produce food
- biofuels made from non-food crops grown on land that is of such a poor quality it cannot be used to food
- biofuels made from crop and agricultural waste that would otherwise be disposed of such as straw o husks

Would you say you... **Repeat scale only if needed**

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

BF3. Other than for food and biofuels, agricultural crops can be used to make other kinds of bioproducts. Please indicate if you strongly support, somewhat support, somewhat oppose or strongly oppose the following potential applications (Randomize): **Repeat scale only if needed**

- a. Making bioproducts from food crops such as using corn to make food packaging or car parts.
- b. Making bioproducts from non-food crops such as using hemp to make clothing fibres.
- c. Making bioproducts from agricultural waste like straw or husk to make packaging, paper product: chemicals.

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

Module 3: Gene-editing

This part of the survey focuses on a new type of biotechnology called gene-editing. Gene-editing involves making small changes to a cell's gene structure and does not necessarily involve mixing together DNA from different species of plants or animals. Gene-editing is often used for medical and agricultural purposes.

GE1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with gene-editing?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say [Do not read]	9

GE2. Please indicate if you strongly support, somewhat support, somewhat oppose or strongly oppose the following ways in which gene-editing can be used (Randomize): **Repeat scale only if needed**

- a. The use of gene-editing to improve plants, such as disease and drought resistance, with more precision and at less time and cost than is possible using conventional breeding techniques.
- b. The use of gene-editing in livestock to enhance animal welfare. For example, the use of gene-editing to create cattle that are born without horns and therefore do not need to undergo dehorning.
- c. Using gene-editing in livestock to improve animal health. For example, genetically modifying cattle to decrease their chances of getting certain diseases, like tuberculosis.
- d. The use of gene-editing to produce fish that grow faster than non-GE fish, potentially reducing the cost of production and costs of fish products to consumers. These fish would be grown in contained, land-based facilities.

- e. The use of gene-editing to create chemicals that can be used in the production of biofuels, which are known to produce fewer greenhouse gases when burned and are considered a more sustainable resource than traditional fuels.
- f. The use of gene-editing for medical purposes or to improve human health. **Randomly split examples – only show one:** For example, researchers are using gene-editing in experimental treatments for sickle-cell disease, which is a hereditary blood disease. / For example, researchers are using gene-editing in experimental treatments for certain types of cancer.

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

Rotate the next two questions, on risk and benefit – all need to be asked about both

GE3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think gene-editing is to society?

Substantial benefit	5
	4
Moderate benefit	3
	2
No benefit	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

GE4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does gene-editing pose for society?

Substantial risk	5
	4
Moderate risk	3
	2
No risk	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

Module 4: Cellular agriculture

We now have a few questions on cellular agriculture which involves making animal products such as meat, seafood, dairy, or leather from animal cell cultures instead of using live animals. By taking cells from an animal and growing them with nutrients, we can obtain products such as meat, leather and milk. Cellular agriculture also includes inserting DNA from an animal into a microorganism like yeast or fungi to make food ingredients like egg or milk protein.

CA1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with cellular agriculture?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say [Do not read]	9

CA2. Do you strongly support, somewhat support, somewhat oppose, or strongly oppose the following ways cellular agriculture can be used? [Randomize] Repeat **scale only if needed**

- a. To reduce the environmental impact of agriculture, this technique could be used to make food products such as meat, milk, or eggs without having to raise farm animals.
- b. Using microorganisms such as bacteria or fungi to recycle carbon dioxide (CO₂) out of the air to produce proteins as ingredients for human food.
- c. Growing skin cells from animals to produce materials such as leather.

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

Rotate the next two questions, on risk and benefit – all need to be asked about both

CA3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think cellular agriculture is to society?

Substantial benefit	5
	4
Moderate benefit	3
	2
No benefit	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

CA4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does cellular agriculture pose for society?

Substantial risk	5
	4
Moderate risk	3
	2
No risk	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

CA5. Do you strongly agree, somewhat agree, somewhat disagree or strongly disagree with the following statements regarding cellular agriculture? (Randomize) **Repeat scale only if needed**

- I am confident the government will ensure products of cellular agriculture, such as cheese, seafood or meat, are safe for people to eat.
- Food products made using cellular agriculture are as nutritious as food products taken from animals.
- Products made using cellular agriculture will help produce more food to feed a growing global population given the world's limited natural resources.

Strongly agree	4
Somewhat agree	3
Somewhat disagree	2
Strongly disagree	1
Prefer not to say [Do not read]	9
I don't know [Do not read]	6

(End of module rotation)

Module 5: Underlying attitudes

We have discussed various new technologies so far. This next section focusses on technology in general.

UA1. Please indicate whether you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with each of the following statements: (Rotate) **Repeat scale only if needed**

- Canada is among the world's leaders in the field of agriculture and food biotechnology research
- Canada should be among the world's leaders in the field of agriculture and food biotechnology research

- c) (SPLIT) These technologies are going to be developed somewhere in the world, so it is better that they be developed in Canada than somewhere else. / I would rather these technologies be developed somewhere else in the world, so we can dedicate our resources to other things and get the benefits of the technologies when others discover them.
- d) Canada’s food production and distribution systems have faced certain challenges brought on by extreme events like global pandemics. Increasing the use of innovative agricultural technologies may help address these challenges.
- e) Although there may be some unknown risks, technologies like biotechnology are a part of the future, so all we can do is make sure that its uses are as safe as possible.
- f) Increasing the use of innovative agricultural technologies can help reduce Canada’s greenhouse gas emissions and increase our chances of meeting our country’s targets.
- g) Increasing the use of innovative agricultural technologies can help feed a growing global population while limiting the impact of food production on the environment.

Strongly agree	4
Somewhat agree	3
Somewhat disagree	2
Strongly disagree	1
Prefer not to say [Do not read]	9
I don’t know [Do not read]	6

Demographic questions

The last few questions are strictly for statistical purposes. We remind you that all your answers remain completely confidential.

D1. What is the highest level of formal education that you have completed? Read list only if needed

Grade 8 or less	1
Some high school	2
High school diploma or equivalent	3
Registered Apprenticeship or other trades certificate or diploma	4
College, CEGEP or other non-university certificate or diploma	5
University certificate or diploma below bachelor’s level	6
Bachelor’s degree	7
Post graduate degree above bachelor’s level	8
Prefer not to say [Do not read]	9

D2. Which of the following categories best describes your total household income? That is, the total income of all persons in your household combined, before taxes. **Read list**

Under \$20,000	1
\$20,000 to just under \$ 40,000	2
\$40,000 to just under \$ 60,000	3
\$60,000 to just under \$ 80,000	4
\$80,000 to just under \$100,000	5
\$100,000 to just under \$150,000	6
\$150,000 and above	7
Prefer not to say [Do not read]	9

D3. Were you born in Canada?

Yes	1
No	2
Prefer not to say [Do not read]	9

D4a. Do you identify as any of the following? **[Select all that apply]**

An Indigenous person, that is, First Nations, Métis or Inuk (Inuit) or Non-Status	1
A member of an ethno-cultural or a visible minority group	2
A member of the gender and/or sexual diverse community	3
None of the above	4
Prefer not to say [Do not read]	9

D4b. [If member of ethno-cultural or visible minority group] Of which ethno-cultural or visible minority group or groups are you a member? **Do not read list – select all that apply**

White or Caucasian (for example, German, Irish, English, Italian, French, Australian, etc.)	1
South Asian (for example, East Indian, Pakistani, Sri Lankan, Bangladeshi, Nepalese, etc.)	2
Chinese	3
Black (for example, African American, Jamaican, Haitian, Nigerian, Ethiopian, Somalian, etc.)	4
Filipino	5
Hispanic, Latino or Spanish origin (for example, Mexican or Mexican American, Puerto Rican, Cuban, Salvadorian, Columbian, etc.)	6
Middle Eastern or North African (for example, Lebanese, Egyptian, Syrian, Moroccan, Algerian, etc.)	7
Southeast Asian (for example, Vietnamese, Cambodian, Malaysian, Laotian, etc.)	8
West Asian (for example, Iranian, Afghan, etc.)	9
Korean	10
Japanese	11
Other – please specify	88
Prefer not to say	99

D5. Which of the following best describes where you live? Read list

Near the center of a large city	1
In the suburbs of a large city	2
In a small city or large town	3
In a small town, or village	4
In a rural area, or remote village	5
Prefer not to say [Do not read]	9

D6. [For respondents living outside Quebec or New Brunswick] Do you consider yourself to be a member of a Francophone minority community in your province or territory? A member of a Francophone minority community refers to Francophones who are outside of Quebec or New Brunswick.

Yes	1
No	2
Prefer not to say [Do not read]	9

D7. [for respondents living in Quebec] Do you consider yourself to be a member of an Anglophone minority community? A member of an Anglophone minority community refers to Anglophones who are living in the province of Quebec.

Yes	1
No	2
Prefer not to say [Do not read]	9

D8. For this study, a person with a disability is a person who has a long-term or recurring impairment such as vision, hearing, mobility, flexibility, dexterity, pain, learning, developmental, memory or mental health-related impairments which limits their daily activities inside or outside the home such as at school, work, or in the community in general. Do you consider yourself to be a person with a disability?

Yes	1
No	2
Prefer not to say [Do not read]	9

This concludes the survey. Thank you for your participation!

Innovative Agricultural Technologies 2021 POR Questionnaire

Online Version

Landing page text

Thank you for participating in this survey. Quorus Consulting Group, a Canadian market research firm, is conducting this survey on behalf of the Government of Canada. The survey will ask you questions regarding various new technologies and your feedback is very important. The survey should take you about 15 minutes to complete. The survey is not a test of your knowledge, we simply seek your candid opinions.

Your participation is voluntary and completely confidential. All your answers will remain anonymous. The information provided will be managed according to the requirements of the Privacy Act, the Access to Information Act, and any other pertinent legislation. The survey is registered with the Canadian Research Insights Council through their Research Verification Service. The final report on the survey will be available through Library and Archives Canada.

Vous pouvez également répondre au sondage en français.

Quota Control Variables

A1. Which of the following age groups do you belong to?

Under 18 years of age	0	[Thank and terminate]
18-24	1	
25-34	2	
35-44	3	
45-54	4	
55-64	5	
65-74	6	
75 or older	7	
Prefer not to say	9	[Thank and terminate]

A2. What is your gender?

Male	1
Female	2
Trans/Non-binary/Other	3
Prefer not to say	9

A3. In which of the following provinces or territories do you live?

Newfoundland and Labrador	1
Nova Scotia	2
Prince Edward Island	3
New Brunswick	4
Quebec	5
Ontario	6
Manitoba	7
Saskatchewan	8
Alberta	9
British Columbia	10
Yukon	11
Nunavut	12
Northwest Territories	13
Prefer not to say [Thank and terminate]	98
Do not currently live in Canada [Thank and terminate]	99

Programming note: rotate the order of modules 1 to 4; do not rotate the order of the questions inside each module unless otherwise indicated

Module 1: Biotechnology

B1. This part of the survey focuses on biotechnology. Generally, when you hear the word biotechnology, do you have a positive, neutral, or negative reaction?

Positive	3
Neutral	2
Negative	1
Prefer not to say	9

Biotechnology is used in many areas, such as health, natural resources, manufacturing and agriculture. Biotechnology involves engineering living organisms, such as plants and animals, or parts of living organisms to produce useful products, such as, medicines or creating plants that are not affected by pests or insects.

B2. Which of the following sources do you use or consult to get information on biotechnology?

- a. Labels on food packaging
- b. Doctor/other health professional
- c. Fact sheets/brochures
- d. Television
- e. Radio
- f. Magazines/cookbooks/books
- g. Social media platforms (for example, Instagram, Facebook, Twitter, etc.)
- h. Blogs/Podcasts
- i. Internet (for example, online publications, Google searches, etc.)
- j. News media, including newspapers, news websites, etc.
- k. Supermarket/retail store
- l. Education institutions (for example, school, college, university)
- m. Government of Canada information
- n. Non-Government Organisation information
- o. Family members or friends

Yes	1
No	2
I don't know/no answer	9

B3. Before participating in this survey, would you say you were very familiar, somewhat familiar, not very familiar, or not at all familiar with biotechnology?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say [Do not read]	9

B4. In general, would you say you strongly support, somewhat support, somewhat oppose or strongly oppose the use of products and processes that involve biotechnology?

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say	9
I don't know	6

B5. Would you say that you're very familiar, somewhat familiar, not very familiar, or not at all familiar with the process by which biotechnology is regulated in Canada?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say [Do not read]	9

B6. On a scale of 1-5, where 1 is not at all confident and 5 is extremely confident, how confident would you say you are in the safety and regulation of biotechnology?

Extremely confident	5
	4
Moderately confident	3
	2
Not at all confident	1
Prefer not to say	9
I don't know	6

B7. In terms of safety and regulatory approval processes for biotechnology products, do you tend to think that rules and systems in place here in Canada are very strict, somewhat strict, somewhat lax or very lax?

Very strict	4
Somewhat strict	3
Somewhat lax	2
Very lax	1
Prefer not to say	9
I don't know	6

B8. The following is a list of areas in which new technologies are currently developing. Based on what you may have seen, read or heard, do you think each one will improve our way of life in the next 20 years, have no effect, or make things worse? (Randomize)

- a. Self-driving cars
- b. Artificial intelligence
- c. Biotechnology
- d. Stem cell research
- e. Block chain
- f. Biometrics
- g. Genetically modified plants, such as crops, fruits and vegetables
- h. Advanced "biofuels" (for example, cellulosic ethanol, bio-jet fuel, renewable natural gas)
- i. Renewable chemicals made from waste carbon dioxide or biomass energy
- j. Genetically modified animals
- k. 5G wireless technology

Improve way of life	3
No effect	2
Make things worse	1
Prefer not to say	9
I don't know	6

Module 2: Biofuels/bioproducts

This part of the survey focuses on bio-based fuels, or biofuels. Biofuels use biological materials such as plants, wood and waste to produce fuels that can be used for cars, trains, airplanes, or to heat and power buildings.

BF1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with biofuels?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say [Do not read]	9

BF2. Where biofuels offer environmental benefits and income opportunities for farmers, how supportive or opposed are you of the following approaches (RANDOMIZE):

- biofuels made from crops that are also a source of food
- biofuels made from crops that cannot be used as food
- biofuels made from non-food crops grown on land that could also be used to produce food
- biofuels made from non-food crops grown on land that is of such a poor quality it cannot be used to grow food
- biofuels made from crop and agricultural waste that would otherwise be disposed of such as straw or husks

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say	9
I don't know	6

BF3. Other than for food and biofuels, agricultural crops can be used to make other kinds of bioproducts. Please indicate if you strongly support, somewhat support, somewhat oppose or strongly oppose the following potential applications (RANDOMIZE):

- a. Making bioproducts from food crops such as using corn to make food packaging or car parts.
- b. Making bioproducts from non-food crops such as using hemp to make clothing fibres.
- c. Making bioproducts from agricultural waste like straw or husk to make packaging, paper products or chemicals.

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say	9
I don't know	6

Module 3: Gene-editing

This part of the survey focuses on a new type of biotechnology called gene-editing. Gene-editing involves making small changes to a cell's gene structure and does not necessarily involve mixing together DNA from different species of plants or animals. Gene-editing is often used for medical and agricultural purposes.

GE1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with gene-editing?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say [Do not read]	9

GE2. Please indicate if you strongly support, somewhat support, somewhat oppose or strongly oppose the following ways in which gene-editing can be used. (Randomize)

- a. The use of gene-editing to improve plants, such as disease and drought resistance, with more precision and at less time and cost than is possible using conventional breeding techniques.
- b. The use of gene-editing in livestock to enhance animal welfare. For example, the use of gene-editing to create cattle that are born without horns and therefore do not need to undergo dehorning.
- c. Using gene-editing in livestock to improve animal health. For example, genetically modifying cattle to decrease their chances of getting certain diseases, like tuberculosis.
- d. The use of gene-editing to produce fish that grow faster than non-GE fish, potentially reducing the cost of production and costs of fish products to consumers. These fish would be grown in contained, land-based facilities.
- e. The use of gene-editing to create chemicals that can be used in the production of biofuels, which are known to produce fewer greenhouse gases when burned and are considered a more sustainable resource than traditional fuels.
- f. The use of gene-editing for medical purposes or to improve human health. **Randomly split examples – only show one:** For example, researchers are using gene-editing in experimental treatments for sickle-cell disease, which is a hereditary blood disease. / For example, researchers are using gene-editing in experimental treatments for certain types of cancer.

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say	9
I don't know	6

Rotate the next two questions, on risk and benefit – all need to be asked about both

GE3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think gene-editing is to society?

Substantial benefit	5
	4
Moderate benefit	3
	2
No benefit	1
Prefer not to say	9
I don't know	6

GE4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does gene-editing pose for society?

Substantial risk	5
	4
Moderate risk	3
	2
No risk	1
Prefer not to say	9
I don't know	6

Module 4: Cellular agriculture

We now have a few questions on cellular agriculture. Cellular agriculture involves making animal products such as meat, seafood, dairy, or leather from animal cell cultures instead of using live animals. By taking cells from an animal and growing them with nutrients, we can obtain products such as meat, leather and milk. Cellular agriculture also includes inserting DNA from an animal into a microorganism like yeast or fungi to make food ingredients like egg or milk protein.

CA1. Before participating in this survey, would you say you were very, somewhat, not very or not at all familiar with cellular agriculture?

Very familiar	4
Somewhat familiar	3
Not very familiar	2
Not at all familiar	1
Prefer not to say	9

CA2. Do you strongly support, somewhat support, somewhat oppose, or strongly oppose the following ways cellular agriculture can be used? [Randomize]

- To reduce the environmental impact of agriculture, this technique could be used to make food products such as meat, milk, or eggs without having to raise farm animals.
- Using microorganisms such as bacteria or fungi to recycle carbon dioxide (CO₂) out of the air to produce proteins as ingredients for human food.
- Growing skin cells from animals to produce materials such as leather.

Strongly support	4
Somewhat support	3
Somewhat oppose	2
Strongly oppose	1
Prefer not to say	9
I don't know	6

Rotate the next two questions, on risk and benefit – all need to be asked about both

CA3. Using a scale of 1-5, where 1 is no benefit and 5 is substantial benefit, how beneficial do you think cellular agriculture is to society?

Substantial benefit	5
	4
Moderate benefit	3
	2
No benefit	1
Prefer not to say	9
I don't know	6

CA4. Using a scale of 1-5, where 1 is no risk and 5 is substantial risk, how much risk does cellular agriculture pose for society?

Substantial risk	5
	4
Moderate risk	3
	2
No risk	1
Prefer not to say	9
I don't know	6

CA5. Do you strongly agree, somewhat agree, somewhat disagree or strongly disagree with the following statements regarding cellular agriculture? (Randomize)

- I am confident the government will ensure products of cellular agriculture, such as cheese, seafood or meat, are safe for people to eat.
- Food products made using cellular agriculture are as nutritious as food products taken from animals.
- Products made using cellular agriculture will help produce more food to feed a growing global population given the world's limited natural resources.

Strongly agree	4
Somewhat agree	3
Somewhat disagree	2
Strongly disagree	1
Prefer not to say	9
I don't know	6

(End of module rotation)

Module 5: Underlying attitudes

We have discussed various new technologies so far. This next section focusses on technology in general.

UA1. Please indicate whether you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with each of the following statements: (Rotate)

- a) Canada is among the world's leaders in the field of agriculture and food biotechnology research
- b) Canada should be among the world's leaders in the field of agriculture and food biotechnology research
- c) (SPLIT) These technologies are going to be developed somewhere in the world, so it is better that they be developed in Canada than somewhere else. / I would rather these technologies be developed somewhere else in the world, so we can dedicate our resources to other things and get the benefits of the technologies when others discover them.
- d) Canada's food production and distribution systems have faced certain challenges brought on by extreme events like global pandemics. Increasing the use of innovative agricultural technologies may help address these challenges.
- e) Although there may be some unknown risks, technologies like biotechnology are a part of the future, so all we can do is make sure that its uses are as safe as possible.
- f) Increasing the use of innovative agricultural technologies can help reduce Canada's greenhouse gas emissions and increase our chances of meeting our country's targets.
- g) Increasing the use of innovative agricultural technologies can help feed a growing global population while limiting the impact of food production on the environment.

Strongly agree	4
Somewhat agree	3
Somewhat disagree	2
Strongly disagree	1
Prefer not to say	9
I don't know	6

Demographic questions

The last few questions are strictly for statistical purposes. We remind you that all your answers remain completely confidential.

D1. What is the highest level of formal education that you have completed?

Grade 8 or less	1
Some high school	2
High school diploma or equivalent	3
Registered Apprenticeship or other trades certificate or diploma	4
College, CEGEP or other non-university certificate or diploma	5
University certificate or diploma below bachelor's level	6
Bachelor's degree	7
Post graduate degree above bachelor's level	8
Prefer not to say	9

D2. Which of the following categories best describes your total household income? That is, the total income of all persons in your household combined, before taxes.

Under \$20,000	1
\$20,000 to just under \$ 40,000	2
\$40,000 to just under \$ 60,000	3
\$60,000 to just under \$ 80,000	4
\$80,000 to just under \$100,000	5
\$100,000 to just under \$150,000	6
\$150,000 and above	7
Prefer not to say	9

D3. Were you born in Canada?

Yes	1
No	2
Prefer not to say	9

D4a. Do you identify as any of the following? [Select all that apply]

An Indigenous person, that is, First Nations, Métis or Inuk (Inuit) or Non-Status	1
A member of an ethno-cultural or a visible minority group	2
A member of the gender and/or sexual diverse community	3
None of the above	4
Prefer not to say [Do not read]	9

D4b. [If member of ethno-cultural or visible minority group] Of which ethno-cultural or visible minority group or groups are you a member? [Select all that apply]

White or Caucasian (for example, German, Irish, English, Italian, French, Australian, etc.)	1
South Asian (for example, East Indian, Pakistani, Sri Lankan, Bangladeshi, Nepalese, etc.)	2
Chinese	3
Black (for example, African American, Jamaican, Haitian, Nigerian, Ethiopian, Somalian, etc.)	4
Filipino	5
Hispanic, Latino or Spanish origin (for example, Mexican or Mexican American, Puerto Rican, Cuban, Salvadorian, Columbian, etc.)	6
Middle Eastern or North African (for example, Lebanese, Egyptian, Syrian, Moroccan, Algerian, etc.)	7
Southeast Asian (for example, Vietnamese, Cambodian, Malaysian, Laotian, etc.)	8
West Asian (for example, Iranian, Afghan, etc.)	9
Korean	10
Japanese	11
Other (Specify)	88
Prefer not to say	99

D5. Please indicate which of the following best describes where you live.

Near the center of a large city	1
In the suburbs of a large city	2
In a small city or large town	3
In a small town, or village	4
In a rural area, or remote village	5
Prefer not to say [DO NOT READ]	9

D6. [For respondents living outside Quebec or New Brunswick] Do you consider yourself to be a member of a Francophone minority community in your province or territory? A member of a Francophone minority community refers to Francophones who are outside of Quebec or New Brunswick.

Yes	1
No	2
Prefer not to say	9

D7. [For respondents living in Quebec] Do you consider yourself to be a member of an Anglophone minority community? A member of an Anglophone minority community refers to Anglophones who are living in the province of Quebec.

Yes	1
No	2
Prefer not to say	9

D8. For this study, a person with a disability is a person who has a long-term or recurring impairment such as vision, hearing, mobility, flexibility, dexterity, pain, learning, developmental, memory or mental health-related impairments which limits their daily activities inside or outside the home such as at school, work, or in the community in general. Do you consider yourself to be a person with a disability?

Yes	1
No	2
Prefer not to say	9

This concludes the survey. Your answers have been submitted. Thank you for your participation!

Focus Group Moderation Guide

Moderation Guide

AAFC

Innovative Agricultural Technologies

Introduction to Procedures (10 minutes)

Thank you all for joining this online focus group!

- Introduce moderator/firm and welcome participants to the focus group.
 - Thanks for attending.
 - My name is [INSERT MODERATOR NAME] and I work with Quorus Consulting, and we are conducting research on behalf of the Government of Canada.
 - Today we will be talking about innovations in the area of agriculture and we are quite eager to get your feedback. This topic is relevant to all Canadians so don't feel as though you need to be an expert in agriculture to participate.
 - The discussion will last approximately 90 minutes.
 - If you have a cell phone or other electronic device, please turn it off.
- Describe focus group.
 - A discussion group is a “round table” discussion, meaning we will discuss something and everyone has an equal chance to express an opinion. We may also be asking you to answer survey questions from time to time to help guide the discussion.
 - My job is to facilitate the discussion, keeping us on topic and on time.
 - Your job is to offer your opinions on the topics I'll be presenting to you tonight/today.
 - Your honest opinion is valued. There are no right or wrong answers. This is not a knowledge test.
 - Everyone's opinion is important and should be respected.
 - We want you to speak up even if you feel your opinion might be different from others. Your opinion may reflect that of other Canadians.
 - To participate in this session, please make sure your webcam and your microphone are on and that you can hear me clearly. If you are not speaking, I would encourage you to mute your line to keep background noise to a minimum...just remember to remove yourself from mute when you want to speak!

- We might use the chat function. [MODERATOR EXPLAINS HOW TO ACCESS THE ZOOM CHAT FEATURE DEPENDING ON THE DEVICE THE PARTICIPANT IS USING]. Let's do a quick test right now - please open the chat window and send the group a short message (for example, Hello everyone). If you have an answer to a question and I don't get to ask you specifically, please type your response in there. We will be reviewing all chat comments at the completion of this project.
 - Explanations.
 - Please note that anything you say during these groups will be held in the strictest confidence. We do not attribute comments to specific people. Our report summarizes the findings from the groups but does not mention anyone by name. Please do not provide any identifiable information about yourself.
 - The report can be accessed through the Library of Parliament or Library and Archives Canada.
 - Your responses will in no way affect your dealings with the Government of Canada.
 - The session is being audio-video recorded for report writing purposes / verify feedback. The recordings remain in our possession and will not be released to anyone, even to the Government of Canada, without your written consent.
 - Some of my colleagues involved in this project are watching this session and this is only so they can hear the comments first-hand.
 - Please note that I am not an employee of the Government of Canada and may not be able to answer questions about what we will be discussing. If questions do come up over the course of the group, we will try to get answers for you before we wrap up the session.
- Any questions?

Introductions: Let's go around – please tell us your name and a little bit about yourself, such as where you live, who lives with you, what you do for a living, etc.

Biotechnology – Initial Perceptions (10 minutes)

So throughout our discussion tonight, we will be touching on a few agricultural technologies. I just want to remind everyone that I'm simply looking for your general impressions around some of these technologies.

- **Show of hands:** First of all, who has heard of the word biotechnology?
- What first comes to mind when you hear the word 'biotechnology'? Do any examples come to mind?

Here is a description of biotechnology: **[Share on screen]**

Biotechnology is used in many areas, such as health, natural resources, manufacturing and agriculture. Biotechnology involves engineering living organisms, such as plants and animals, or parts of living organisms to produce useful products, such as, medicines or creating plants that are not affected by pests or insects.

- After hearing this definition, would you say you support or oppose using biotechnology to create products? Help me understand that position.
- Where have you been hearing about biotechnology? **Prompt as needed:** Internet, news media, certain organizations, family or friends, etc.

Biofuels (16 minutes)

Let's turn our attention to biofuels.

- What have you seen, read or heard about biofuels?

Here is a description of biofuels: **[Share on screen]**

Biofuels use biological materials such as plants, wood and waste to produce fuels that can be used for cars, trains, airplanes, or to heat and power buildings.

- Based on this description, how familiar would you say you are with biofuels?
- What do you see as some of the benefits of using biofuels as a source of energy? And what do you see as a disadvantage?
 - To what extent can using biofuels help Canada lower its greenhouse gas emissions? Is this a good reason to increase Canada's use of biofuels?

There are numerous natural sources that can be used to make biofuels. I am going to put up on the screen different ways of making biofuels. I want you to tell me if you support or oppose each of them and why.

Thumbs up/down/flat hand

Moderator to show each statement one at a time

- f) biofuels made from crops that are also a source of food – an example would be ethanol which can be made from corn or sugarcane
- g) bioproducts made from crops that are normally not used as food [**Example if needed:** such as using hemp for clothing]
- h) biofuels made from non-food crops grown on land that could also be used to produce food
 - i. **Explore thumbs down in detail:** When would this approach be okay and when would it not be okay? Why do you think that?
- i) biofuels made from non-food crops grown on land that is of such a poor quality it cannot be used to grow food
- j) biofuels made from crop and agricultural waste that would otherwise be disposed of such as straw or husks

Gene-editing (15 minutes)

Let's discuss another topic related to biotechnology, which is gene-editing.

- What have you seen, read or heard about gene-editing?

Here is a description of gene-editing: **[Share on screen]**

Gene-editing involves making small changes to a cell's gene structure and does not necessarily involve mixing together DNA from different species of plants or animals. Gene-editing is often used for medical and agricultural purposes.

- And in general, do you support or oppose the use of gene-editing?

There are numerous ways in which gene-editing can be used. Please tell me if you support or oppose the following ways of using gene-editing, and why you feel that way. **Thumbs up/down/flat hand**

Moderator to show each statement one at a time

- e) For medical purposes to improve human health (gene-editing in experimental treatments for cancer or sickle-cell disease).
- f) To improve animal health or welfare
- g) To improve plants, such as disease and drought resistance
- h) To help the food production system lessen its impact on the environment

- **As applies:** In the list of gene-editing applications, some of you seemed more open to the idea of using gene-editing to improve plants than using gene-editing to improve animal health or welfare. Help me understand this a bit more.

I would like to understand the extent to which you think gene editing might be a benefit or a risk to our society:

- What do you think are the major risks of gene-editing, if any?
- What do you think are the benefits of this kind of research, if any?
- Do you have any ethical concerns with gene-editing? In what ways?
- Overall, which of the following best captures your views about gene-editing? **[Share on screen – quick vote in the chat]**
 - a. I approve of the use of gene-editing as long as the usual levels of government regulations and controls are in place.
 - b. I approve of the development of gene-editing if it is tightly controlled and regulated.
 - c. I do not approve of gene-editing except under very special circumstances.
 - d. I do not approve of gene-editing under any circumstance.

Cellular Agriculture (15 minutes)

Let's consider another topic: cellular agriculture.

- What have you seen, read or heard about cellular agriculture?

Here is a description of cellular agriculture: **[Share on screen]**

Cellular agriculture involves making animal products such as meat, seafood, dairy, or leather from animal cell cultures instead of using live animals. By taking cells from an animal and growing them with nutrients, we can obtain products such as meat, leather and milk. Cellular agriculture also includes inserting DNA from an animal into a microorganism like yeast or fungi to make food ingredients like egg or milk protein.

- Broadly speaking, do you support or oppose the use of cellular agriculture for making products that traditionally would have come from animals?

There are numerous ways in which cellular agriculture can be used. Please tell me if you support or oppose the following applications, and why you feel that way. **Thumbs up/down/flat hand**

Moderator to show each statement one at a time

- d. To reduce the environmental impact of agriculture, this technique could be used to make food products such as meat, milk, or eggs without having to raise farm animals.
- e. To help preserve our aquatic ecosystems, this technique could be used to grow cellular versions of fish and seafood products.
- f. Growing skin cells from animals to produce materials such as leather.

I would like to understand the extent to which you think cellular agriculture might be a benefit or a risk to our society:

- What do you think are the major risks of cellular agriculture, if any?
- What do you think are the benefits of cellular agriculture, if any?
- Do you think food products such as meat, milk, and eggs created with cellular agriculture are **safe** for consumption? Why or why not?
 - Do you think they are as **nutritious** as when they come directly from animals? Why or why not?
- Do you think food products made using cellular agriculture should be labelled to show they were produced differently from traditional animal farming?

Agricultural Technologies – General Views (10 minutes)

[Share list of three technologies]

- We have discussed these three agricultural technologies throughout the session – which ones do you feel hold the most promise in terms of benefiting you personally or benefiting society / “the world” moving forward? In what ways?
- **Time permitting:** What would be the one thing you would like to know more about regarding the agricultural technologies we discussed tonight? If you could have a conversation with a group of experts in this area, what questions would you want to ask them?
 - Who would you trust to answer those questions?

Regulation of Biotechnology (8 minutes)

- How **knowledgeable** would you say you are in the safety and regulation governing biotechnology in general and the three specific technologies we’ve discussed tonight? Why do you say that?
- How **confident** would you say you are in the safety and regulations governing biotechnology? Why do you say that?
 - What is your level of confidence based on exactly? ...what signals or type of information do you use to establish how confident you feel regarding the regulation of biotechnology in Canada?
 - Is your confidence in the regulatory system lower or higher than in the past? Help me understand that shift.
- What would help increase your confidence in the regulatory system?

Impact of Pandemic (5 minutes/time permitting)

To wrap things up, I’d like to better understand if any aspect of the pandemic has had an impact on the biotechnology-related topics we’ve discussed tonight. Any thoughts?

- Has the COVID-19 pandemic influenced **how you feel about the use** of biotechnology?
- Has the pandemic changed your **receptiveness** to biotechnology in any way?
- Has it had any impact on your views of **how biotechnology is regulated** in Canada?

- Has it had any impact on **the role the Government of Canada plays or the level of trust you have in the government** when it comes to biotechnology?

If needed: When it comes to using biotechnology and the regulations involved, does it make a difference to you whether we are talking about food or whether we are talking about drugs such as vaccines?

Wrap-up (1 minute)

Thanks again! The team that invited you to participate in this session will contact you regarding the manner in which you can receive the incentive we promised you.

Thank you – have a nice evening!

Focus Group Recruitment Screener

2021-22 Consumer Attitudes Towards Innovative Agricultural Technologies Focus Groups English Recruitment Screener

Summary

- Recruit 8 participants for each group for 6 to 8 to show.
- Participants must be at least 18 years of age, with groups segmented by age group (excluding OLMC groups)
- Good mix of demographics in each group, as appropriate
- Participants to be paid \$100

Location	Language	Segment	Recruit	Participate
Ontario / Nunavut	English	18 to 34	8	6 to 8
		35+	8	6 to 8
Quebec	French	18 to 34	8	6 to 8
		35+	8	6 to 8
Atlantic	English	18 to 34	8	6 to 8
		35+	8	6 to 8
West Canada / Yukon / Northwest Territories	English	18 to 34	8	6 to 8
		35+	8	6 to 8
OLMC in Quebec	English	18+	8	6 to 8
OLMC in Ontario	French	18+	8	6 to 8
Total	-	-	80	60 to 80

All times are stated in local area time unless specified otherwise.

Group 1
Ontario / Nunavut
Young Adults (18 to 34)
December 8
5:30 pm EST

Group 2
Ontario / Nunavut
Adults (35+)
December 8
7:30 pm EST

Group 3 [French]
Quebec
Young Adults (18 to 34)
December 9
5:30 pm EST

Group 4 [French]
Quebec
Adults (35+)
December 9
7:30 pm EST

Group 5
Quebec
OLMC (18+)

December 13
5:30 pm EST

Group 6 [French]
Ontario
OLMC (18+)

December 13
7:30 pm EST

Group 7
Atlantic
Young Adults (18 to 34)

December 14
5:30 pm AST

Group 8
West Canada / Yukon /
Northwest Territories
Young Adults (18 to 34)

December 14
5:00 pm PST

Group 9
Atlantic
Adults (35+)

December 15
5:30 pm AST

Group 10
West Canada / Yukon /
Northwest Territories
Adults (35+)

December 15
5:00 pm PST

A. Introduction

Hello/Bonjour, my name is [Name] and I am with Quorus Consulting Group, a Canadian market research company. We're planning a series of online discussion groups on behalf of the Government of Canada with people in your area. Would you prefer to continue in English or French? / Préférez-vous continuer en anglais ou en français?

[Interviewer note: for English groups, if participant would prefer to continue in French, please respond with, "Malheureusement, nous recherchons des gens qui parlent anglais pour participer à ces groupes de discussion. Nous vous remercions de votre intérêt." For French groups, if participant would prefer to continue in English, please respond with, "Unfortunately, we are looking for people who speak French to participate in this discussion group. We thank you for your interest."]

[Interviewer note 2: During the recruiting, if someone from a region outside Ontario or Quebec asks to participate in French, efforts will be made to include them in a group in their preferred language in the nearest time zone to where they live. Anglophones in Quebec and Francophones in Ontario should be considered for the OLMC session in their respective provinces.]

As I was saying – we are planning a series of online discussion groups on behalf of the Government of Canada with people in your area. This is for the purpose of understanding Canadians' opinions on various issues of importance to the country, including emerging technologies and food production. The groups will last up to one and a half hours (90 minutes) and people who take part will receive a cash gift to thank them for their time.

Participation is completely voluntary. We are interested in your opinions. No attempt will be made to sell you anything or change your point of view. The format is a group discussion held using an online web conferencing platform called Zoom, led by a research professional with about six to eight other participants invited the same way you are being invited. All opinions will remain anonymous and will be used for research purposes only in accordance with laws designed to protect your privacy.

[Interviewer note: if asked about privacy laws, say: "The information collected through the research is subject to the provisions of the *Privacy Act*, legislation of the Government of Canada, and to the provisions of relevant provincial privacy legislation. For more information about our privacy practices, please contact Agriculture and Agri-Food Canada's public opinion research unit"]

1. Before we invite you to attend, we need to ask you a few questions to ensure we get a good mix and variety of people. This will take 5 minutes. May I ask you a few questions?

Yes **Continue**

No **Ask if anyone else in the household might be interested. If not, Thank and terminate**

B. Qualification

2. We are looking to include people of various ages in the group discussion. May I have your age please?

Record age: _____

Age	Group	Recruitment specifications
18 to 34	Young adult groups	Under 18 Thank/terminate 18 to 24 } 25 to 34 } Mix of ages (aim for 50/50 split between age groups)
35+	Adult groups	35 to 44 } 45 to 54 } 55 to 64 } 65 to 74 } 75+ } Mix of ages
18+ (Groups 5 and 6)	OLMC groups	Under 18 Thank/terminate Recruit mix of ages 18+

3. **[Confirm with respondent]** In which province or territory do you live?

Alberta	1
British Columbia	2
Manitoba	3
New Brunswick	4
Newfoundland and Labrador	5
Northwest Territories	6
Nova Scotia	7
Nunavut	8
Ontario	9
Prince Edward Island	10
Quebec	11
Saskatchewan	12
Yukon	13

4. **[For respondents living in Ontario]** Do you consider yourself to be a member of a Francophone minority community? A member of a Francophone minority community refers to Francophones who are outside of Quebec or New Brunswick.

Yes	1
No	2
Prefer not to say [do not read]	3

5. **[For respondents living in Quebec]** Do you consider yourself to be a member of an Anglophone minority community? A member of an Anglophone minority community refers to Anglophones who are living in the province of Quebec.

Yes	1
No	2
Prefer not to say [do not read]	3

6. Do you or any member of your household work for... **[Read list – select all that apply]**

a marketing research or advertising firm?	1
a magazine or newspaper?	2
a radio or television station?	3
a public relations company	4
the government, whether federal, provincial, or municipal?	5
the agriculture sector (for example, farming, food/crop production, etc.)?	6

If “Yes” to any of the above, thank and terminate

7. What is your gender identity? [If you do not feel comfortable disclosing, you do not need to do so] **[Do not read list]**

Male	1
Female	2
Transgender Male	3
Transgender Female	4
Non-Binary	5
Prefer to self-describe, please specify: _____	6
Prefer not to say	7

Aim for 50/50 split of male and female, while including other gender identities as they fall

8. Do you currently live in... **[Read list]**

A city or metropolitan area with a population of at least 100,000	1
A city with a population of 30,000 to 100,000	2
A city or town with a population of 10,000 to 30,000	3
A town or rural area with a population under 10,000	4

For each group, recruit a mix of individuals who live in a city or town with a population of at least 30,000 and those who live in smaller towns/rural (max of 2/8 from small town/rural)

9. Do you identify as any of the following? **[Read list]**

An Indigenous person (First Nations, Inuit or Métis)	1
A member of an ethnocultural or a visible minority group other than an Indigenous person	2
None of the above	3

Ensure some representation of visible minorities in each session and approximately 6 to 8 Indigenous across all sessions

10. What is your current employment status?

Working full time	1
Working part time	2
Self employed	3
Unemployed	4
A student	5
Retired	6
Homemaker	7
Other	8
Don't know/Prefer not to say [Do not read]	9

Ensure good mix per group

11. What is the last level of education that you completed?

Some high school only	1
Completed high school	2
Some college/university	3
Completed college/university	4
Post-graduate studies	5
Don't know/Prefer not to say	6

Ensure good mix per group

12. Generally speaking, how familiar are you with agricultural practices and technologies?

Not at all	1
Not very	2
Somewhat	3
Very	4
Don't know/Prefer not to answer	5

Ensure at least 2 participants in each group feel they are either very or somewhat familiar

13. Have you participated in a discussion or focus group before? A discussion group brings together a few people in order to know their opinion about a given subject.

Yes	[Recruit max ½ per group]	1
No	[Skip to q16]	2

14. When was the last time you attended a discussion or focus group?

If within the last 6 months	[Thank and terminate]	1
If not within the last 6 months	[Continue]	2
Don't know/Prefer not to say	[Thank and terminate]	3

15. How many of these sessions have you attended in the last five years?

If 4 or less	[Continue]	1
If 5 or more	[Thank and terminate]	2
Don't know/Prefer not to say	[Thank and terminate]	3

16. Participants in group discussions are asked to voice their opinions and thoughts, how comfortable are you in voicing your opinions in front of others? Are you... **[Read list]**

Very comfortable	[Minimum 4 per group]	1
Fairly comfortable	[Continue]	2
Comfortable	[Continue]	3
Not very comfortable	[Thank and terminate]	4
Very uncomfortable	[Thank and terminate]	5
Don't know/Prefer not to say	[Thank and terminate]	6

17. This research will require participating in a video call online. Do you have access to a computer, smartphone or tablet with high-speed internet which will allow you to participate in an online discussion group?

Yes	[Continue]	1
No	[Thank and continue]	2

18. Does your computer, smartphone or tablet have a camera that will allow you to be visible to the moderator and other participants as part of an online discussion group?

Yes	[Continue]	1
No	[Thank and terminate]	2

19. Sometimes participants are asked to read text, review images, or write out answers during the discussion. Is there any reason why you could not participate?

Yes	[Continue]	1
No	[Go to invitation to participate]	2
Don't know/Prefer not to say	[Thank and terminate]	3

20. **[Ask if yes to q19]** Do you require accommodations or assistance in order to participate in the focus group?

Yes	[Continue]	1
No	[Thank and terminate]	2
Don't know/Prefer not to say	[Thank and terminate]	3

21. **[Ask if yes to q20]** What specifically? **[Open end]** _____

C. Invitation to Participate

I would like to invite you to participate in an online focus group session where you will exchange your opinions in a moderated discussion with other Canadians from your community. The discussion will be led by a researcher from the national public opinion research firm, Quorus Consulting. The session will be recorded but your participation will be confidential. The group will be hosted using an online web conferencing platform, taking place on **[day of week], [date], at [time]**. It will last one and a half hours (90 minutes). People who attend will receive \$100 to thank them for their time.

22. Would you be interested in taking part in this study?

Yes	[Continue to privacy questions]	1
No	[Thank and terminate]	2

Privacy questions

Now I have a few questions that relate to privacy, your personal information and the research process. We will need your consent on a few issues that enable us to conduct our research. As I run through these questions, please feel free to ask me any questions you would like clarified.

23. First, we will be providing a list of respondents' first names and profiles (screener responses) to the moderator so that they can place you in a group. Do we have your permission to do this? I assure you it will be kept strictly confidential.

Yes	[Go to q24]	1
No	[Read respondent info below and go to q23a]	2

We need to provide the first names and background of the people attending the focus group because only the individuals invited are allowed in the session and this information is necessary for verification purposes. Please be assured that this information will be kept strictly confidential. **[ask Q23A]**.

- 23A. Now that I've explained this, do I have your permission to provide your first name and profile?

Yes	[Go to q24]	1
No	[Thank and terminate]	2

24. A recording of the group session will be produced for research purposes. The recordings will be used by the research professional to assist in preparing a report on the research findings and may be used by the Government of Canada for internal reporting and analysis purposes.

Do you agree to be recorded for research and reporting purposes only?

Yes	[Go to q25]	1
No	[Read respondent info below and go to q24a]	2

It is necessary for the research process for us to record the session as the researchers need this material to complete the report and the Government of Canada may need them for their own analysis purposes and to help inform their communications plan/approach. **[ask 24a]**.

- 24A. Now that I've explained this, do I have your permission for recording?

Yes	[Go to q25]	1
No	[Thank and terminate]	2

25. Employees from the Government of Canada may also be online to observe the groups.

Do you agree to be observed by employees of the Government of Canada?

Yes	[Thank and go to invitation]	1
No	[Read respondent info below and go to q25a]	2

It is standard research practice to invite clients to observe the groups online. They will be there simply to hear your opinions firsthand although they may take their own notes and confer with the moderator on occasion to discuss whether there are any additional questions to ask the group. **[Ask 25a]**.

25A. Do you agree to be observed by employees of the Government of Canada?

Yes	[Thank and go to invitation]	1
No	[Thank and terminate]	2

Full invitation and focus group information

Thank you. We would like to invite you to attend one of the online discussion groups, which will be led by a researcher from the national public opinion research firm, Quorus Consulting Group. The group will take place on **[day of week]**, **[date]**, at **[time]** and it will last one and a half hours (90 minutes). Following your participation, you will receive \$100 to thank you for your time.

26. Are you interested and available to attend?

Yes	[Continue]	1
No	[Thank and terminate]	2

To conduct the session, we will be using a screen-sharing application called Zoom. **We will need to send you by email the instructions to connect.** The use of a computer or tablet is preferred, and you should find a quiet room.

We recommend that you click on the link we will send you a few days prior to your session to make sure you can access the online meeting that has been setup and repeat these steps at least 10 to 15 minutes prior to your session.

As we are only inviting a small number of people to attend, your participation is very important to us. If for some reason you are unable to attend, **you cannot send someone to participate on your behalf** - please call us so that we can get someone to replace you. You can reach us at **[insert number]** at our office. Please ask for **[insert name]**.

So that we can contact you to remind you about the focus group or in case there are any changes, can you please confirm your name and contact information for me? **[Read info and change as necessary.]**

First name _____

Last Name _____

Email _____

Day time phone number _____

Night time phone number _____

Thank you!

If the respondent refuses to give his/her first or last name or phone number, please assure them that this information will be kept strictly confidential in accordance with the privacy law and that it is used strictly to contact them to confirm their attendance and to inform them of any changes to the focus group. If they still refuse Thank and terminate.

27. Do you consent to being contacted again for validation and confirmation purposes?

Yes **[Thank and recruit participant]** 1

No **[Thank and terminate]** 2