

Consumer Perceptions and Knowledge of Genetically Modified Organisms in Belgium:
A Case Study of the Potato Event

An Undergraduate Honors Thesis

in the

Agricultural Education, Communications and Technology Department

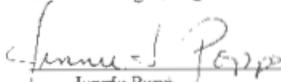
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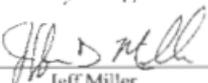
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**Consumer Perceptions and Knowledge of Genetically Modified Organisms in Belgium:
A Case Study of the Potato Event**

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Consumer Perceptions and Knowledge of Genetically Modified Organisms in Belgium: A Case Study of the Potato Event

Abstract

It is widely known that Europeans have the strongest resistance to genetically modified organisms (GMO). Despite biotechnology advancements in the United States and other countries, European Union (EU) policymakers continue to argue over market-driven GMO regulations. Because humans depend on agriculture for survival, they tend to be concerned with the fundamental risk of combining agricultural production and scientific/technological advancements. In 2011, scientists at a large research institution in Belgium planted a field trial of GM potatoes (during this time GM foods were not in the market). On May 29, an activist group arrived at the field and uprooted the potatoes. The event resulted in scientific damage, media coverage, a court trial for defacing government property, and mixed perceptions among the public. This study examined the perceptions, knowledge, and awareness of GMOs among a purposive sample of Belgian public to determine the need for various educational programs concerning GMOs. Ten emergent themes occurred: 1) variation in GMO definitions; 2) concerns about potential economic risks; 3) concerns about potential environmental risks; 4) media influence; 5) government involvement; 6) public perceptions/opinions; 7) potato event impact; 8) perception of medical biotechnology; 9) awareness of GM food; and 10) concerns about potential health risks. All respondents recognized that a GMO was genetically engineered for a specific purpose such as higher yield, lower costs, and less negative environmental impact. Many respondents noted the main reason behind the activist actions was fear of monopolistic corporations. Respondents were more concerned with economic effects of GMOs than environmental or health risks. Respondents also expressed the need for more scientific

communication. This study brings a clearer understanding of consumer perceptions of GM technology and food in Belgium, which can be pivotal to understand if Europe fully embraces GM technology in the future. These findings support the conclusion that educational campaigns and programs about GMOs will provide the primarily urban Belgian public with objective knowledge to guide perceptions, knowledge, and awareness of GMOs.

Literature Review

Despite biotechnology advancements in the United States and other countries, European Union (EU) policymakers continue to argue over market-driven genetically modified organism (GMO) regulations. Because humans depend on agriculture for survival, they tend to be concerned with the fundamental risk of combining agricultural production and scientific/technological advancements, such as genetic engineering. In 2011, scientists at a large research institution in Belgium planted a field trial of GM potatoes (during this time GM foods were not in the market) engineered for resistance to the potato late blight disease. On May 29, an activist group arrived at the field and uprooted the potatoes. The event resulted in scientific damage, media coverage, a court trial for defacing government property, and mixed perceptions among the public.

Genetically Modified Organism

“Genetically modified products are products of modern biotechnology that are created by transferring a gene from one species (plant) to another in order to produce a product with a new desirable trait” (Skogstad, 2011, p. 901).

One of today’s most controversial biotechnology policy issues involves the development and consumption of genetically modified (GM) foods. With many

developing nations already struggling to meet their citizens' food and nutritional needs, with global populations slated to increase by 50 percent between now and 2050, and with concerns rising regarding how these needs can be met without causing large-scale environmental problems, GM foods have attracted growing attention over the past two decades. (Durant & Legge, 2010, p. 59)

Many would be surprised to consider Belgium as the forefront of GM plant technology; however, Gent University researchers developed the first GM plant in 1983 (de Krom, Dessein, & Erbout, 2013). Belgian field trials were conducted from 1987-2002, until "the government declined such [authorizations] in three cases, despite positive advices from the (then ad interim) Biosafety Advisory Council (BAC) that is assigned biosafety assessments of genetically modified organisms (GMOs)" (de Krom et al., 2013, p. 2-3). Field trials were no longer administered in Belgium beginning in 2003.

Public Perceptions of GMOs

Despite the United States' and other countries biotechnology advancements, European Union (EU) policy makers still argue over the regulation of genetically modified organisms (GMOs) into the market. Although the issue is visible on a political and social level, the slow decision-making process has caused uncertainty among the European public (Drott, Jochum, Lange, Sklerka, Vach, & van Asselt, 2013). Although the rapid advancement in agricultural biotechnology has led to public controversy over the ethics and regulation event in the US (Davis, Payson, & Irani, 2002), controversy is still strongest among the European public. Perceptions of GMOs influence the consumer's purchasing choice. A study by Irani, Sinclair, and O'Malley (2001) found that respondents' consideration to purchase GMOs depended on their gender, ethnic background, and geographic location. This study also found that subjects

residing in rural areas were more likely to consider buying GMOs than respondents in urban areas (Irani et al., 2001). Similarly, a study of high school student knowledge and perception of agriculture found that respondents from rural areas had significantly higher agricultural knowledge than respondents from urban areas (Frick, Birkenholz, Gardner, Machtmes, 1995). Plonski (2008) recommended agricultural education programs to inform urban students about the rural, agricultural sectors of Europe and agricultural biotechnology. According to data from the World Bank, in 2012, the percentage of rural population in Belgium was 2.49% (Trading Economics, 2013).

Biotechnology and Risk

“Risk is often a product of advances in science and technology” (Abrams & Meyers, 2010, p. 7). Science and technology have caused significant advances in agricultural production and other industries to improve the quality of life for citizens in the United States and other countries, but the advancements were not made without initial risk. Although advancements in science and technology aim to improve life quality and productivity, uncertain consequences categorize such advancements as risky (Hardaker, Huirne, Anderson & Lien, 2004).

“Agricultural production is a risky endeavor” (Abrams & Meyers, 2010, p. 6). Agricultural production risks can include environmental issues, technology experiments, and food safety matters. Uncertain consequences cause high opposition from the public because they “are usually associated with large-scale, long-term, and transboundary hazards with which society has no or only limited experience” (Drott et al., 2013, p. 1123). Many European policy makers and public consumers are concerned about GMO effects on the environment, economy and human health. “As it is contested whether GMOs constitute a risk to the environment and/or human health, scholars have pointed out that GMOs should be conceived of in terms of uncertainty”

(Drott et al., 2013, p. 1123). Economic risks from introducing GMOs are another concern for European policy makers; however, previous studies show economic benefits of GMOs for farmers. Surveys gathered by Carpenter (2010) found that farmers received direct benefits from growing GM crops. “Results from 12 countries indicate, with few exceptions, that GM crops have benefitted farmers. The benefits, especially in terms of increased yields, are greatest for the mostly small farmers in developing countries” (Carpenter, 2010, p. 319). Another study by Brookes and Barfoot (2013) found that “GM technology has had a significant positive impact on farm income derived from a combination of enhanced productivity and efficiency gains” (p. 9).

During risk situations, governors (or rulers) usually spend their time closed to the public, leading to the public’s suspicion and resentment of hidden information (Jacob & Schiffino, 2011). Research by Jacob and Schiffino (2011) was shaped by the foundation that a democracy and its public policy depend on the unified stance, or opinion, of the public, and argues “how contemporary democracies can regulate risk issues within a representative model including participatory processes” (p. 991). This foundation follows the belief that risk management decision-making is defined first at the democratic level (Jacob & Schiffino, 2011). If citizens are addressed before a potential risk is taken in agricultural production methods, less negative feedback will occur during an experiment, trial, or test.

Since the acceptability of GMOs is inconsistent in the EU, and in particular, Belgium, GMO issues can easily become a crisis. A crisis occurs when an issue becomes lethal among society; that is, when different subject groups in a society have different perceptions of truth amidst a chaotic situation. After illegal action by Belgian citizens in revolt to field-testing genetically modified (GM) potatoes, communication in regards to preventing a societal crisis has

a stronger influence. “Nowadays, citizens are consulted before field trials are carried out in Europe and, therefore, in Belgium” (Jacob & Schiffino, 2011, p. 989).

Policy Decision Impact on the Public

The lack of a unified stance between policy-makers in Belgium and the EU is directly reflected in the opinion of the public (Jacob & Schiffino, 2011). Through survey research, Jacob and Schiffino (2011) found that the internal uneasiness of Belgium citizens about GMOs portray a negative attitude toward their possible regulation. The public’s perception of the trustworthiness of the national and transnational governments and the large-scaled EU government—rather than fear of potential health and environmental risks—could be the main factor in resistance to GM food products. “Hence, GMO regulation is in need of adequate mechanisms ensuring that decision-makers justify and account for their behavior” (Drott et al., 2013, p. 1124). A study by Klerck and Sweeney (2007) measured the effect of the two knowledge types on GMO perceptions, explaining that subjective knowledge is “a person’s perception of the amount of information about a product class stored in his or her memory” and objective knowledge is “the actual amount of accurate information stored in his or her memory” (p. 174). Klerck and Sweeney’s (2007) study found that consumers relying on objective knowledge were less prone to performance and psychological risk when making decisions regarding GM food than the consumers relying on subjective knowledge. Notably, Durant and Legge (2010) tested and refined the hypothesis that individuals rely upon emotion rather than fact when faced with a decision about GMOs.

Public Perceptions of Medical Biotechnology

Maesele and Schuurman (2008) cited survey results, performed by Claeys et al. (2004) van Brabander (2003), and Devos et al. (2008), in Belgium which assessed perceptions regarding

biomedical biotechnology, reproductive cloning, and agricultural biotechnology. Biomedical technology was positively accepted, reproductive cloning was absolutely dismissed, and agricultural biotechnology was “shrouded with controversy with agricultural applications dividing the public” (Maesele & Schuurman, 2008, p. 443). Maesele and Schuurman (2008) noted that recent and former surveys confirmed the consistent popularity of biomedical technology among Belgians and the lack of the same feelings toward agricultural biotechnology. This leads to questioning if Belgians have both an awareness for and understanding of the risks and side effects of new biomedical treatments and agricultural biotechnology, which appears to be common knowledge among the public. Jacob and Schiffino (2011) used the word “disenchantment” (p. 987) to describe the Belgian citizens’ views on knowledge of GMOs. Maesele and Schuurman (2008) found environmental and social movement groups to be the cause of negative perception among biotechnology because they are the largest media source. These groups are responsible for “emphasizing risks and for a negative evaluation of this application” (Maesele & Schuurman, 2008, p. 464.). As a result, the public is caught between these organizations and the scientists themselves (Maesele & Schuurman, 2008), creating potential confusion, tension, and ignorance.

GMO Regulation in the EU and Belgium

Over 500 million consumers are represented within the EU member states and 10.4 million of those consumers are Belgian. The EU does not have an outright ban on the cultivation and placing on the market of GM food or feed (although a member state can create its own ban). Instead, the European Parliament and Council have established a legal framework to regulate GM food and feed and to ensure the development of modern biotechnology takes place under safety regulations. This framework covers GMO experimental release into the environment,

placement on the market for food or feed, movement between member states and exports, and labeling and traceability requirements (ECARD, 2013). Traceability is the tracking of GMOs and GMO-produced food or feed at all stages of the supply chain, using labeling and monitoring potential health and environmental effects. This tracking system provides the process by which products can be withdrawn if any unexpected risk is detected. EU traceability requirements enlist all operators involved, such as anyone introducing a product to the supply chain or receiving such a product (farmers, producers, etc.), to identify the supplier and the company supplying the product. Conventional products (those produced without GM) that may unintentionally contain traces of GMOs due to cross-pollination or an unavoidable mix of GM and non-GM during harvesting, storage, transport or processing are exempt from this rule. To be included in this exemption, the traces of GMOs in conventional products must fall under 0.9% (ECHC, n.d.a).

A member state can create a safeguard clause to ban GMO use within its borders once approved by the European Commission. “According to this clause, Member States may provisionally restrict or prohibit the use and/or sale of the GM product on its territory. However, the Member State must have justifiable reasons to consider that the GMO in question poses a risk to human health or the environment” (ECHC, n.d.b, para. 1). Only six member states currently apply safeguard clauses (Austria, France, Greece, Hungary, Germany, and Luxembourg). Since February 2005, Belgium has followed the European legislation Directive 2001/18/EC that does not ban GMOs but only serves to protect citizen’s health and the environment when releasing GMOs into the environment or placing them on the market (Belgian Biosafety Server, 2009).

In 2010, the European Commission published a book of results of research on GM crops, which received €200 million in funding from the EU. The EU press release claimed, “According

to the projects' results, there is, as of today, no scientific evidence associating GMOs with higher risks for the environment or for food and feed safety than conventional plants and organisms” (ECPR, 2010, para. 4). Over €300 million has been invested by the Commission since 1982 for the research of GMOs.

Media Review

Europeans have the strongest opposition to GM foods (Durant & Legge, 2010). The anti-GM food campaigns strongly communicate health concerns of their argument:

Most prominent among those risks for humans are the disruption or silencing of existing genes, activation of silent genes, modification in the expression of existing genes, and formation of new or altered patterns of metabolites. Hypothesized as well are the creation of new allergies or harmful toxins that the body is ill-prepared to handle, causing sickness and death among vulnerable populations. Anti-GM food activists also posit that a rise in antibiotic resistance in humans could occur as a result of gene splicing. (Durant & Legge, 2010, p. 60)

Activist groups can strongly influence subjective knowledge, but Klerck and Sweeney (2007) credited the media for causing most of the fear toward GMOs among consumers. A study by Vestal and Briers (2000) gathered information on the knowledge, attitudes and perceptions of metropolitan journalists concerning GMOs, and found that the level of knowledge about GM technology was low. However, “journalists’ level of acceptance of biotechnology increased among journalists with greater perceived level of scientific knowledge” (Vestal & Briers, 2000, p. 142). According to Vestal and Briers (2000), agricultural communicators and extension educators should create an educational environment of biotechnology information that is attractive to journalists. The need for educational campaigns, programs, and environments is

relative to how the mass media presents GMO issues. Klerck and Sweeney's (2007) study showed "accusations leveled against it [GM technology] by the mass media are not grounded in fact and these media rarely communicate the many benefits of GM foods to the public" (Klerck & Sweeney, 2007, p. 175).

Mass communication has been referred to as mass education (McQuail, 2005). As codes of ethics were adopted in journalism in the early twentieth century, so was the popular idea that media "could be a potent force for public enlightenment, supplementing and continuing the new institutions of universal schooling, public libraries and popular education" (McQuail, 2005, p. 52). Political figures began using media to communicate campaigns, but it led to the rise of political harms such as "violent political protest and demonstration, xenophobia, and even the supposed decline of democracy and rise of political apathy and cynicism" (McQuail, 2005, p. 53).

The functionalist theory describes the media as an outlet for communication to serve the society in relation to the environment and culture. The media functions in society include "providing information about events and conditions in society and the world" (McQuail, 2005, p. 97) and "providing support for established authority and norms" (McQuail, 2005, p. 98).

A media frame is how an issue is interpreted and presented by a media outlet to the public (Irlbeck, 2009). Maesele and Schuurman (2008) defined framing in the media as "being able to prominently display your preferred frame relative to rival frames" (p. 438). Media has the ability to not only reflect, but shape, power (Maseele & Schuurman, 2008). Issues such as those related to GMOs are likely to be strongly framed by the media because they are considered political, ethical, economical, and environmental issues. "Frames construct meanings that, in turn, serve certain interests. Frame sponsorship and framing contests are shaped by the

distribution of economic, political, and cultural resources, and are related to questions of social and political power” (Maseele & Schuurman, 2008, p. 438). Maseele and Schuurman (2008) explained the difference in prospective-framed biomedical biotechnology and concerned-framed agricultural biotechnology: “Biomedical biotechnology is represented as beneficial and a matter of progress, while agricultural biotechnology is represented as more problematic and risky, still a matter of economic prospects, but also increasingly of public accountability” (p. 440).

Potato Event in Belgium

In 2011, Belgian scientists at a large research institution, in conjunction with two Belgian universities and a Flemish biotechnology institution, planted a field trial of GM potatoes engineered for increased resistance to late blight potato disease (*Phytophthora infestans*). This was the first GM crop field trial in Belgium since 2003. This group of consortium scientists created and administered the trial, aiming to “assure that the trial results would be socially relevant within a Belgian context” (de Krom et al., 2013, p. 4). On May 29, 2011 an activist group called “Belgian Field Liberation Movement” arrived at the field in Wetteren and destroyed the potatoes. Prior to the event, consortium scientists and the government proposed a dialog meeting for May 7 to discuss the research with the opposing activists. The government and consortium “stressed that independent and objective scientists had been involved in designing and assessing the biosafety of the trial” (de Krom et al., 2013, p. 4), but their argument was found unacceptable by the opposing activists. Scientific practices used in the field trials were not acknowledged as authoritative, but became “subjected to public contestation” by the public (de Krom et al., 2013, p. 4). In response to threats of destroying the field trial, a group called “Save Our Science” was organized to protect the research (Kuntz, 2012). The event resulted in

scientific damage and a court trial for defacing government property, and it did not go unnoticed in the media.

On May 29 about 300 people gathered to protect the field trial site, while about 350 people joined the opponents' meeting. A police force of 86 was present. The activists agreed that around 30 people would try to destroy the trial without violence and would offer no resistance to arrest. But after the arrest of some individuals, almost all the others invaded the trial premises. A number of police officers got wounded in the subsequent violence. Finally, 18 people succeeded in getting through the fences and 7 of these were able to reach the potatoes and destroy 15% of the trial. (Kuntz, 2012, p. 262)

A public debate began in Flanders after the event concerning “the risks and benefits of the GM crop field trial, and on the rights and responsibilities of scientists, politicians, and the broader public in assessing and managing these” (de Krom et al., 2013, p. 2). The debate continues at both the political and social levels.

Need for the Study

In Belgium, there is no safeguard clause creating an outright ban on GM products; however, there is obvious public opposition against the technology. Although Belgium and other parts of the EU are strongly against GM technology, other countries are rapidly adopting the technology. Biotechnology crops are the fastest adopted crop technology worldwide, with “a 100-fold increase from 1.7 million hectares in 1996 to 170.3 million hectares in 2012” (Navarro, Tome, & Gimutao, 2013, p. 20). Worldwide concern for the global population by 2050 makes genetic engineering more attractive, especially for less-developed countries; however, many developed countries have invested in GM technology.

Of the 28 countries planting biotech crops in 2012, a total of 20 were developing and 8 were industrial countries. The top 10 countries (USA, Brazil, Argentina, Canada, India, China, Paraguay, South Africa, Pakistan, and Uruguay) each grew more than one million hectares to biotech crops. (Navarro et al., 2013, p. 20)

GM technology has undeniably grown at a rapid rate, yet Europe continues to remain stagnant about fully implementing the technology. The goal of this research was to identify consumer perceptions and knowledge of GMOs, and to determine if the potato event had influence on consumer beliefs, through qualitative interviews. Consumer media consumption was also examined to determine if media bias effects consumer perceptions. This study brings a clearer understanding of consumer perceptions of GMO technology in Belgium, which can be pivotal to understand if Europe fully embraces GM technology in the future.

Purpose of Study

The purpose of this study was to examine the potato event in Belgium and determine perceptions and awareness of GMOs among a small sample of the Belgian public in regards to media exposure, risk awareness and political preferences in decision-making.

The following objectives guided the study:

1. Assess participants' perceptions and knowledge of GMOs and associated risks;
2. Determine media consumption and influence on the participants' perceptions of GMOs;
3. Assess participants' perception of medical biotechnology;
4. Determine participants' perception of the potato event; and
5. Determine participants' perceptions of government involvement regarding GMO decisions.

Definitions

Crisis: The Merriam-Webster Dictionary (2013a) defined crisis as “an unstable or crucial time or state of affairs in which a decisive change is impending, especially one with the distinct possibility of a highly undesirable outcome” (¶1).

Genetically Modified Organism (GMO): “Genetically modified products are products of modern biotechnology that are created by transferring a gene from one species (plant) to another in order to produce a product with a new desirable trait” (Skogstad, 2011, p. 901).

Medical biotechnology: Biotechnology that is applied in a medical context is the genetic engineering or manipulation of living organisms, such as bacteria and enzymes, to produce commercial products, such as pharmaceuticals, to treat an illness (Merriam-Webster, 2013b).

Risk: While uncertainty is defined as imperfect knowledge, risk is defined as “uncertain consequences, particularly exposure to unfavorable consequences” (Hardaker et al., 2004, p. 5).

Methodology

A qualitative study was used to measure Belgian perceptions and awareness of GMOs based on the potato event. Belgian scientists ($N = 5$), farmers ($N = 4$), general consumers ($N = 10$) and an activist ($N = 1$) participated in individual interviews ($N = 20$) to gather qualitative data about GMOs and the potato event.

Instrumentation

Interviews were conducted in Belgium from May through July of 2012. The researcher received Internal Review Board (IRB) approval to complete this research (see Appendix A). A structured interview guide (Appendix B) was developed with 20 questions to guide each interview. The guide was reviewed for face and content validity by a panel of experts ($N = 4$) with experience in agricultural communications ($N = 3$) or who served on the honors program

committee ($N = 1$). The guided questions were asked to each participant during the interview and were structured to encourage a conversational tone for the participant's comfort and ability to answer honestly. This allowed dialogue between the researcher and each participant, which allowed depth and opportunity for expansion in each participant's responses. The Belgian participant interviews were audio recorded for data analysis. The interviews were recorded with a voice recorder while physical notes were also taken. Both the recordings and notes were transcribed to assist in analyzing findings.

Limitations to the study could have occurred due to the language barrier between the researcher and the study participants. Interviews were conducted in English, which is a second or third language to the Flemish-speaking Belgians. Google Translate was heavily relied upon when reviewing some literature and media articles to support this study; however, it was never found as unreliable. A translator assisted in interviews ($N = 3$) (R8, R9, R10) where the farmers were not confident or fluent in an English interview. The shortest interview was nine minutes and the longest was 86 minutes, with varying times in between. The shortest interviews were with respondents who identified with the general consumer category, rather than scientist, farmer or activist. Interviews took place in comfortable environments usually chosen by each participant, including public cafés and respondents' homes, farms or offices. All interviews took place in Belgium, but travel outside of Melle was required for interviews ($N = 5$) to Gent and Brussels. The translated interviews ($N = 3$) took place outside of Brussels in the respondents' homes. The location of each interview and profession of each respondent are noted in Appendix C.

Data Collection and Analysis

Interviews were recorded and transcribed to find emergent themes in responses. Emergent themes can be represented through ideas or opinionated statements. Interviews were loaded into NVIVO 9 software, which assisted in structural transcription and coding of the content in its original context (Creswell, 1998; Strauss & Corbin, 1998). Coding and analysis determined emergent themes, supported with quotations and field notes taken during interviews (Creswell, 1998). Purposive sampling, interview notes, coding of key words and quotes during transcription and the NVIVO 9 audit trail provided study trustworthiness and dependability. Following Lincoln and Guba's (1985) constant comparative method, passages were coded in their original context (Creswell, 1998; Strauss & Corbin, 1998), and themes emerged that characterized participants' perceptions related to the potato event and perceptions and awareness of GMOs. Credibility of the findings was achieved through the use of the participants' reflections of the potato event and GMOs in Belgium. Trustworthiness and dependability were established through purposive sampling, the use of thick description, and the use of an audit trail supporting the key findings.

Research Reflexivity Statement

To keep my integrity as a researcher and not allow any personal biases to influence my study, I continued, as a researcher, to remain neutral in my beliefs throughout this study. However, the following areas have shaped my views of agriculture and GMOs.

Growing up on a small produce farm during the late 1990s and early 2000s, I saw the differences in agriculture as my grandfather integrated pesticides into his farming practices. As I watched his productivity increase and intense labor decrease, I formed an appreciation for

agricultural innovations. However, I have always seen the need for all types of agricultural practices to meet various consumer preferences.

Although I did not pursue agricultural-related activities in high school, I declared Agricultural Education, Communication and Technology (AECT) as my major with a concentration in communications as I pursued my bachelor's degree. When entering college, I was unsure I wanted to pursue an education in the AECT program, so I began exploring other fields of study. After interacting with students in other majors, I realized many people did not possess objective knowledge about agricultural practices, and decided to not only study agricultural communications, but also engage on a deeper level by enrolling in the Honors Program, which led to this study. When offered the opportunity to complete a 13-week summer internship with a large research institution in Belgium, I decided to pursue this study with hopes to gain insight to a small sample of European citizens' perceptions of GMOs.

Although I was curious to understand why a scientific field trial would lead to activism in Belgium, I did not desire a specific outcome from this study. It is my hope that through this study, I would gain valuable research skills and a deeper knowledge of how policy, media, and activism can influence perceptions of GMOs to apply to a career in agricultural communications.

Findings and Results

Each respondent was asked his/her profession when interviewed. Of the 20 respondents, five (R1, R2, R3, R5, R7) were scientists, four (R6, R8, R9, R10) were farmers, one was an activist (R4), and 10 were listed as general consumers with no professional relation to agriculture or research (R20, R21, R11, R12, R13, R14, R15, R16, R17, R18). One respondent (R1, scientist) reported that he/she was directly involved in GMO studies. Four respondents (R2, R3, R6, R14) said they were affiliated with a Flanders governmental research institution.

Interview questions were open-ended to encourage conversation, but one question generated similar responses from all 20 respondents. When asked to define a GMO, every respondent recognized that a GMO was a result of genetic engineering that could not happen in nature. The respondents also said that the purpose for changing, transferring, or replacing DNA between organisms (R1, R10, R11, R12, R13, R14, R2, R20, R21, R3, R4, R5, R6, R7, R8, R9) was done for a purpose such as higher yield, lower costs, and less negative environmental impact (R9, R8, R3, R20, R18, R17, R14, R15, R1, R10). Respondents used key words such as “change genetic code,” “modify DNA,” “manipulated” and “cannot happen in nature.” Although the respondents had different levels of understanding regarding the definition of a GMO, each understood that it was a scientific technique that introduced foreign genes into the DNA of another organism. When asked to define a GMO, one respondent answered, “I presume they go inside the DNA and change some molecules inside but how and exactly—I wouldn’t know” (R13, general consumer).

A GMO is an organism where you do some changes about DNA genetics, and by doing this you introduce a new property that you want, like more tolerance to drought stress or maybe minor susceptibility to a bug or pest. (R10, farmer)

Another respondent (R2, scientist) answered, “It’s an organism that has a changed genetic code because of using techniques that wouldn’t be possible in nature.” One respondent, a scientist directly involved in GM studies, gave reason for the exploration of GMOs in science, particularly in Belgium.

And now what is the advantage of GMO? Well, it’s to have access to diversity—genetic diversity—in a dedicated way. To create, in other words, the diversity—the variety of genotypes that you need to improve your gene pool by using crossing.

So in that respect we are really convinced of the benefit of this technology and of course, to be able to demonstrate the benefit, you need field trials. And that is the reason that we, together with other partners, all of them with a different motivation, invested in setting up field trials here—for example, the potato. (R1, scientist)

Emergent themes were derived from key words, phrases, and opinions stated by respondents in the interviews. The following emergent themes occurred: A) concerns about potential economic effects; B) concerns about potential environmental effects; C) media influence; D) government involvement/political preference; E) opinion of public perceptions; F) potato event impact; G) perception of medical biotechnology; H) concerns about potential health risks; and I) awareness of GM food.

A. Economic effects

- a. Fear/skepticism of monopolies/influence, hurt market (12 respondents)

R11, R12, R14, R15, R16, R2, R7, R9, R18, R16, R3, R13

- b. Monsanto (14 respondents)

R10, R12, R14, R17, R2, R7, R9, R8, R4, R1, R16, R18, R3, R5

- c. Recognize potential economic benefits of GMOs (7 respondents)

R15, R17, R1, R6, R8, R11, R20

Key words to support this theme include economical, economy, monopoly, monopolies, multinationals, corporations, businesses, market, influence, control, Monsanto, companies, labeling, and money.

Many respondents noted that the potential negative economic impacts such as monopolistic corporations were the driving force behind the activist actions. “It’s more an economical thing than anything else. I think it’s pure political decision based on economics”

(R13, general consumer). However, the activist involved in the GM-potato uprooting (R4, activist) never addressed any economic concerns, including concerns regarding multinational corporations and monopolies. One respondent (R1, scientist) said mandatory labeling was an economic aspect because it gives a GM product a different value than a non-GM product.

Some respondents (R8, farmer; R7, scientist) remarked that industry profit was not the issue, but that industry monopoly was something to be feared. Although no questions concerning Monsanto were in the questionnaire, the company was mentioned by 14 respondents, nearly always used as the respondent's example of economic concerns and impact on farmers. When one respondent (R8, farmer) explained skepticism toward Monsanto's presence in Europe, the respondent remarked, "I would prefer to see small companies giving local employment on foods sold locally, rather than transported halfway around the world."

Although respondents recognized the argument for potential positive economic effects of GMOs for farmers and even consumers, many expressed that private industry profit was the driving force behind the science. One respondent (R16, general consumer) felt GMOs were not the answer to world hunger because "there is world hunger but plenty of food. The crops are not a problem, it's the distribution of the agricultural process."

You can look at it from a health perspective or how can we make plants grow better or more resistant to disease. But I'm more inclined to think that the real deal behind it is still money, even though I know the scientists who do their work are passionate about it and want to do a good job with it, I think when you track down the whole chain of why and how and when, it still comes down to money. (R14, general consumer)

However, one respondent thought the technology was for society's benefit. "We think that this technology really deserves a correct evaluation. We really are convinced that we contribute to the benefit of society" (R1, scientist). One respondent said that the only danger associated with GM food was the competitive impact it would have on the markets.

I don't think it's dangerous to eat them. But the danger is, and what we don't know, is that they will come into competition with organic food. If they get cheaper than organic food, they will push it out of the markets. I think that could be a real problem for a part of the peasants, the small farmers and especially the third world.
(R11, general consumer)

Notably, not all respondents were negative about private industry profit. "I don't see why they shouldn't make a profit. An industry is made to make a profit otherwise it cannot survive. Personally, I have no objection against it. The problem, of course, is the monopoly" (R7, scientist). However, one respondent (R14, general consumer) said monopolistic corporations have the most influence in every industry because, "it's just how the world is turning, you get to one thing and that's money." Another respondent (R12, general consumer) said it is possible to have GM foods without a monopoly in charge, but it depends on "making the correct regulations." One scientist with experience in GMO experiments argued that although it is mostly large agricultural companies that invest in these experiments, they have no influence on the results of the projects.

Except for the crop protection chemicals, there are not many companies that are very big investors into agriculture. It's mainly the government that tries to invest in it with partners, and of course you'll see that the budget is maybe more private investors than the government, but the idea comes as 90% of the government

without the private investors. And those private investors have in fact, practically no influence in the scientific data of these projects or experiments. (R1, scientist)

When asked about any negative perceptions of GMOs, one respondent (R7, scientist) answered that it was the economic effects causing concern. “Not in essence the experiment itself, but the fact that once later in the development it will not be the universities, it will not be the laboratories—it will be the industries that make the profits alone of GMOs.” The same concern was expressed by another respondent (R3, scientist): “So maybe one day the government is not involved in agriculture, but major companies are going to say what the farmers have to do.” Another respondent thought that GM crops could provide economic benefits and negative consequences at the same time.

Well I think the purpose of GM crops is to have less [fewer] expenses for making the crop grow, so it gets cheaper. And if it’s cheaper and less vulnerable, you have a larger crop, which gets even (more) cheaper. If you have cheap prices, you can dump it on the market and make people who haven’t the same opportunities or same seeds, make it harder to get their things on the market. (R13, general consumer)

B. Environmental Effects

a. Negative Impact (7 respondents)

R10, R15, R16, R20, R4, R17, R2

b. Positive Impact (8 respondents)

R15, R3, R8, R9, R13, R17, R10, R1

Key terms that support this theme include danger, biological system, environment, pesticides, environmental risk, nature, and limit(s).

Environmental concerns were also identified as an emergent theme, with seven respondents expressing concern that GMOs would have a negative impact on the environment, while eight respondents mentioned the positive environmental impacts from GMO usage. One respondent (R16, general consumer) felt the environmental risk and health risk were equal: “It’s a difficult issue because there could be dangers to the environment and to people’s health but we don’t know them for sure yet. So it’s difficult.”

However, some respondents recognized that GMOs affect more than just the environment—and that scientists understand the environment on a high level. One respondent (R8, farmer) stated, “The scientists are a lot further than we know as the big public. So I don’t expect problems with the environment if GM potatoes are introduced.” The respondent (R1, scientist) involved in the GM potato field trial said the technology could benefit the environment. “We do our best for our society. We work on sustainable agriculture because we think that this technology can be of benefit for agriculture and also for [the] environment” (R1, scientist).

I’m not very enthusiastic about all the modifying things, but on the other hand, because we don’t have enough land to have food for everyone, if they could make sure that with these procedures they can have more food and less space it would be ok. (R15, general consumer)

Notably, another respondent shared negative concerns about GMO environmental impacts and also admitted the potential of GMO’s as part of the solution to feeding the global population.

On one hand I don’t think it is very good because manipulating vegetables or plants in any way, they will probably have their effect on the biological system, and don’t really believe they have good research on the effects on that. But on the other hand,

there is a food shortage in some countries, mostly Africa, and if we can solve that partly by manipulating some vegetable so it grows better there, I think that's the way we will. I don't know what to choose on this point. (R20, general consumer)

One respondent (R3, scientist) mentioned positive environmental effects from GMO usage based on personal experience. This respondent stated concern over the seasonal increase in spraying pesticides to fight the fungi attacking potatoes.

And of course, this is not positive for the environment because you are using chemical products again and again. So you are spraying some chemical products and you can, by GMOs, be rid of this product. Why not do some more experience [experiments] about [on] it and to do some more experiments about it? And then I am more positive about it. I think it would be nice to know, after these trials have taken place with GM food, whether there is [are] any dangers to health or wildlife or the soil or future crops that would be grown in that soil. (R3, scientist)

Another respondent (R21, general consumer) did not know of any environmental risks, but said there was a limit to be respected. "I don't know the risks but I think nature has its limits." One respondent (R10, farmer) said since there are no GM crops grown in Belgium, the result was more information about the potential negative effects of GM crops because the positive effects could not be directly seen.

C. Media Influence

a. Neutral (8 respondents)

R1, R11, R13, R15, R20, R21, R3, R6

b. Biased (5 respondents)

R12, R17, R2, R4, R16

c. Sensation Seeking (4 respondents)

R1, R5, R17, R3

d. Broadcast (12 respondents)

R1, R10, R11, R13, R15, R17, R2, R20, R21, R3, R4, R9

e. Print (8 respondents)

R1, R10, R16, R2, R3, R4, R8, R9

f. Online (5 respondents)

R16, R20, R3, R4, R6

g. Media does influence public view of GMOs (8 respondents)

R10, R11, R13, R14, R4, R7, R9, R8

Key words and phrases that support this theme include media, sensation, neutral, bias, influence, newspaper, television, journalists, reporters, documentaries, information, communication, story, news, and opinion.

Although most respondents said the activists had no influence through media, eight respondents said that the media could influence the general public's view of GMOs. However, one respondent (R14, general consumer) thought the influence could have been different from its original intent.

I think they influenced a lot of people but I don't know whether the influence or direction is what they thought it would be. I think they mostly got a bad reputation and that might be because of the media – how they presented it. (R14, general consumer)

While eight respondents reported the media was neutral and gave exposure to both sides equally, some respondents claimed the media only reported the event as a story rather than an

issue. “I think if it hadn’t been for the destruction of the fields no one would have talked about it” (R13, general consumer). Another respondent (R1, scientist) remarked: “Journalists want to bring sensation. People have educated themselves a bit, but that is limited of course.”

Although one respondent (R11, general consumer) said, “for most of the people, its one item amongst all the others,” another respondent (R17, general consumer) said he/she doesn’t know if citizens are typically conscious of news. Still, five respondents felt the news was biased toward the activists or the researchers—rather than for or against GMOs.

Notably, the respondent directly involved with GMO studies (R1, scientist) said the media portrayed the news in a neutral way, while the activist (R4, activist) said the media was very biased against the activists. Although the respondent (R4, activist) said social media discussion allowed exposure to the activist group which helped gain more support, the respondent (R4, activist) also said that members of other non-governmental organizations accused the FLM group of breaking their reputations by association.

One respondent (R9, farmer) said the respondent found the biggest problem with information from the media is because “they are not waiting for the whole picture, they just say what they already know but it’s not enough to give the right information—maybe you need to interview or read more before you start to inform the public.” Although the respondent said his/her opinion of GMOs was not swayed by the activist actions, the respondent said the activists had the power to sway others’ opinions. “Political parties or influential people or groups like the one that destroyed the field have very big influence on the public opinion. They can make the public fear something that is not right” (R9, farmer). One respondent (R16, general consumer) attributed the potato event to potential lack of communication over issues “we are in more doubt about, like GMOs.” Another respondent (R15, general consumer) was not aware of GM trials in

Belgium until the event. “I didn’t even realize [realized] they were doing it in Belgium until the whole potato story. So I never asked myself the question if we were informed properly or if there was bad communication.” However, one respondent (R11, general consumer) said the media coverage did not cause any public distrust toward the scientists or government. Another respondent (R5, scientist) explained how it is easier for educated people to automatically realize “reality is much more complicated, always” than it is portrayed through the news on television. Another respondent (R9, farmer) said the event was smaller than the newspapers portrayed it.

One respondent (R14, general consumer) said he/she was originally against GMOs “because it meant engineered,” but after speaking with a scientist involved in the GM potato field trial, his/her opinion changed. This respondent (R14, general consumer) reported that he/she preferred informational documentaries to potentially influenced news reporting.

I like to get as much information as I can, so I look up a lot of documentaries. It’s more like I see the things I want to see or am looking for rather than sit in front of the television and get fed whatever the media feeds me. (R14, general consumer)

As far as the media, I think it’s more of a global thing on one hand and we need deep journalism, and that is missing. It is more like sensational. And then you have to have as much [many] views as possible, not to teach them anything, but to give the facts so they can form all their opinions, not like sensation. (R17, general consumer)

The respondents who said the media was biased explained how they found the media biased. Two respondents (R2, scientist; R16, general consumer) said the media was biased toward the research side, while three (R12, general consumer; R17, general consumer; R4, activist) said the media was biased toward both sides, depending on different outlets.

One of the more interesting news sources in this was [online news website], an alternative news website backed by social movements like the Unions here in Flanders. So you could say it's biased toward the left hand side of the political spectrum, but the advantage of having such a news outlet is that you have more voices to be heard in a debate. Because in the newspapers, people were quickly talking about eco-terrorism...and in that way I think media were a bit biased, were too much focusing on the aspect of protecting scientific research and personal property compared to or opposed to political activism and the right to have another opinion and expressing it other than publishing some opinion piece in a newspaper or on the internet. (R17, general consumer)

D. Government involvement/political preference

- a. Current involvement is fine (4 respondents)

R1, R10, R11, R7

- b. Government needs to be involved more (3 respondents)

R17, R10, R13

- c. Government needs to be involved less (3 respondents)

R3, R12, R4

Key words and phrases that support this theme include government, EU, European Commission, Parliament, policy, support, law, enforce, labeling, communication, Flanders, Gent, research, political, control, and regulation.

The views on government involvement and opinions on GMOs differed among respondents. One respondent (R6, farmer) said, "If the government is pro, the majority will be pro. If the government is not sure, then I think the people is [are] not sure." While one

respondent (R10, farmer) felt that the government had a general negative perception of GM regulation, another respondent (R1, scientist) felt the government is not for or against GMOs, but simply supports scientific experiments.

The commission of the Flemish Parliament—the members of the Parliament—made [a] statement that they cannot accept the destruction of the field trials. But on the other hand, this statement does not include that they are in favor of each GM product, but they want to give fair chance to the evaluation of potential GM crops. So they are really supporting the idea that you have to do research before you make a conclusion. (R1, scientist)

The respondent continued to credit the Flemish Parliament for supporting the GM potato research. “At least they take this science into account to develop their policy. Because for me, there is a difference between policy and scientific research” (R1, scientist).

When asked if the government addresses GMO issues effectively, most respondents answered positively and attributed communication to the media. However, one respondent (R17, general consumer) said that issues involving GMOs should be in politics and the politicians should be informing citizens on their stance.

People should be informed so they can make a decision and also help to make a decision, so you have action and interaction. So I think there should be more awareness because another European policy—they changed it last time—and now I think some GMOs are allowed because you can read it on the back. So, some GMOs, but it’s sometimes not very clear whether it’s GMO or not, to be honest. People should be aware this is happening, this is going on, and that link is missing. And this is why in Europe, the last several years, there are few from the public

against Europe itself, because Europe is opposing tons of laws. It does not really communicate to the people and people are like, “What is happening? All these laws, all these things.” So there is certain need for information, which isn’t [given] at the moment. (R17, general consumer)

This respondent also wants the government to enforce labeling if GMOs are regulated. “I mean, if you are so sure the technology is healthy, let the people decide” (R17, general consumer). However, this respondent also explained the skepticism in trusting the government.

Do I trust the government? Yes, in a certain way, but not in a blind way. I am a bit skeptical because in the end you never know, the members of the committees that approve it, who is paying them. More transparency would be nice in that sense. (R17, general consumer)

Another respondent explained that by the EU mandate to label GM foods (if the product passes strict review), the consumer could make an informed decision. One respondent (R9, farmer) recommended for more communication to exist between the government and farmers if the government is funding GMO trials. The respondent (R9, farmer) expressed that it is difficult for farmers to not know more than the general public about what is going on within scientific advancements in agriculture.

One respondent (R3, scientist) said that the Flanders government presented GMO issues to the public in two contradictory ways, especially considering Flanders’ history in biotechnology.

On one hand, they invest enough money into biotechnology. So, if you invest money in it, you are sure that there is some profit to find in it, or you expect some positive things about it. On the other hand, they say maybe it’s not so positive; we

have to check if there are some negative things about it, so we are doing some field experiments. We are known for biotechnology in Flanders. But we restrict completely the use of GMOs into the field and that's of course contradictory for the countries or companies that want to invest in this biotechnology. (R3, scientist)

Another respondent (R1, scientist) gave a notable example of the past biotechnology experiments in Flanders.

The technology, the research, the knowledge comes from Flanders, from Gent. There everything started. Flanders was very proud of this technology and the potential use of this technology. It was a time when there was proudness where Flanders was the developer of this technology. (R1, scientist)

When asked to share any further information, one respondent (R10, farmer) referred to inability to grow GMOs as a "handicap." "The EU sets a farmer a little bit aside on the world scale. We are in a much less easier position than other countries around the world where the legislation makes it possible that you use GMOs" (R10, farmer). Another respondent (R13, general consumer) stated that GM food engineering and regulation should be "politically controlled."

Another respondent (R13, general consumer) attributed slow decision-making regarding GM regulation to finding a consensus between the Flemish government, Belgian government, and European Commission. "I think the problem is to find a consensus between all those different political organizations. It may make it more difficult. The more people that have to decide about something, the harder it gets to get to a decision" (R13, general consumer).

There's kind of a double-speech about the government who says, 'GMOs are okay,' and the EU who says, 'No, the GMOs do not enter.' Who is wrong? Who is right?

I would say that the EU and European Commission has more respect from the general public than the Flemish government and institutions, but I think people are just not connected with food—they don't know where their food comes from. (R2, scientist)

The EU's anti-GMO stance, according to one respondent (R3, scientist), is hindering scientific progress.

One of the discussion points that we have with a lot of other member states in the EU is we don't have enough data to say we are against or for GMOs. And Europe says, 'You cannot introduce them because you don't have enough data.' But if we don't have enough field experiments, we will not have enough data. (R3, scientist)

Regarding scientific research and government involvement, one respondent (R20, general consumer) stated that the government would not support research and experiments that would hurt the people. "I don't believe that they are doing it to ruin the world. I think they are doing it for everybody's good" (R20, general consumer).

E. Opinion of public perception

a. Positive (0 respondents)

b. Negative (6 respondents)

R11, R9, R10, R1, R5, R9

c. Confused (4 respondents)

R11, R2, R1, R16

d. Uninformed (10 respondents)

R11, R17, R16, R12, R13, R14, R15, R17, R18, R7

e. Indifferent (4 respondents)

R12, R13, R20, R21

Key words and phrases that support this theme include confused, uninformed, unsure, perception, influence, scared, anxious, afraid, concerns, public opinion, general feeling, don't care, and aware.

When asked how the general public feels about GM foods, one respondent (R11, general consumer) answered, "I think most of the people don't know what it is and I think they're scared. The basic feeling is to be anxious about what is going to become with that kind of science or technology." This respondent (R11, general consumer) also said that the general public would not accept or purchase GM food. Another respondent (R10, farmer) echoed this thought by stating that the public does not support nor fully understand the scientific experiments. Interestingly, one respondent (R5, scientist) answered: "I have to say that in Europe the perception of all this stuff is not very positive, in contrast to the States." Another respondent thought American influence on the food industry created fear for Europeans.

If America should disappear, it should be a relief. Well, in the sense that we are relieved from the pressure and the manipulation [impacting the food industry and media]. That criticism is very rarely heard, but it's a mighty general feeling, because I think we are afraid of America. (R12, general consumer)

However, another respondent (R17, general consumer) thought America could have a positive influence on the food industry and media. "I think we could learn something from our neighbors in America" (R17, general consumer).

As a scientist, one respondent had another view on opposition against GM food trials. "The problem that I discovered in my career is that people that are against something are often using the wrong argument" (R1, scientist). This respondent (R1, scientist) attributed the public's

opinion to emotion. “So when you ask if the public is in favor, against or afraid: it is emotion. It’s only emotion” (R1, scientist).

One respondent (R2, scientist) said the general public was “more confused” about GMOs after the media reported on the potato event. Other respondents (R6, farmer; R8, farmer) said that the general public trusted the scientists performing GMO research. One respondent thought the only concerns Europeans have about GMOs are ethical concerns.

I think the concern in Europe as far as I can see is ethical. I don’t think there are more beyond that besides a few individuals. It’s about ethical problems, the fear of being a guinea pig. It’s not only that, the general feeling is being a guinea pig—on everything. So on top of that, you get even the food. It’s a mainstream of an easiness of the consumer in the hands of unethical entrepreneurs. (R12, general consumer)

Another respondent (R20, general consumer) thought the general public of Flanders is indifferent about GM foods. “I think most of the public doesn’t really care so much. I think it’s just an idealist group who is really, really against it. But I think the public opinion generally is not really against it” (R20, general consumer). Echoing this opinion, one respondent (R21, general consumer) stated: “I think nobody cares.” Another respondent (R13, general consumer) said the public is not concerned with the status of GM foods and experiments in Belgium. “It’s not a subject of conversation anyway” (R13, general consumer). Rather, according to this respondent, it’s the affordability of food that consumers are concerned about.

I presume that most people don’t even think about it. They read some, every once in a while, little article in the newspaper maybe. But as long as they have their lettuce and other crops in the supermarket, whether they are sprayed with chemicals

or GM, I don't think it's important as long as it's affordable. (R13, general consumer)

The majority of respondents said that the general public was more uninformed about GMOs than for or against the science. "Most people are not informed so they don't care. So I guess it depends on your own values, beliefs, and how you're educated and how well you're informed, because I'm sure I don't know anything about it" (R15, general consumer). Another respondent (R16, general consumer) believed the general population knew the possibility of risks, but did not want to choose a side over GMOs. "To be honest, I don't believe many people are aware of the issue" (R17, general consumer).

When asked about the general public's perceptions of GMOs, one respondent (R2, scientist) answered: "I think they are just more confused. People are just not connected with food—they don't know where their food comes from." Another respondent (R7, scientist) agreed: "I don't think most people know what [a] GMO is." However, one respondent (R4, activist), an activist involved in the potato event, expressed that the public remaining neutral in such an issue is not possible. "You cannot say, 'I'm neutral.' You can try to say it, but by polarizing the debate and really provoking reaction, we almost forced people to choose, to take sides, and to really pronounce themselves" (R4, activist). However, one respondent thought the majority of people would choose the pro-science side.

But the majority, I think, are on the other side, certainly in favor of continuation and certainly in favor of the fact that one cannot destroy the work of researchers as it has been done. I think that it is the general viewpoint of the majority of the population. (R7, scientist)

F. Potato event impact

- a. Activists were wrong to destroy scientific research/property (10 respondents)

R13, R14, R15, R20, R3, R5, R8, R1, R7, R12

- b. Offered alternative action activists should have taken (8 respondents)

R1, R14, R16, R20, R3, R7, R8, R15

- c. Named reason(s) why activists took action (10 respondents)

R9, R10, R16, R17, R20, R3, R8, R13, R14, R7

Key words and phrases that support this theme include destroying scientific results, scientific property, scientific damage, too far, stupidest idea, crazy activists doing stupid stuff, have conversation, other ways, share ideas, economical reasons, ecological reasons, field experiments, contaminated, manipulated, protect the environment, anti-globalization, not natural, corporate companies, and industries (Monsanto).

Half of the respondents said the FLM activists should not have destroyed scientific research or trespassed private property to destroy the research. “They’re going too far. It’s not because you are against it that you have to destroy it. You can share your idea with other people, but destroying it is a step too far” (R3, scientist). Even respondents who might tend to support organic, rather than GM food, did not support the activists’ aggressiveness. “I don’t like that. I’m a biologist. Of course I’m from nature, but I don’t like that kind of aggressivity [aggressiveness]” (R5, scientist). Two respondents (R16, general consumer; R17, general consumer) said there was not a right or wrong side to the potato event and were unable to decide their opinions on the activists’ actions.

Some respondents attributed the reason for the activists’ actions to an economical disconnect. “The people that went onto the field and destroyed a few plants is in fact mainly due

to disconnection with industries, with Monsanto. That's what they said is the major reason of their protest" (R7, scientist). One respondent (R10, farmer) said, "He is thinking, 'They fear the enormous influence of the bigger companies like Monsanto.'" However, when asked for the motive of destroying the field trial, one respondent (R4, activist) was unable to give any reason other than a personal duty to activism for destroying the field.

Then you have three things. You have my personal position, you have FLM communication, and you have the anti-GMO – or the GMO critical – movement. And the GMO-critical movement is extremely diverse. I helped with a lot of actions in different ways. You know, I try to be an all-around activist. I have a whole network of people and it interests me a lot. (R4, activist)

This respondent (R4, activist) identified himself/herself as a participant of the destruction: "Yes, I did participate. I was one of the people to get inside the field and actually tear up some potatoes. It's not clear whether these potatoes were GM potatoes or conventional." The respondent (R4, activist) also declared that he/she knew he/she was breaking the law by trespassing private property and destroying scientific research. However, later in the interview, the respondent (R4, activist) gave his/her own opinion about the field trials, but also explained he/she did not have any objections to GM studies.

Personally for me, I have no problem with GM studies. I think biotechnology is one of the most interesting study fields at this moment. I think it's just great to see how life works and how evolution and genetics work. And wow, why not spend a lot of time and money and people on the study of it? And why not experiment with plans and see what happens when you get that gene out? But the introduction in our ecosystem and on our plates, that is the political discussion for me. Because there's

so much insecurity, I don't mind what people do in the laboratories and I would say vote for it. (R4, activist)

Another respondent thought the actions of the activists were more against globalization, rather than GMOs. "I think it was that it is just a group of activists, not just against GMOs only. It was a good time for them to destroy this field because they are anti-globalization" (R8, farmer). However, this respondent (R8, farmer) did not support the actions, and said the activists needed to focus on achieving something, rather than destroying something.

If you are against GMOs, why don't you meet them at the gate and say this, and this is why we are against them. Violence is a proof that you can't translate your ideas to professors or you cannot say what you want. If you want a new forum on the media just by acting violent, that's the stupidest idea you could do. They need to have an idea to achieve something in their lives and not make it a goal to break down someone else's work. (R8, farmer)

However, the respondent who identified himself/herself as an activist (R4, activist) said his/her activist actions were "always non-violent, direct actions." Some respondents offered alternative actions the activists could have taken to communicate their beliefs. "I think it would have been better if they had expressed their beliefs before, in a more public way, like an opinion piece in a newspaper" (R16, general consumer). Many respondents (R17, general consumer; R5, scientist; R7, scientist; R16, general consumer) were aware of one activist employed by a Belgian university who was fired for destroying the scientific research. When asked if he/she thought actions like those in the potato event would happen again, one respondent thought the opposition against the activists would discourage future similar events, and encourage alternative ways of sharing their message.

Because there has been such a severe reaction against it, I don't think it will happen again. There will be other ways in which the people with this viewpoint try to express themselves [themselves] [like] come into the public, go to meetings, have discussions, and they will be invited certainly if we see that there may be problems. Their voice [voices] will be heard more and more. But I don't think there will be an action—an aggressive action—like that. (R7, scientist)

G. Medical biotechnology

- a. Recognized it as GM (8 respondents)

R1, R11, R12, R14, R17, R20, R21, R3

- b. Did not recognize it as GM (4 respondents)

R10, R13, R15, R7

Key words that support this emergent theme include medical biotechnology, medicine, doctor(s), vaccine, ethical, necessity, alternative, and disease.

“People say, ‘I don't want GM,’ but once you are ill and need insulin or a vaccine, then normally you won't say no” (R1, scientist). Another respondent (R12, general consumer) answered that the general public understands the same risk exists in medical biotechnology and agricultural biotechnology. This respondent (R12, general consumer) also said scientists and doctors alike are extremely careful with using biotechnology.

However, one respondent said the two areas of biotechnology were not related. “I've never made that relationship. To me, it's more or less two different things and I don't associate them to each other” (R13, general consumer). This respondent also declared the limit of biotechnology research at manipulating plants.

As long as they stick to plants it doesn't bother me too much. When they start doing it to animals, it's getting closer to us and when they start doing it to people then we are completely out of normal and ethical evolution. (R13, general consumer)

Another respondent (R14, general consumer) said that both medical biotechnology and agricultural biotechnology are "like a Band-Aid, they treat the symptoms rather than the cause." Additionally, this respondent (R14, general consumer) said that GM was not a solution to a problem, but a treatment for a symptom, and also reported he/she rarely consumed medicines prescribed by medical doctors. When discussing awareness of genetically engineered food and medicines, the respondent (R14, general consumer) answered, "I think they're more aware of food, but when they're sick they just get the medicines and don't ask. It's just the next step. I think they say, 'It's going to be ok because the doctor gave it to me.'"

Another respondent (R17, general consumer) was surprised that the relationship between medicine and GM food had never been obvious to him/her before, yet was still sure GM food was an alternative, while medicine was a necessity.

To be honest, I didn't quite think of that point of view. The thing about it is, for pills there is a necessity. Well, to be honest I'm at a quite interesting view, I didn't think about it before. But I am certain that with medicine you have an illness that you are trying to cure. For GMOs, for all I have seen, there are alternatives. (R17, general consumer)

Interestingly, one respondent (R3, scientist) said that medical biotechnology was safer than agricultural biotechnology because of the direct impact on humans, instead of impacting "the field, the environment outside the field, the biodiversity, and people that live next to and

around this” (R3, scientist). This respondent remarked that a problem associated with medical biotechnology “is more or less a small problem” (R3, scientist), because it affects only a small group of people rather than a whole environment. One respondent (R20, general consumer) expressed concern about the use of biotechnology and how it can be easily abused. This respondent’s experience working in a hospital caused question of the long-term effects of medical equipment with radiation techniques.

Because I work in a hospital, I have some thoughts about that. I think they do a lot of examinations too much. They are not necessary. It’s easy; it’s easy money for the doctors. But they studied well for it too, so they earned it. There’s some profit in it too. But I don’t really believe that’s the good way to go. (R20, general consumer)

One respondent (R21, general consumer) expressed that open communication between the doctor and patient made medical biotechnology safer and informative to the consumer. This respondent did not find one type of biotechnology necessarily safer than another, but remarked, “I don’t think we pay attention to food” (R21, general consumer).

According to one respondent (R7, scientist), GM food is vague and unreliable because “there is a great variety of food.” “But medicine is dedicated to treat one particular disease. So if it is proven that a medicine is effective against disease, then the population will take it without asking many questions. There is a great difference between the two” (R7, scientist). This respondent (R7, scientist) said that people do not need to understand the medicines they consume, but because of the different types of food available, there is reason for skepticism of GM foods.

H. Health concerns

- a. Concerned about health (1 respondents)

R17

- b. Not concerned (5 respondents)

R15, R11, R6, R18, R20

Key words to support this emergent theme include health, danger, and risk.

One respondent (R15, general consumer) said there is no reason to believe scientists would try or allow a GM food product to harm the health of humans. Another respondent (R17, general consumer) did not know if health effects existed with GMOs, but explained that if consumers felt a health threat caused by GMOs, they would respond negatively. “People are selfish. When people themselves are affected, they’re interested, so you give them that information, they will do something about it” (R17, general consumer). Another respondent (R11, general consumer) thought there was no danger to health from GM foods.

I. Awareness of GM food

- a. Aware of possible present GM (6 respondents)

R1, R11, R12, R13, R18, R5

- b. Unaware (1 respondent)

R10

Key words to support this emergent theme include labeling, authorization, cultivation, grown, and choice.

One respondent (R1, scientist) knew the EU’s evaluation process for GM authorization. “But even then [if authorized] the EU decided that the consumer can have the choice to consume GMO. And of course then to implement it you need the labeling. Labeling means detection”

(R1, scientist). This respondent referred to labeling as a marketing strategy rather than an informational program.

The big problem is that there is a huge gap in knowledge and the other problem is that there is a small group of people that are misusing this knowledge to create fear within society. There is also a small group of companies that can see a short-term benefit in their attitude. For example, I remember a supermarket in the beginning of the 90s. They announced they would give the consumer the choice. But I am in favor of GMO, at least I can think for certain crops it's a benefit. But I couldn't find GMO in [the supermarket], but in their communications strategy—that was to be in front of the competition. I think this is also a problem because for them it was not difficult to be GM-free. It has no costs and they could gain goodwill from the consumer. It's only getting money in short term. (R1, scientist)

Another respondent (R10, farmer) did not communicate any knowledge of possible GM cultivation in Belgium. “There is less attention on the positive things and its normal because we cannot see them, because we have no GMO crops here in Belgium” (R10, farmer). When asked if he/she would be open to purchasing GM foods, one respondent (R11, general consumer) answered positively. “Because it will become a necessity. I think we are already eating them now. I don't think it's dangerous to eat them” (R11, general consumer). This respondent believed packaged and processed goods like cookies and cereals were genetically modified through the production phase. The respondent (R11, general consumer) was asked if Belgium might be currently importing GM foods, but answered negatively.

One respondent (R12, general consumer) believed the general public of Flanders would not have a choice to accept or reject GM foods. “They will not know” (R12, general consumer).

Another respondent (R13, general consumer) said Belgians probably already eat GM food without knowing it. While one respondent (R18, general consumer) has never noticed GM labeling on food, the respondent felt past and current consumption of GM foods was likely.

Conclusions and Discussion

Participant level of understanding was diverse when defining a GMO. All respondents had an accurate idea of what a GMO was, even if they could not fully describe how crops were scientifically generated. All responses referred to an unnatural, controlled change in genetic code. This allowed perceptions to be gathered with support that previous knowledge of a GMO was already established.

Respondents showed much skepticism about the economic effects of GMOs. However, according to Drott et al. (2013), scholars recommended regarding GMOs as uncertain because of environmental and health risks, without mention of economic risks. Many respondents in this study expressed fear and uncertainty about monopolistic corporations, instead of the farmers, receiving all the profit from GMOs. However, studies by Carpenter (2010) and Brookes and Barfoot (2013) found that GM crops benefitted farmers with increased yields, productivity, and efficiency.

Respondents expressed concern with industry using GM technology to take over developing countries for profit incentives that could hurt the small farmers. This concern was also noted in surveys conducted with small farmers in Colombia (Carpenter, 2010). Brooks et al. (2013) found that no-tillage production, as a result of GM technology, has allowed farmers in South America to follow a wheat crop immediately with a soybean crop in the same growing season, boosting production.

Twelve respondents expressed skepticism of effects GM food would have on the market, particularly on smaller companies providing local employment. One respondent was especially concerned on the impact GMOs would have on the market competition for small farmers. However, benefits not expressed in the market value price are not always seen by consumers, even if valued by farmers. The peer-reviewed surveys by Carpenter (2010) indicated that “farmers may value intangible benefits of GM insect-tolerant crops,” with one survey of US corn farmers finding that “non-pecuniary benefits (handling and labor-tie savings, human and environmental safety, reduced yield risk, equipment cost savings and better standability)” of GM crops were significantly valued (Carpenter, 2010, p. 321).

Concerns regarding environmental effects were lower than expected; however, respondents expressed the opinion that nature had limits. The European Commission’s outright ban clause declares for a member state to enforce an outright ban, it must justify why the GMO presents an environmental or human health risk (EHC, n.d.b.). According to the Belgian Biosafety Server (2009), GMO legislation serves to protect citizen’s health and the environment. However, only one respondent expressed health concerns. Respondent concerns for health and environmental risks do not support the claim by Drott et al. (2013) that scholars recommend uncertainty toward GMOs due to a risk to the environment and/or human health. The low concerns of environmental and health effects agree with the 2010 EU press release: “There is no scientific evidence associating GMOs with higher risks for the environment or for food and feed safety than conventional plants and organisms” (ECPR, 2010, para. 4).

Eight respondents acknowledged positive potential environmental effects from GMO usage, including less use of chemical control mechanisms, such as pesticides. According to Brookes and Barfoot (2013), the environmental impact of insecticide and herbicide use was

significantly reduced as a result of GM crops, falling by 18.3% since 1996. Another important environmental impact of GM crops is reduced tillage. Surveys showed decreases of 25-58% in tillage operations due to GM herbicide-tolerant (HT) crops, with no countries reporting an increase in tillage for adopters of GM HT crops (Carpenter, 2010).

Although there are risks in GM technology – just as there are risks with any innovation – the risks have not been proven as harmful. However, Klerck and Sweeney (2007) found that the mass media rarely communicated GM food benefits to the public, but instead made nonfactual accusations against GM technology. Four respondents found the media to focus on sensation regarding the potato event, instead of fact.

Vestal and Briers (2000) reported that agricultural communicators and extension educators should create an educational environment of biotechnology information that is attractive to journalists. This source of information could have an effect on the reporting, leading to less sensation and more information. Five respondents reported that the media was biased when covering the potato event, while eight respondents said the media does influence the general public's perception of GMOs. With an information source like the one recommended by Vestal and Briers, the bias view of consumers on journalistic reporting could be reduced or eliminated.

Media coverage of the potato event supports the functionalist theory, which portrays the media as the communication outlet for society to learn about the environment and culture through reporting about events and conditions (McQuail, 2005). Although responses were split regarding the media acting neutral or biased when reporting the potato event, the opposition against the activists was rooted in the disapproving responses toward the violent actions taken by

activists. This supports the functionalist theory claim that the media “provides support for established authority and norms” (McQuail, 2005, p. 98).

The idea that uncertainty among the public is a reflection of uncertainty among the different levels of EU government (Drott et al., 2013; Jacob & Schiffino, 2011) was supported by the findings of this study. Confusion among respondents about the government’s stand on GM regulation support the lack of stability among the EU policy-makers concerning GM technology discussed by Drott et al. (2013). One respondent (R3, scientist) described both the Belgian and EU government’s stances on GM technology as contradictory because they invest great amounts of money into biotechnology, but then cannot decide if the technology is positive. Another respondent (R2, scientist) said confusion is caused by “the [Belgian] government who says, ‘GMOs are ok,’ and the EU who says, ‘No, the GMOs do not enter.’” However, although the EU has made GMO entry difficult, it has not banned the entrance completely. Rather, the Belgian government denied field trials after 2003 until the potato event in 2011. One respondent’s (R13, general consumer) explanation that the problem lies in finding a consensus between the levels of government supports the claim that the government’s slow-decision making process causes public uncertainty (Drott et al., 2013). The findings in this study support the idea that the indecisive viewpoint of GM regulation on different governmental levels is hindering Belgian and European agricultural advancements (de Krom et al., 2013; Jacob & Schiffino, 2011).

One respondent (R4, activist) expressed that because of insecurity toward introducing GM crops into the ecosystem, GM regulation should be a political discussion. Although only one activist was interviewed, the response does not support the claim by Durant and Legge (2010) that anti-GM food activists are primarily concerned about health risks. The respondent’s

(R4, activist) claim to being “an all-around activist” and having “no problem with GM studies” and support of spending “a lot of time and money and people on the study of it” supports strong consideration of another respondent’s (R8, farmer) opinion that the activists were “not just against GMOs only,” but were against globalization.

Ten respondents expressed that the activists were wrong to destroy scientific research/property, but also stated that the social movement of the activists should have been carried out differently. This supports findings by Schurman and Munro (2010) that the actions must be generally accepted by society to gain outside support. “The efficacy of these movements depends not just on what movements do but also on the contexts in which their members carry out their actions, as well as the ongoing interactions between movements and their adversaries” (Schurman & Munro, 2010, p. xx). Respondents offered alternative ways the activists should have acted to express their ideas and potentially gain support, such as public meetings, newspaper opinion columns and discussions. No respondent reported they were convinced by the activists’ actions that GMOs were bad, rather, the respondents focused on the disrespectful actions the activists performed. The violent attitude and actions pointed the attention away from the GM field trial and toward the destruction.

Jacob and Schiffino (2011) found that Belgian citizen’s internal uneasiness about GMOs caused negative concerns toward GMO regulation. Most respondents identified the general public’s perception of GMOs as negative, confused, uninformed and indifferent. One respondent (R1, scientist) stated that the public was not for, against, or afraid of GMOs, because it is all based upon emotion. This response directly supports Durant and Legge’s (2010) claim that individuals make GMO decisions based on emotion rather than fact.

Many respondents explained that the general public was uninformed, so they could not fully understand or support the science. However, responses indicate that the public generally trusts the scientists performing the research, but skepticism lies in the companies funding the research. Other responses support the uninformed public idea by claiming that the public is simply not connected with their food. Interestingly, one respondent (R7, scientist), a scientist, did not think the general public would know how to define a GMO, while another respondent (R17, general consumer), did not think many people were aware of the issue.

Respondents were likely to be more supportive of medical biotechnology than agricultural biotechnology, supporting survey results cited by Maesele and Schuurman (2008). The surveys conducted in Belgium found biomedical technology positively accepted, while agricultural biotechnology presented controversial results that divided the public opinion (Maesele & Schuurman, 2008). Many respondents were unable to give their opinion on the relation of agricultural biotechnology and medical biotechnology. Interestingly, some respondents did not consider the two types of biotechnology on the same level by presenting medicine as a solution and GM crops as an alternative.

Recommendations

“The big problem is that there is a huge gap in knowledge and the other problem is that there is a small group of people that are misusing this knowledge to create fear within society” (R1, scientist). Although all respondents had an accurate definition of a GMO, there was confusion about the effects of GMOs. A key recommendation for further research is to apply this study to a larger sampling group with questions used to determine subjective versus objective knowledge. Klerck and Sweeney (2007) found that consumers relying on subjective knowledge were more prone to performance and psychological risk when making decisions

regarding GM food. The same study also attributed subjective knowledge to media influence and bias (Klerck & Sweeney, 2007). Therefore, the perceptions of the potato event and GMOs among Belgian respondents could be guided by subjective knowledge influenced by the media and activists. Because these two knowledge types have specific effects on storing information and consumer behavior (Klerck & Sweeney, 2007), understanding the knowledge type of a sample would be beneficial to measure perceptions and acceptance of GM food. By applying this to a larger study among Belgian participants, purchasing behaviors could be predicted and more efficient media dissemination methods could be recommended.

The fear of a monopolistic presence in GMO production and need for more informational and scientific communication remained constant themes throughout the interviews. The participants expressed the Belgian general public is uninformed and cannot support or understand the scientific experiments because they are only presented in a high scientific level, unsuited for the general consumer. The findings from this study present recommendations directly from the respondents about making information easier to access and understand, while still maintaining scientific objectivity. For consumers to possess objective knowledge over subjective knowledge, objective knowledge must be disseminated. “The overall findings thus suggest the need for cooperation among government, scientific institutions, and the food industry to foster effective communication strategies that increase consumers’ objective knowledge, reduce their risk perceptions, and encourage consumer adoptions of GM technology” (Klerck & Sweeney, 2007, p. 171). This recommendation is linked to the strong support for government cooperation, stability, and transparency. “Hence, GMO regulation is in need of adequate mechanisms ensuring that decision-makers justify and account for their behavior” (Drott et al., 2013, p. 1124).

One recommended method for presenting information is an educational campaign implemented in Belgium to provide consumers with objective knowledge. Further research could measure a larger sample's perceptions, knowledge and behavior, incorporate a campaign with objective information—including the economic benefits of GMOs and research proving they are not harmful to health or the environment, and then measure any change in consumer perceptions, knowledge, and behavior. Another method is roundtable discussions, where scientists, policy-makers, activists, journalists, and consumers meet and discuss the benefits and concerns of GMOs. Vestal and Briers (2000) expressed the need for an educational environment accessible and attractive to journalists that gives objective information on GMOs. The influence such a program would have on journalists could eliminate bias and promote objective knowledge among the Belgian public.

Agricultural education programs will benefit the agricultural sectors of Europe in regards to biotechnology (Plonski, 2008). Because Belgium's population, like the rest of the EU, is mostly urban, educational programs should be of high priority in secondary school curriculum. This recommendation supports the findings of Frick et al. (1995), where high school students in rural areas had a significantly higher agricultural knowledge than respondents from urban areas. Only eight respondents recognized medical biotechnology as GM, and this connection could be more recognizable if biotechnology is studied in education programs. It is important that these communication and educational recommendations explain the technology and its purposes to advance the agricultural industry in efforts to combat anti-GM messages. "Many problems in this world are not caused by the use or misuse of technology. They are mostly caused by the humans themselves" (R17, general consumer). By receiving and processing objective

knowledge about GMOs, consumers will feel less indecisive or fearful, and more informed and empowered when making decisions regarding GMOs.

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Appendices

Appendix A. IRB Approval



Office of Research Compliance
Institutional Review Board

May 18, 2012

MEMORANDUM

TO: Maggie Jo Pruitt
Leslie Edgar

FROM: Ro Windwalker
IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 12-05-698

Protocol Title: *The Crisis Communication Methods Regarding Genetically Modified Organism Acceptability in Europe: A Case Study of the Belgium Potato Crisis*

Review Type: EXEMPT EXPEDITED FULL IRB

Approved Project Period: Start Date: 05/18/2012 Expiration Date: 05/17/2013

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (<http://vpred.uark.edu/210.php>). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 50 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

Appendix B. Instrumentation

Interview Guide:

1. Are you familiar with the northeastern Belgium related GMO potato event in May 2011?
 - a. If no, thank the participant for their time.
 - b. If yes, continue questioning.
2. Did you participate in uprooting GM potato field trials in May 2011? If yes, what was your participation?
3. Do you work for, or are associated with, the Flanders government? If yes, what is your current involvement?
4. How are/were you involved in GMO studies or issues?
5. In your own words, please define a genetically modified organism (or genetically modified food product).
6. How have GMO studies affected you individually and professionally?
7. How has the Flanders government presented GMO issues to the public?
8. Do you think the government addresses GMO issues in an effective way? If not, what solutions would you offer regarding GMO issues?
9. What was the primary method of disseminating information to the public regarding the event?
10. Do you feel media coverage was adequate? Why or why not?
11. Are there any miscommunications between the government and public regarding GMO studies? If yes, please explain.

12. How accurate is the public's perception regarding GMO usage in Belgium compared to the government view?
13. Can you describe any negative feelings toward GMO issues? If yes, what are they?
14. Can you describe any positive feelings toward GMO issues? If yes, what are they?
15. What have you appreciated about the risk management tactics the Flanders government has taken to provide valuable information to the public?
16. In your own words, what is medical biotechnology? How do you feel toward the use of it?
17. Please explain, in your own words, what happened in the Belgium potato event in May 2011.
18. Is there anything else you want to express to us about the Belgium potato event or about how the event should have been/or could have been handled differently in the media?

Appendix C. Interview Location

Respondent	Profession	Location of Interview
R1	Scientist	Professional Office
R2	Scientist	Professional Office
R3	Scientist	Professional Office
R4	Activist	Coffee Shop
R5	Scientist	Respondent's Home
R6	Farmer	Professional Office
R7	Scientist	Respondent's Home
R8*	Farmer	Coffee Shop (near Brussels)
R9*	Farmer	Respondent's Home (near Brussels)
R10*	Farmer	Respondent's Home (near Brussels)
R11	General Consumer	Respondent's Home
R12	General Consumer	Respondent's Home
R13	General Consumer	Respondent's Home
R14	General Consumer	Respondent's Home
R15	General Consumer	Respondent's Home
R16	General Consumer	Respondent's Home
R17	General Consumer	Respondent's Home
R18	General Consumer	Respondent's Home
R20	General Consumer	Respondent's Home
R21	General Consumer	Restaurant

*Indicates respondent that was assisted by a translator