AWARENESS OF AND PERCEPTIONS TOWARDS CROP BIOTECHNOLOGY: CASE STUDY OF MEMBERS OF THE SEED TRADE ASSOCIATION OF KENYA

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DECLARATION

This research project is my original and has not been submitted for a degree or any other award in any other university.

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This research project report has been submitted for examination with my approval as the supervisor.

Signature:…….. Date……..

Dr. Tom Kwanya

DEDICATION

To my dear wife Sally and daughters Kelsey and Crystal
for their love, encouragement and support

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CHAPTER ONE

1.0 BACKGROUND OF STUDY

1.1 Introduction

This chapter provides a brief background regarding the awareness of and perceptions towards crop biotechnology. The chapter also briefly discusses the application of crop biotechnology and the debate about that application. It also states the problem of the study as well as the theoretical and conceptual frameworks that will underpin it. Since the study population will be drawn from the members of the Seed Trade Association of Kenya (STAK), the chapter also explains what STAK is, when and why it was formed and its membership structure. The significance of the study, ethical considerations and the methods of dissemination of the findings are also presented in this chapter.

1.1 Background of Study

Biotechnology may be defined as the use of living things (plants, animals and microbes) to make useful products to benefit human beings, animals and the environment. More scientifically, it can be defined as any technique that uses living organisms, or substances from these organisms, to make or modify a product, to improve plants or animals or to develop micro-organisms (AfricaBio 2007)

United Nations (2009), Navarro (2009), Karembu *et al* (2010) and AfricaBio (2007) define biotechnology from a similar perspective as any technological application that uses biological systems, living organisms or derivatives thereof, to make or modify

products or processes for specific use. United Nations (2009) adds that it is the application of technical and scientific advancement in life science to develop commercial products.

Crop biotechnology is part of the new technological trend available to breeders to address intractable agricultural challenges (Navarro 2009). Even so, the technology has attracted considerable polarized and emotional debate (Paarlberg 2008). Various individuals and groups of people have taken opposing positions with regard to crop biotechnology with a view to influencing public opinion and public policy on the matter. Those opposed to biotechnology argue that it is harmful to the environment while on the other hand proponents of crop biotechnology maintain that it is a useful tool that, if responsibly applied, could help to improve agricultural productivity and food security (Karembu *et al* 2010). Mosier & Ladisch (2011) also argue that biotechnology is the application of scientific and the principles of engineering by biological agents to provide goods and services. From the inception of biotechnology it has maintained a strong tie with society since historically biotechnology has been associated with food addressing preeminent issues such as malnutrition and famine in various parts of the world.

Crop biotechnology, also known as genetic engineering of crops, draws its uses and applications from biological sciences such as genetics, biochemistry and cell biology. At the same time it is dependent upon methods as well as knowledge outside the sphere of biology, which include chemical engineering and information technology, among others (Shan 2010).

Advances in genetic engineering have brought crop biotechnology to the fore-front showing the significance of science and technology in solving life problems and issues facing the society in a large scale. The technology is bringing changes in the way people live, their health and the environment (Yount 2008).

1.1.1 Applications of Crop Biotechnology

The promise of biotechnology has been recognized by many scholars and expert groups including United Nations (2002), Juma & Serageldin (2007) and Juma (2011). United Nations (2002), for example, is explicit that biotechnology promises a significant contribution in enabling the development of products for better healthcare and enhanced food security.

Murphy (2011) asserts that biotechnology has been used to increase crop yields. The techniques of modern biotechnology have been used to transfer one or more genes to another crop variety to impart new traits to make it resistant to diseases, pests and tolerant to drought and salinity making it capable of more yields compared to its conventional counterpart (Sadras & Calderini 2009; Paarlberg 2008).

According to James (2011) global adoption of biotechnology crops has continued to grow at unprecedented rate. In 2011 for example, 160 million hectares were planted (up from 148 million in 2010) by 16.7 million farmers in 29 countries, including 19 developing countries and 10 industrial countries. He estimates that such adoption represents a 94-fold increase in hectares planted since the first biotech planting in 1996. If so then, this would qualify biotechnology crops as the fastest adopted crop technology in the history of agriculture.

Altman & Hasegawa (2011) also say that crop biotechnology can reduce vulnerability of crops to environmental stress through introduction of genes to make transgenic crops that are capable of withstanding biotic and abiotic stresses, such as drought, salinity, floods and high temperatures. Plant engineering strategies for reducing stress to crops have become very popular with breeders (Melendez-Ortiz & Sanchez, 2005).

According to Kreuzer & Massey (2008) crop biotechnology has been used extensively to increase nutritional qualities in crops, a classic example being increasing proteins in legumes and cereals through genetic transformation leading to provision of amino acids needed by human beings. High nutritional value is also achieved when plants are genetically modified to give more vitamins and minerals or less fat (Dudek 2009).

When it comes to improvement of taste, texture and appearance of food, crop biotechnology has also come in handy (Khan 2011). The technique has been used to reduce post-harvest spoilage of fruits and vegetables. Fruits can ripen longer on the plant before they can be harvested and transported to the consumer with a reasonable shelf life. This has played a big role in expanding markets for farmers in developing countries due to reduction in spoilage (Khan 2011).

Murphy (2011) further argues that there has been research on how crops can be modified to reduce their dependence on fertilizers and pesticides and the results have been outstanding, adding that the focus of the current commercial applications of modern crop biotechnology is to reduce dependence of farmers on agrochemicals and to prove that crop biotechnology is not harmful to human and animal consumption.

In as much as biotechnology has had positive impact in the world of crop production, the negative influences cannot be ignored. Dudek (2009), for example, claims crop biotechnology has had negative impacts on the economy and food security since companies which produce the seeds have to cover their costs, thus making biotechnology crop seeds more expensive. Hence, he argues that crop biotechnology may result in creating dependency on other countries or multinational companies for supply of better quality seeds to their farmers.

1.1.2 Seed Trade Association of Kenya (STAK)

STAK was formed in December 1982 under the Societies Act Cap 108 of the Laws of Kenya to represent the ideals and interests of the seed industry and to promote trade in quality seed in the county (Seed Trade Association of Kenya 2008).

The association is recognized by the Ministry of Agriculture and the Kenya Plant Health Inspectorate Services (KEPHIS) as the representative of the seed companies in the country.

The organization has a vision of attaining excellence in the production and distribution of quality seeds and any related services pertaining to the seed industry. Its vision is driven by a mission focused categorically on promoting the interest of the seed trade stakeholders by upholding standards in the provision of quality seeds.

The objectives of STAK are to: provide a forum for interaction and information exchange among the members of the organization and relevant stakeholders in the industry; and represent the interest of the seed industry in Kenya both locally, regionally and

internationally and give advice to the respective government regulatory authorities on rules, regulations and general policy (Seed Trade Association 2008).

STAK membership is open to public or private seed enterprises through payment of a one-time entry fee and an annual subscription based on turnover. Membership is in two categories: ordinary members, who are public or private seed companies having seed as their core business. The other category is associate membership, which is open to Non-Governmental Organizations (NGOs), government agencies and relevant agricultural research institutions. The association strongly supports adoption of modern biotechnology by its members. It is affiliated to the African Seed Trade Association (AFSTA), whose position on biotech is also supportive of the technology (AFSTA 2006).

1.2 Problem Statement

Despite the potential benefits of crop biotechnology (Karembu *et al* 2010; Melendez-Ortiz & Sanchez 2005), especially to developing countries and commitment by various governments, including Kenya's, to harness the technology for national development, there is little progress in the adoption of the technology in Africa where only three countries - South Africa, Egypt and Burkina Faso - have commercialized biotechnology crops (James 2011). Instead, a lot of resources have been devoted to managing perceptions towards biotechnology risks rather than investing in its adoption and use.

The question is why the rate of adoption of crop biotechnology is so slow in Africa, even in countries like Kenya where all the necessary legal requirements needed for commercial deployment of such crops have been put in place by the government. These include the Biosafety Act 2009, Biosafety Policy 2006 and Biosafety Regulations 2011.

Studies conducted by Paarlberg (2008) and Juma & Serageldin (2007) concluded that negative perceptions, low awareness and opposition to biotechnology are major factors contributing to low adoption of crop biotechnology in Africa. Karembu *et al* (2010) adds that there is low uptake of crop biotechnology in Africa, including Kenya, because the governments, due to influence by negative perceptions and low awareness of the technology, adopted stringent regulations and policies that make it harder for companies to trade in crop biotechnology.

Anunda *et al* (2008) and Gathaara *et al* (2009) have also conducted thorough assessment of biotechnology awareness and perceptions in Kenya. The studies concluded that there is a low level of awareness of modern biotechnology among the Kenyan public. Anunda *et al* (2008) therefore recommends that a well-designed program be implemented in Kenya to create more awareness of biotechnology among the public. However, the two studies focused on biotechnology awareness and perceptions by the general public. Currently, there is no study that has been conducted on members of STAK's awareness of and perceptions towards crop biotechnology. This proposed study therefore aims at bridging this gap by conducting scientific study to establish awareness of and perceptions towards crop biotechnology by members of STAK.

This study also determines STAK members' sources of information so that such information can be used in future to design a biotechnology awareness education and communication program to be targeted at the seed industry to partly fulfill the proposal for such a program by Anunda *et al* (2008).

This research intends to fill this gap because the seed industry in Kenya plays crucial role in the deployment of certified quality seeds to farmers through the market system. The seed industry is expected to play a significant role of acquiring, producing, packaging and marketing the biotechnology crop seeds to the farmers in Kenya. It was therefore the purpose of this study to find out their level of awareness of and perceptions towards crop biotechnology as this would determine their readiness to diffuse the crop biotechnology seeds to farmers through their well-established commercial network.

1.3 Research Objectives

This research sought to assess the level of awareness of and perceptions towards crop biotechnology by members of STAK (*see 1.1.2 above for details about STAK membership*). It further aims to establish the sources of crop biotechnology information among STAK members.

1.3.1 Specific Research Objectives

The specific objectives of this study were to:

i) Determine STAK members' level of awareness of crop biotechnology;

ii) Determine STAK members' perceptions towards crop biotechnology;

iii) Establish STAK members' key sources of information on crop biotechnology;

iv) Determine factors that determine STAK members' perceptions about crop biotechnology;

v) Recommend strategies to improve STAK members' awareness of and perceptions towards crop biotechnology.

1.4 Research Questions

i) What is the level of awareness of crop biotechnology among STAK members?

ii) What are the perceptions towards crop biotechnology by members of STAK?

iii) What are the sources of information used by members of the STAK with regard to crop biotechnology?

iv) What factors determine formation of STAK members' perceptions about crop biotechnology?

v) What are the strategies that can be used to improve levels of awareness of and perceptions about crop biotechnology among STAK members?

1.5 Theoretical Framework

1.5.1 Selective Exposure Theory

The Selective Exposure Theory of communication underpins this study. Available data shows that selective exposure theory originated from the cognitive dissonance theory, which posits that people always strive for consonant information and avoid dissonant ones to maintain their mental balance (Severin & Tankard 2000). The cognitive dissonance theory on which selective exposure theory is based can be traced back to Festinger (1957). Cognitive Dissonance theory notes that an imbalance among cognitions can affect a person in three ways: a consonant relationship, in which cognitions are in equilibrium with each other; a dissonant relationship, in which cognitions are in

competition with each other; and an irrelevant relationship, in which the cognitions in question have no effect on one another.

The selective exposure theory refers to individuals' tendency to favour information that reinforces pre-existing views while avoiding contradictory ones (Fischer *et al* 2010). According to this theory people tend to select specific aspects of information they are exposed to depending on their perceptions, beliefs, awareness and decisions. For example, STAK members may selectively expose themselves to either negative or positive information about crop biotechnology depending on their predispositions towards the technology. Diab (in McCroskey & Prichard 1966) found that Muslim students tend to listen to radio programmes and read newspapers containing views, ideas and opinions expressing Arab unity in conformity with their own. The reason for such selective exposure to information could be to achieve cognitive equilibrium since contradictory information could lead to cognitive dissonance. In order to attain this equilibrium, Zillmann & Bryant (1985) argue that individuals may either reinterpret the information they are exposed to or select information that is supportive of their predestined view, say, of crop biotechnology.

Selective Exposure Theory shows that information-seeking behaviour continues even after an individual has taken a stance on an issue such as adoption of crop biotechnology. This means that information-seeking behaviour will be influenced by the position already taken on the issue by the individual or by a group, such as STAK, to which the individual may belong. Thus, selective exposure operates by reinforcing knowledge, attitudes and beliefs rather than exposing individuals to a diverse array of viewpoints, which is

considered an important aspect to better understanding of a controversial subject like modern crop biotechnology.

Furthermore, because information and resources are critical to learning, people decide to stay away from new information because it often conflicts with their own beliefs. Selective exposure can affect the decisions people make because they may be unwilling to change their views and beliefs (Sweeny *et al* 2010). A number of studies have shown that selective exposure effects can occur in the context of both individual and group decision making. For example, Schulz-Hardt *et al* (2010) investigated whether information searches were determined by subjectively perceived information and to what extent they were persuaded by such information.

In summary selective exposure can enable one to consume messages consistent with their views while eschew those that are in discordance. This study uses the theory to determine information seeking behaviour of STAK members with regard to crop biotechnology. According to Freedman and Sears (1965), Selective Exposure Theory makes two basic assumptions concerning the decision-making process. First it assumes that seeking consonant information does not cease once a decision has been made but continues into a post-decision period to reinforce the decision already made. Second, it assumes that the post-decisional information seeking and evaluation is biased by certain factors conditioned by the decision-making process. Even so, Freedman and Sears (1965) failed to take into account the revision of the basic postulates of the theory by Festinger (1964). In this work, Festinger noted that an individual originally opposed to an idea or issue can willingly expose himself to dissonant information if he thinks such information can easily

be refuted. He also argued that an individual may expose himself to dissonant information if he thinks it will be useful to his future decisions regarding the issue, such as crop biotechnology. This can easily happen to STAK members who currently may be opposed to crop biotechnology but because of the rapid adoption of the technology they may feel that their continued resistance could lead to even great pain of cognitive dissonance, especially when they see their competitors who became early adopters of the technology are reaping the benefits by selling more seeds to farmers. This theory combined with the Uses and gratification theory discussed below will therefore be very helpful in understanding the behaviour of the members of STAK towards crop biotechnology.

1.5.2 Uses and gratifications theory

In addition to the Selective Exposure Theory, this study was guided by the Uses and Gratifications Theory. The origins of this theory can be traced to the 1940s and 1950s when researchers started investigating what motivated people's mass communication behavior, such as reading newspapers, and listening to particular programs on radio among others. According to Greenberg (1974), uses and gratification research continued into late 1960s with focus being on identification of social and psychological factors behind people's media use patterns.

This theory brings fresh approach to the understanding of why people actively seek out specific media outlets and content for gratification purposes. The theory discusses how users proactively search for media that will not only meet a given need but enhance knowledge, social interactions and diversion. This study used the uses and gratifications

theory to reinforce understanding of how members of STAK use sources of information to obtain information on crop biotechnology. This is because, according to Greenberg (1974) the theory posits that audiences are responsible for choosing media to meet their particular needs. It assumes that usage of information sources depends upon individuals' sociological milieu, that is, the structure of both the groups and the contexts in which the audience is situated. Uses and gratifications research tests also imply the psychological principle that human perception is not a passive registering process, but an active organizing and structuring process and that they are generally aware of their underlying reasons for consuming the contents of a particular information source such as the mass media (Greenberg 1974). The above uses and gratifications approach helped this study to determine what sources of information influences members of STAK's awareness and perceptions of crop biotechnology.

This theory has, however, been criticised for being non-theoretical and a mere strategy for collecting data (Swanson 1977). He argues that uses and gratification theory is bereft of a systematic method for explaining human behaviour. Critics of uses and gratification also argued that it relied heavily on self-reports; that it failed to investigate the origins of the needs that people sought to gratify; and that it also did not critique possible dysfunction both for self and society of certain kinds of audience satisfaction, (Katz 1987). Despite the severe criticism, several researchers, especially at Columbia University, continued examining the effects of the mass media on political behavior using uses and gratification approach. For instance, Lazarsfeld *et al* (1948) and Berelson & Steiner (1964) studied voters in Erie County, Ohio, during the 1940 election between

Roosevelt and Wilkie and voters in Elmira, New York, during the 1948 Truman–Dewey election and concluded that mass media had limited influence on voters' voting decision.

Hence, for purposes of this research, uses and gratification theory was useful in aiding understanding of why and how members of STAK use information sources to receive crop biotechnology information. It also helped in finding out whether the mass media STAK members use as sources of information on crop biotechnology have any significant influence on their perceptions towards the technology. In summary, using this theory in combination with selective exposure theory described above provided a better understanding of not only how members of STAK use the media to get information on crop biotechnology but also why they seek such information from particular sources or medium.

1.5.3 Conceptual Framework

Conceptual Framework is the result of what a researcher conceptualizes as the relationship between variables in the study and shows the relationship diagrammatically (Mugenda & Mugenda 2003). A conceptual definition is an element of the scientific research process in which a specific concept is defined as a measurable occurrence or in measurable terms; it basically gives one the meaning of the concept (Mugenda 2008). He says that a conceptual framework helps in the formulation of the research design and providing a reference points for discussion of literature, methodology and data analysis. It thus assists the researcher to organize his/her thinking and complete an investigation successfully by providing the linkages between the various concepts in the study.

Independent variables are those variables which are systematically varied by the researcher. On the other hand, dependent variables are those variables whose values are presumed to depend on the effects of the independent variables (Mugenda 2008). In this study media influence; social interaction and professional interaction are the independent variables while perception and awareness of crop biotechnology are the independent variable.

Media is thought to have ability to influence formation of perceptions towards and creation of awareness of crop biotechnology. Social interaction just like media influence can shape perception and awareness of a given technology. When people in the network talk about crop biotechnology then the existence of the technology will be known by the members. For instance, STAK may be taken as an example of a professional and social network, where if discussions about crop biotechnology frequently take place, then members who are privy to such discourse could reasonably be expected to be aware of the technology. Positive talk about crop biotechnology as people interact may influence the perception of the technology positively and vice versa.

The conceptual framework in figure 1.0 below shows the relationship between the dependent variable and the independent variables. It also shows the expected outcomes from the interaction of the variables. In this study the independent variables are the components of communication channels. In addition to the above functions, this conceptual framework will guide development of the questionnaire for data collection and interpretation of data to determine to what extent the various dependent variables are responsible for STAK members awareness and perceptions towards crop biotechnology.

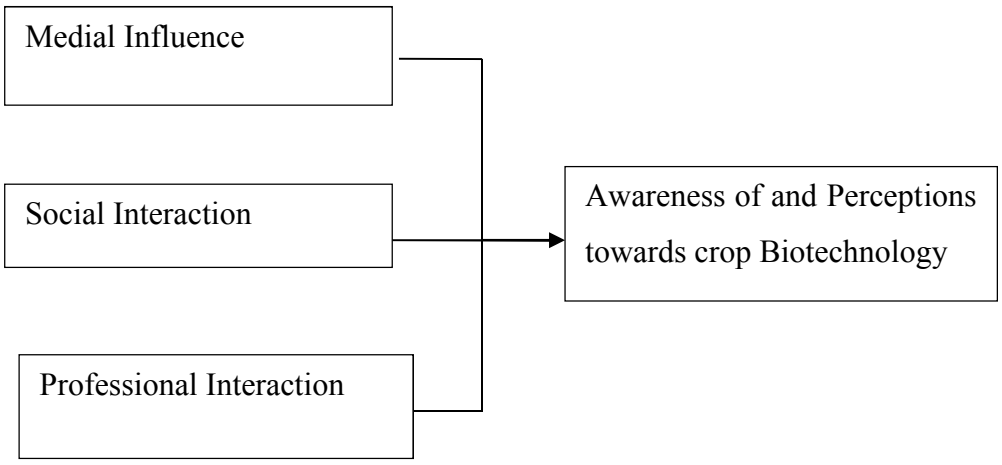


Figure 1.0: Conceptual Framework

Source: The Researcher 2012

1.6 Significance of the Study

This proposed study is new and unique as it aims to determine the awareness of and perceptions of members of STAK with regard to crop biotechnology. Although critical to the deployment of crop biotechnology seeds to farmers in Kenya, currently there is no concrete information about the seed industry's perceptions of crop biotechnology. Hence, this study is significant because it will bridge that critical gap. In addition, the study will be significant to a number of groups and institutions, including:

1.6.1 Scholars

The information will be of great value especially for development communication scholars interested in the adoption and diffusion of crop biotechnology in Kenya. The study will provide them with a source of credible, scientific reference material and data for future studies on perceptions and awareness on crop biotechnology and types of existing knowledge about it within the seed industry in Kenya.

1.6.2 Government

The government will be able to use the findings to know what the seed companies in Kenya think about crop biotechnology so it can find ways of communicating with them to raise their awareness or change their perceptions towards crop biotechnology as it moves towards ensuring that crop biotechnology seeds as available to farmers as provided for in the National Biotechnology Development Policy of 2006 and the National Biotechnology Awareness Creation Strategy of 2008.

1.6.3 Development agencies

The findings will help crop biotechnology transfer organizations to design appropriate, evidence-based crop biotechnology communication and outreach intervention strategies for the seed industry. This will also help them to determine the level of resources needed to create an environment which is conducive for safe and responsible commercial deployment of biotechnology crop seeds in the country.

1.7 Scope of the study

This study is exploratory in nature. It explores and analyzes the awareness of and perceptions towards crop biotechnology by members of STAK. It does not explore awareness levels and perceptions towards crop biotechnology of all Kenyans. It l also does not explore STAK members' awareness of and perceptions towards other aspects of biotechnology like industrial, medical and environmental biotechnology.

1.8 Limitations of the study

The first limitation involves finance. All the expenses involving the research were met by

the researcher besides the fact that part of the same finances had to be channeled into other household uses. This was overcome by acquiring loans to meet the expenses involved.

The second limitation appertains to confidentiality. Some of the interviewees were be willing to reveal information fearing that it would compromise their corporate secrets. They did not wish to reveal the information or they thought that they would not benefit from responding perhaps even be penalized by their superiors for divulging sensitive information on the company's position on biotechnology. This was overcome by sending the questionnaires together with the introductory letters with specific information on the purpose of the research and the confidentiality of the information provided. The letter informed the respondents that the information would be used specifically for academic purposes and absolute confidentiality would be maintained.

The third limitation involved limited availability of relevant literature on the study topic. There was no study on awareness of and perceptions towards crop biotechnology by members of STAK. There was also very scanty literature on general awareness and perceptions of modern biotechnology among the Kenyan public. Our search for literature on biotechnology awareness yielded only two relevant studies. However, there was a lot of literature on biotechnology perception studies elsewhere in Africa and the world. But even these were not specific to seed industry's awareness of and perceptions towards crop biotechnology in those countries.

1.9 Dissemination strategy

The following strategies will be used to disseminate the findings of this study.

- Publishing in refereed journals;
- Presenting the findings in relevant seminars, workshops and conferences;
- Writing and publishing an educated opinion article in the mass media;
- Placing copies at the University of Nairobi libraries; and
- Uploading a PDF copy on to the School of Journalism website.

1.10 Ethical considerations

The following ethical considerations were taken into account:

- Ensure voluntary participation of respondents in the study;
- Maintain confidentiality of sources;
- Provide respondents with adequate information about the study for them to give informed consent;
- Attribute all secondary data used in this research; and
- Reflect views of respondents accurately.

1.11 Summary of Chapter

Crop biotechnology is a reality and it exists with us as a society, no matter the views held by those for and those against the technology. It is therefore critically important to study and find out awareness of and perceptions towards crop biotechnology among members of the Kenyan public in general and specific segments of the public, such as seed traders in particular. This study proposes to determine awareness of and perceptions towards crop biotechnology among members of STAK, using selective exposure and uses and gratifications theories of the media as the theoretical underpinnings. This chapter argues that it is critical to study and establish the levels of awareness of and perceptions towards

crop biotechnology among this segment of the Kenyan population because they are critical to the deployment of seeds to farmers.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter presents a structured review of the relevant literature on awareness of and perceptions towards crop biotechnology. The review is structured into five major parts. Part one is a review of general literature on perceptions and awareness with a view to providing a brief explanation of what perceptions and awareness are. Part two provides a review of literature on perceptions and awareness with reference to crop biotechnology. Whereas part three gives an incisive look at literature on arguments in support of crop biotechnology, part four is a review of secondary materials against it. The last part is a review of materials on controversies surrounding crop biotechnology. The chapter ends with a concise summary of what has been presented in the five parts and an overview of the purpose of the study.

2.1.1 Perception and Awareness

According to Park & Parks (2009) perception is the process by which individuals collect, collate and comprehend the world through their five senses. They assert that all people have filters that affect their perceptions. People's perception filters are majorly shaped by their interests. The filters exist so as to keep them from overloading themselves with too much information.

Perceptions are also very powerful and difficult to change unless a very significant event occurs, argues Park & Parks (2009). In the case of modern crop biotechnology,

misperceptions and logical inconsistencies that impede diffusion of the technology in Africa can only be deconstructed if the technology is explained thoroughly through strategic communication so that it can be understood by stakeholders for what it really is. Several stakeholders (the attentive publics) are involved in framing the crop biotechnology discourse thereby influencing policy and determining the adoption trends of the technology (Navarro 2009).

According to Gardner (2009) there is indeed a big difference between the perception and the reality about biotechnology crops. He contends that perception is a process by which people become aware of the world around them through the process of comprehending, apprehending and finally understanding. Hence, biotechnology communication interventions aimed at modifying perceptions ought to target all these stages of perception process.

He *et al* (2009) define awareness as the knowledge gained through one's perception or by means of information. It is a level of consciousness where awareness of one type of idea automatically leads to awareness of another idea. According to White *et al* (2011) awareness is a state and quality of being aware of something.

CTA (2002) defines public awareness as a process of informing target audiences about an organization's activities. It can also be about informing people about a subject or an issue they need to know about and understand so that they can make informed choices.

2.1.2 Perceptions and Awareness of Crop Biotechnology

According to Dadezie (2001) public perceptions can negatively affect the acceptance and diffusion rate of an innovation, such as biotechnology-driven crops and their products. He further argues that adverse public reaction to a technology or product may keep it from ever being commercialized.

The awareness of and perceptions towards crop biotechnology are influenced by communication channels, which are means through which they get to the direct or indirect consumers. Good examples are the media which will champion both sides of the debate about crop biotechnology (Brossard *et al* 2007).

Biotechnology, as a new scientific development, raises a lot of perceptions and awareness issues among the stakeholders concerned (Navarro 2009; Nwankwo 2009). Navarro (2009), for example, notes that world opinions on biotechnology vary markedly. For instance, most European Union countries reluctantly accept adoption and trade in genetically modified organisms (GMOs). Some of them like France have banned growing of some biotechnology crops, such as Bt. Maize.

These contrasts starkly to the position taken by many other countries like the United States of America, India, China, Mexico, Argentina, south Africa, India, Burkina Faso, Egypt, The Philippines and Spain, among others, who are convinced that the technology, though not a panacea to food security challenges, can help to reduce hunger and poverty around the world (James 2011; Paarlberg 2008; Juma 2011). Yet there are those who posit that hunger and poverty are social issues that cannot be resolved by technological interventions, such as crop biotechnology, alone (Clark & Pazdernik 2010).

The implementation of crop biotechnology in Africa should be quite attractive since the weather conditions are harsh and crop yield is reducing every year, argues Murphy (2011). On the contrary, others, such as Jain (2011), argue that crop biotechnology may not be suitable for small-scale farmers in Africa. They insist that those who benefit from crop biotechnology are large corporations like Monsanto, Pioneer, Bayer and Syngenta, among others, who own the technologies (Schurman & Munro 2010). This kind of reasoning may have significant influence on the behaviour of owners of smaller seed companies towards adoption and diffusion of modern biotechnology crops.

Public opinion surveys have been conducted and have yielded a lot of good information on the public knowledge about crop biotechnology. Examples include Anunda *et al* (2008) and Gathaara *et al* (2009), among others. The surveys are of two types. There are those that are professionally designed illuminating a lot of useful information and those that are poorly designed with an aim to gather support from one viewpoint either for or against crop biotechnology (Correa 2010).

Most of information on perceptions towards and awareness of crop biotechnology is from the internet where there is little quality control. The organizations that provide this information are primarily interested in marketing and selling what they are giving without the consumers' interest in mind. The mass media, such as television and the radio, are also major sources of information on crop biotechnology. Even so, very few of them provide an in-depth analysis of crop biotechnology issues from all the angles whether for or against (Peczon & Manalo 2009).

Kreuzer & Massey (2008) point out the existence of print media, such as journals and newspapers that provide information on crop biotechnology and that even if they exist, very few people have access to them due to lack of money. They maintain that most of the people are not interested in reading and digesting the technical information. The result is a large percentage of the global population with very little factual, concrete information on modern biotechnology (Navarro 2009).

2.1.3 Arguments for Crop Biotechnology

Ancient crops have been facing challenges adapting to changes in the environment resulting to environmental stresses. Crop biotechnology has played a key role in developing crops that are resistant to extreme weather conditions, such as heat, cold and water stress. Also included are adverse soil conditions, such as high salinity, acidity, alkalinity and various types of toxicity (McHugen 2007; Persley & MacIntyre 2008).

There are those who believe that crop biotechnology is the answer to some of the challenges facing agriculture today. Juma & Serageldin (2007), for example, say the technology should be deployed to address key challenges facing Africa, such as food security, malnutrition, healthcare and environmental degradation, among others. Hence, they urge the continent to expand its capacity through training, investments and infrastructure development so that it can effectively and efficiently harness biotechnology for development. Their advice is for the continent to adopt a 'co-evolutionary' approach whereby consumer protection goes hand-in-hand with exploitation of the continent's crop biotechnology potential.

That position is supported by Paarlberg (2008) who posits that most African countries have frustrated adoption of crop biotechnology by adopting stringent European Union regulatory approaches towards the technology. He argues against such a position noting that Africa needs the technology more than Europe that is already food secure and rich. In fact two-thirds of farmers in Africa use out dated agricultural technologies are too poor to afford fertilizers and insecticides needed for crop protection for better yields. Hence they are in need of better technologies, such as crop biotechnology-driven seeds, that can give them higher yields with less additional inputs. Paarlberg (2008) further attributes the rising poverty and hunger indexes in Africa to non-productive agriculture and submits that crop biotechnology adoption could help to reverse such negative trends.

Juma & Seragaldin (2007) are explicit that African leaders should take strategic measures to promote the application of modern biotechnology as central to regional economic development. Towards this end, the Common Markets for Eastern and Southern Africa (COMESA) has moved a step forward by developing guidelines for trade, importation and planting of biotechnology crops. COMESA is categorical that the region's regulatory institutions, like the Kenya National Biosafety Authority (NBA), should have transparent and high quality scientific regulatory capacity to facilitate rather than stifle trade in biotechnology products in the region. Juma & Serageldin (2007) further argue that the African Union should task the Pan-African Parliament to lead in the promotion of adoption of crop biotechnology by the member-states.

According to Altman & Hasegawa (2011), the goals of crop biotechnology fall into two categories: input traits and output traits. While input traits are purposed to improve the

performance of crops in the field; output traits are designed to develop new products with enhanced value. Currently, most of the commonly grown biotechnology crops are of input traits kind. However, more crops with output traits are expected to be available to farmers in the near future due to trends in advancement in crop biotechnology development and innovations (Shan 2011).

McHugen (2007) also says that crop biotechnology has played a crucial role in the development of new crops that are resistant to drought, pests and diseases which are very relevant to developing countries. The first generation biotechnology crops provided tangible benefits to farmers by cutting costs of weed and insect control.

Improvement of post-harvest life has also been accredited to crop biotechnology (McHugen, 2007). Fruits and vegetables today can be genetically engineered to improve taste and post-harvest qualities. The technology has been applied to reduce early softening of fruits like apples to increase their shelf-life which is advantageous to both farmers and traders.

Crop biotechnology has also played a crucial role in producing foods with improved nutritional qualities. Crop biotechnology has also enabled scientists to produce crops with improved vitamin content. Crops like rice, sorghum, potatoes, cassava and maize have been targeted for vitamin A fortification. Vitamin A deficiency is the leading cause of blindness among children, affecting up to 250 million children.

According to Paarlberg (2008), African agriculture needs to follow on the footsteps of Asian Green Revolution of the 1960s and 1970s. This famous agrarian revolution epoch

was based on widespread planting of new improved seeds, heavy use of fertilizers and lavish application of insecticides. He argues that with crop biotechnology seeds, Africa has a chance to improve its agricultural productivity and reduce hunger and poverty.

2.1.4 Arguments against Crop Biotechnology

In recent years as awareness has increased about crop biotechnology, various arguments have been advanced from both academic and social spheres against the use of crop biotechnology to improve agricultural productivity because it is allegedly harmful to health and against the principles of nature (Mills 2010).

Biotechnology has also been pilloried as a matter of man dominating nature without respect for the slow process of plant natural growth. Critics further argue that genes can mutate with harmful effects. Jain (2011), for instance, asserts that the artificial insertion of genes has the possibility of destabilizing organisms with devastating effect on non-target species such as pollinators and micro-organisms.

Questions have been raised about who benefits from crop biotechnology as a scientific innovation. Pilisuk & Rountree (2008), for example, argue that crop biotechnology does not benefit the common people; it is a technology that is run and controlled by those in the corporate class protected by patent contrary to what famers do year in year out of saving and exchanging seed for replanting.

Murphy (2011) says consensus from varied places and collected data has shown that widespread yields has increased significantly without biotechnology crops contrary to what is said about the crops having the potential to increase yields by many folds. For

example, he argues that the use of Bt maize has not resulted in increased yields contrary to claims by crop biotechnology supporters.

Midiwo & Clough (2010) and Mzinga (2005) dispute the notion that biotechnology will eradicate hunger in Africa. They contend that the real causes of hunger are poverty, inequality, lack of access to land and poor food distribution. They further argue that the call to farmers by supporters of crop biotechnology to practice monoculture in agriculture could undermine ancient ecological methods of farming like crop rotation and multi-cropping that have served farmers well for decades. Mzinga (2005) goes as far as calling on African governments to either ban or adopt a precautionary principle with regards to application of crop biotechnology.

2.1.5 Controversies Surrounding Biotechnology

Despite claims that biotechnology has helped increase crop yield and production of foods with improved nutritional value and longer self-life, there are various controversies that still surround crop biotechnology (Navarro *et al* 2006). The controversies fall into three main categories: safety, ethics and trade (Traynor *et al* 2007). While environmental health and ethical aspects of crop biotechnology are important and require policy attention; the main sources of controversy lie in the socio-economic impacts of biotechnology, especially those related to trade, argues Juma (2008).

Critics of crop biotechnology claim that its process and products pose grave danger to the environment (Millar *et al* 2009; Mzinga 2005). They claim that a number of researches conducted on potential impact of biotechnology-derived crops on beneficial insects and concluded that the technology is harmful to such insects. They give the example of the

Monarch Butterfly larvae that they claim was affected by pollen from transgenic maize deposited on milkweed plants after feeding on them and that this led to the decline of butterfly population in the areas affected (ISAAA 2002). Proponents of crop biotechnology dismiss that claim as a myth, arguing that detailed investigations by the USA's environment protection agency found no evidence of diminished population of the butterflies. Instead, the Agency concluded that reduction in insecticide use due to planting of transgenic crops is beneficial to the butterflies which feed mainly on milkweed plants found next to main farms in the country (ISAAA 2002).

On the contrary, proponents of crop biotechnology, such as James (2011), ISAAA (2002) and Traynor *et al* (2007), argue that the technology should be hailed as a saviour to the environment instead of being vilified since it:

- Allows for no-till agriculture which preserves topsoil by preventing soil erosion, conserves water due to less runoff and even cuts greenhouse gasses due to reduction in the use of farming machinery;
- Reduces the amount of pesticide used in growing crops;
- Protects crops against disease, almost like a built-in vaccine that prevents the crop being destroyed by viruses;
- Maximizes crop yields which helps to meet increasing world demand for food without taking over more land; this preserves biodiversity. Biotechnology has the potential to double crop production on existing farms, preventing the need to convert additional land; and

- Allows farmers to control weeds more selectively and use environmentally friendly herbicides, among others.

Graham & Barfoot (2012) also posit that crop biotechnology has contributed significantly to reduction of insecticide and herbicide use to the advantage of the environment. They say that since 1996, the use of pesticides on the biotechnology crop area was reduced by 448 million kg of active ingredient (nine per cent reduction), and that the environmental impact associated with herbicide and insecticide use on these crops fell by17.9 per cent.

Even so, Persley & MacIntyre (2008) underscore the fact that application of modern biotechnology in agriculture has split the public leading to an intense debate as to the safety and efficacy of the new products. Hence they call for effective regulation to allay such fears.

In addition, Chauhan (2008) argues that crop biotechnology could lead to risks such as geneflow that may produce super-weeds, genetic pollution and destruction of biodiversity.

According to Kreuzer & Massey (2008), research on biotechnology has been focused on benefit analyses rather than examining environmental impacts of the technology. Consequently, they label the benefit analyses reports as biased and only favourable to interested parties.

Consumer concerns on the labelling of crop biotechnology products have also been a thorny issue (Roy 2011). Due to such concerns, enormous pressure has been piled by lobby groups on some governments and unions, such as Kenya, South Africa and Japan

and the African Union and the European Union countries, to put in place regulatory requirements that biotechnology-derived products must be labelled.

From a trade perspective the use of crop biotechnology has raised a lot of concerns. According to Holdrege & Talbott (2008) the use of crop biotechnology can result in the loss of export opportunities since some countries have put a moratorium on trade in biotechnology products within their borders. This could lead to strained trade relations and an escalation of poverty in developing countries, they argue.

Alexander (2009) argues that crop biotechnology will only benefit large scale farmers as it is not suitable for smallholder farmers that dominate farming in Africa. He fears that this scenario could lead to a situation where food production and accruing benefits are controlled by few commercial farmers. This would gravely interfere with the livelihoods of poor people who depend on subsistence farming.

The cost of crop biotechnology-derived seeds is also another touchy matter. Alexander further argues that farmers in developing countries have to dig deep into their pockets to buy seeds every year from the same company that provides the genetically engineered crop leading to dependency. On the other hand, James (2011) argues that the benefits of crop biotechnology far outweigh the perceived risks. James (2011) asserts that the technology should be embraced by all countries.

Paarlberg (2008) asserts that biotechnology crops are more regulated than their conventional counterparts. Nuffield Council on Bioethics (2003) also attests to the

stringent regulation and safety of biotech crops and recommends them for use in developing countries to fight poverty and hunger.

There are also ethical questions about crop biotechnology (Nuffield Council on Bioethics 2003). Critics argue that the technology is playing God by changing the genetic make-up of organisms to create new transgenic crops. Transgenic crops are crops which contain a foreign gene artificially inserted into it through genetic engineering.

In response to the above concerns about risks and safety of crop biotechnology, the international community has set biosafety standards for risk assessment under the Cartagena Protocol on Biosafety to the Convention on Biological Diversity (Secretariat of the Convention on Biological Diversity 2000). The Protocol obligates signatories to develop, adopt and implement national biosafety laws to govern research, development and trade in biotechnology products, including biotechnology crops or seeds. As stated below, the Protocol is very explicit on its main purpose:

"…the objective of this Protocol is to contribute to ensuring an adequate level of protection in the field of the safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health, and specifically focusing on trans-boundary movements" (Secretariat of the Convention on Biological Diversity 2000:3).

Commenting on the controversies surrounding crop biotechnology, the Chairman of the Nuffield Council on Bioethics, Professor Bob Hepple QC, writes: "I have been struck by

the extent to which the public debate on GM crops continues to be highly polarized in a partisan way. Instead of a sober estimate of the risks and benefits of GM crops on a case by case basis, there is a view that any attempt to even consider their potential is unconscionable. This cannot be right" (Nuffield Council on Bioethics 2003: v).

2.4 Summary of Chapter

In this chapter, the researcher reviewed literature on perceptions and awareness in an attempt to define the two terms. He also reviewed and presented scholarly literature in support and against crop biotechnology. The chapter has also reviewed literature on the controversies surrounding crop biotechnology in areas like safety, ethics and trade. Attempts have also been made to review literature on attempts to address the concerns and controversies, for example, to promulgation of the Cartagena Protocol on Biosafety and the Nuffield Council on Bioethics. From the foregoing, it is evident that there will always be those supportive and those opposed to application of crop biotechnology in agriculture in Africa. This is because while one group sees crop biotechnology as a solution to the hunger and poverty situation in Africa, another group views it as unethical and full of risks to the environment, health and trade. Although not much is known about the views of members of STAK with regards to crop biotechnology, it is possible that they also hold such polarized views with regards to the technology as has been demonstrated above. This study explored the awareness and perceptions of members of STAK with regard to crop biotechnology with a view to generating data that could be used to provide credible biotechnology communication targeting them with factual

information to help them to make informed decisions with regards to crop biotechnology and also resolve the dilemma.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter lays down the procedures that the researcher used in conducting the study on *Awareness of and Perceptions towards Crop Biotechnology by Members of STAK*. The whole section describes the area of study, research design, study population, sampling techniques, sample size, data collection techniques and finally data analysis and presentation.

3.2 Research Design

This was an exploratory research. It sought to explore a phenomenon. It therefore explored such basic questions as what, how, when and where about the factors influencing awareness of and perceptions towards crop biotechnology by members of STAK.

According to Mugenda & Mugenda (2003), a survey is an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables. According to Kothari (2004), surveys are only concerned with conditions or relationships that exist, opinions that are held, processes that are going on, effects that are evident or trends that are developing. The method of data collection happens to be either observation or interviews or questionnaire (Kothari 2004). A cross-sectional survey research involves the use of structured questionnaires and/or statistical surveys to gather data about people and their thoughts and behavior (Cooper 2001).

Survey research is suitable for this research because it seeks to obtain information that explores in order to describe an existing phenomenon. It also helps to explain and explore the existing status of two or more variables at a given point in time. Surveys are also used in collecting data from large populations that are not easy to observe directly. This study endeavored to assess perception and awareness levels of the members of the STAK on crop biotechnology.

3.3 Research Paradigms

Social scientists, including communication researchers, have developed four main paradigms for understanding social behavior Denzin &Lincoln (1994). These include Positivist, Systems, Interpretive and Critical Paradigms. This study used a combination of the *Positivist* and *Interpretive* Paradigms to explore and explain levels of awareness of and perceptions towards crop biotechnology by members of STAK.

The Positivist Paradigm is based on the belief that society could be studied in the same way that scientists study natural phenomena. In other words, it is based an objective reality and seeks to explain causal relationships between variables (Wood 1997). Thus, the paradigm, whose origins is attributed to the French Philosopher Auguste Comte (1798-1857), is characterized by its belief in an objective reality knowable only through empirical observation; the study of variables; the development of theories that enable prediction, explanation and control; the search for generalized laws; and observations in the form of quantitative data Denzin &Lincoln (1994). Therefore, using this paradigm gave us better insight into the quantitative aspects of this research.

On the other hand, Interpretive paradigm helped us to understand and explain why members of STAK behave the way they do towards crop biotechnology. According to this paradigm, human action is purposive (Putman & Pacanowsky 1983). It posits that people act based on their social milieu and values in which they oscillate, and that such actions are attributed meaning by significant others in their shared social world. Hence, to the interpretivists, individuals act the way they do because they are attempting to achieve a certain objective or purpose. For example, a member of STAK may decide to attend a crop biotechnology seminar because his or her company is planning to produce and sell crop biotechnology-derived seeds. This paradigm relies heavily on qualitative data to construct frameworks for understanding and explaining human behavior (Wood 1997). In summary, since this research used both qualitative and quantitative data to determine the levels of awareness of and perceptions towards crop biotechnology, it would benefit immensely by using combination of the Positivist and Interpretive paradigms

3.4 Study Population

According to Mugenda & Mugenda (2003), a population is a complete set of individuals, cases or objects with some common observable characteristics while target population refers to that population to which a researcher wants to generalize the results of a study. The population of the study consisted of both the individual and associate members of STAK.

3.5 Sampling Technique

A sample is a subset of a particular population. A sample of 33 (10% of total population) interviewees were selected using purposive sampling method to reduce the occurrence of

undesired responses and because of ease of data collection, time available and the cost involved in data collection. Different opinions have been expressed by experts on the subject of sample size. Some suggest the sample should be five percent of the population while others suggest it should be at least 10 percent. However, none is true or false because the mere size alone does not ensure representativeness and information value. According to Mugenda & Mugenda (2003), purposive sampling is a sampling technique that allows a researcher to use cases that have the required information with respect to the objectives of his or her study. Cases of subjects are therefore handpicked because they are informative or they possess the required characteristics. It is a form of biased sampling or non-probability sampling used when a researcher is not interested in selecting a sample that is representative and information value of the population. Most qualitative studies use non-probability samples because the focus is on in-depth information and not making inferences.

A sample representation was chosen for the study through stratified random sampling procedures. The target population included the individual as well as associate members of the STAK who were administered with their respective questionnaires.

3.6 Data Collection Technique

Data collection is the process of gathering information about a phenomenon using data collection instruments (Sekaran 2000). Both primary and secondary sources of data were used to obtain information for the study. Secondary data from research reports, books, journals and Internet were used to provide a wider understanding of the issues under research and to supplement primary data. This was conducted by referring to existing

official reports and documents from the named entities, journals, other empirical researches in the area and any other relevant document from the libraries and Internet. Primary data was collected using the interview technique through the questionnaire tool administered to representatives of sampled seed companies. The questionnaires had both closed-ended and open-ended questions. The questionnaires dropped and picked later from the respondents. This approach gave the respondent time to provide detailed responses to the questions without feeling being put under pressure to provide answers instantly. At the same time, it enabled the researcher to move faster in distribution and collection of filled up questionnaires because he did not have to spend too much time sitting with the respondent to fill the questionnaire.

3.7 Data Analysis and Presentation

After administering the questionnaires, the researcher coded and had the data converted into numerical codes for statistical analysis. Data was analyzed using both quantitative and qualitative methods. Data from the survey was analyzed using both content and conversation analyses. The Statistical Package for Social Sciences (SPSS) computer software was used to generate simple frequency tables to summarize them. Data from secondary sources was analyzed qualitatively by reading, coding, displaying, reducing and interpreting.

3.8 Reliability

According to Mugenda (2008) reliability is the proportion of variance attributable to the time measurement of a variable and estimates the consistency of such measurements over time from a research instrument. It is a measure of the degree to which a research

instrument would yield the same results or data after repeated trials. In order to ensure reliability, the researcher issued the questionnaires to the respondents, collected them and checked the responses. After two weeks the questionnaires were re-tested by administering it again to the same respondents. This ensured internal consistency of the questionnaire and affirmed the responses from the selected sample.

3.9 Validity

Validity establishes the relationship between the data and the variable or construct of interest. It estimates how accurately the data obtained in a study represents a given variable or construct in the study Mugenda (2008). To ensure accuracy of the data, the researcher pre-tested the questionnaires and analyzed the results and made corrections on the questions that were not clear.

The questionnaire provided accurate data due to the process of pre-testing in the selected sample to maintain validity. The researcher visited the sampled individuals to make them aware of the need for the study. This ensured validity of the data collected.

3.10 Summary of Chapter

This chapter presented and discussed in details the research methodologies used in the study. It has explained and discussed the exploratory research design used. The research paradigms used are also presented. The positivist and interpretive paradigms have been discussed and reasons for choosing them provided. The chapter also presents and discusses study population, sampling technique, data collection and data analysis techniques. Reliability and validity are also defined and explained.

CHAPTER FOUR

4.0. STUDY FINDINGS, ANALYSIS AND INTERPRETATION

4.1. Introduction

This chapter presents detailed findings, analysis and interpretations of the study on awareness of and perceptions towards crop biotechnology by the members of STAK.

4.2. Findings

4.2.1. Awareness of crop biotechnology regulatory environment in Kenya

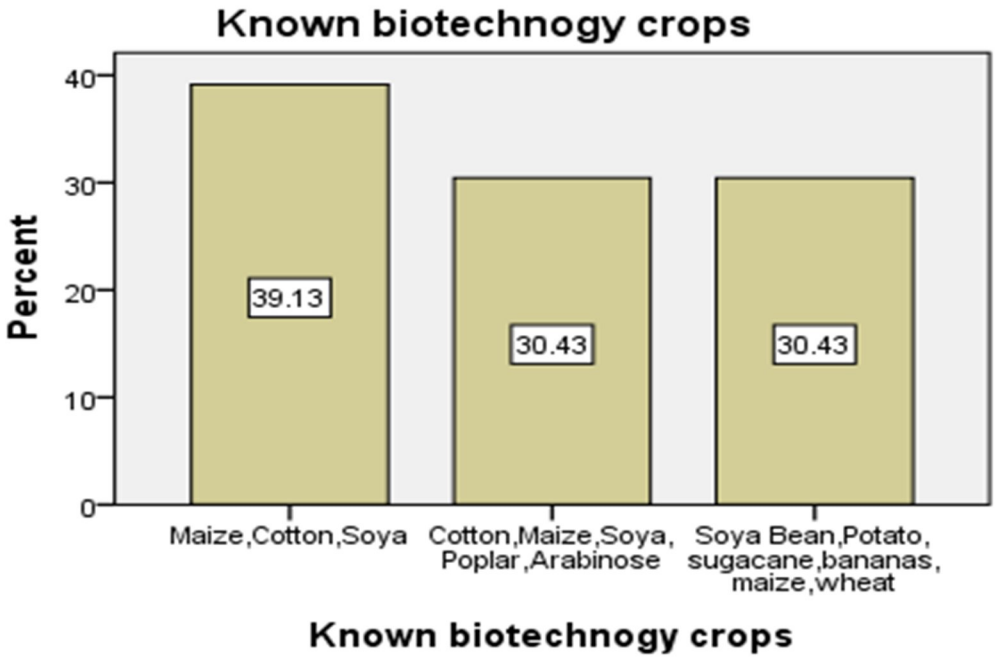
The study sought to find out whether respondents are aware of regulations, polices, bodies and laws governing biotechnology research, development and trade in Kenya. Absolute majority of 100 percent of respondents said they were aware of the Biosafety Act of 2009; National Biosafety Authority (NBA) and the National Biotechnology and Biosafety Development Policy of 2006.

Table 4.1 Awareness of policies governing, laws, bodies and regulations governing crop biotechnology research and trade in Kenya

	Percentage		Mean	Std. Deviation
	Yes	No		
Awareness of crop biotechnology or GMO	100		1.0000	.00000
Awareness of Biosafety Act 2009	100		1.0000	.00000
Awareness of National Biosafety Authority (NBA)	100		1.0000	.00000
Awareness of National Biotechnology and Biosafety Development Policy 2006	100		1.0000	.00000
Awareness of Biotechnology Awareness Creation Strategy (BioAware Kenya) 2008	43.5	56.5	1.5652	.50687
Awareness of GMO Labeling Regulation	69.6	30.4	1.3043	.47047
Awareness of Environmental Safety Regulation	60.9	39.1	1.3913	.49901
Awareness of Biosafety regulations on Trade	87	13	1.1304	.34435
Awareness of Cartagena Protocol on Biosafety	100		1.0000	.00000
Valid N (list-wise)	23			

However, awareness of regulations was lower compared to that of laws, regulations, policies and bodies governing the technology deployment in Kenya. On GMO Labeling Regulation, 69.6 percent were aware while 30.4 percent were not. On the other hand, on whether respondents are aware of the environmental safety regulation, 43.5percent and 56.5 percent agreed and disagreed respectively. On whether respondents are aware of Biosafety regulations on Trade 87 percent agreed while 13percent disagreed. While on awareness of Cartagena Protocol on Biosafety, 100 percent of respondents agreed. Overall, majority of respondents agreed that they are aware of policies, laws, bodies and regulations governing crop biotechnology research and trade in Kenya.

Fig 4.1 Known Biotechnology crops



From the above chart maize, cotton and soya are the most known biotechnology crops represented at 39 percent followed by cotton, maize, Soya, Poplar and Arabinose at 30 per cent and lastly Soya, Bean, potato, sugarcane, bananas, Maize and wheat.

Table 4.2 Willingness to produce, package and sell genetically modified crops

The study sought to know whether the respondents would be willing to produce, package and sell genetically modified crops. 100 percent of the respondents indicated that they would be willing, implying that they are aware of the benefits of biotechnology crops.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	23	100.0	100.0	100.0

4.2.3. Awareness of on-going GM crop research

The study also sought to establish whether awareness of crops with insect resistance research influences the formation of such awareness all the respondents affirmed to this while none dis-affirmed to the statement. Likewise on whether awareness of crops with disease resistance research and awareness of crops with herbicide tolerance research influence the formation of such awareness all the respondents agreed while none disagreed.

Table 4.3 Awareness of elements of biotechnology

	Percentage		Std. Deviation
	Yes	No	
Awareness of Crops with insect resistance research	100		.00000
Awareness of Crops with disease resistance research	100		.00000
Awareness of Crops with herbicide tolerance research	100		.00000
Awareness of Crops with drought tolerance research	39.1	60.1	.49901
Awareness of Protein enriched tubers research	87	13	.34435
Awareness of Saline tolerant crops research	100		.00000
Awareness of Protein enriched cereals research	87	13	.34435
Awareness of Nutritionally enhanced cereals research	60.9	39.1	.49901
Awareness of Crops requiring lesser chemical fertilizers research	56.5	43.5	.50687
Awareness of Nutritionally enhanced vegetables and fruits research	26.1	73.9	.44898
Awareness of Crops longer shelf life periods research	69.6	30.4	.47047
Awareness of Crops containing hormones for better human health research	26.1	73.9	.44898
Awareness of Crops containing vaccines against human diseases research	26.1	73.9	.44898
Valid N (list-wise)	23		

On whether awareness of Crops with drought tolerance research leads to the formation of such awareness 39.1 percent agreed while the rest 60.1 percent disagreed. Likewise on whether awareness of crops requiring lesser chemical fertilizers research leads to formation of such awareness 56.5 percent agreed while 43.5 percent disagreed.

On whether awareness of nutritionally enhanced vegetables and fruits research influences the formation of such awareness 26.1 percent agreed while 73.9 percent disagreed. Likewise on whether awareness of crops with longer shelf life periods research influences the formation of such awareness 69.6 percent agreed and 30.4 percent disagreed.

The study sought to establish whether awareness of crops containing hormones for better human health research results to formation of such awareness 26.1 percent agreed while 73.9 percent disagreed. While awareness of Crops containing vaccines against human diseases research 26.1 percent agreed while 73.9 percent disagreed.

Table 4.4 Acceptance to levels of genetically modified elements

	To a great extent	Somewhat	Not at all
I accept the levels for genetically modified organism involving Food crops	43.5	56.5	
I accept the levels for genetically modified organism involving Non-food crops	69.6		30.4
I accept the levels for genetically modified organism involving Animals	30.4		69.6
I accept the levels for genetically modified organism involving Microorganisms	30.4		69.6
Valid N (listwise)	23		

The study sought to establish the views of respondents regarding genetically modified organism in Food crops, Non-food crops, Animals and Microorganisms on a three point scale from to a great extent somewhat and Not at all, 43.5 percent of respondents accept the levels for genetically modified organism involving food crops agreed to a great extent 56.5 per cent somewhat agreed.

4.2.4. Acceptance of crop biotechnology research

On whether respondents accept the levels for genetically modified organism involving Non-food crops 69.6 percent agreed to a great extent while 30.4 percent somewhat agreed. On whether respondents accept the levels for genetically modified organism involving animals 30.4 percent agreed to a great extent while 69.6 percent did not agreed. Likewise 30.4 percent of respondents agreed to a great extent and 69.6 percent did not agree at all on the levels for genetically modified organism involving Microorganisms.

Table 4.5 Acceptance of Biotechnology practice

	To a great extent	Somewhat	Not at all
I accept the levels of biotechnology practice involving Herbicide resistant crops	43.5		56.5
I accept the levels of biotechnology practice involving Insect resistant crops	30.4		69.6
I accept the levels of biotechnology practice involving Slow vine ripening crops	73.9	26.1	
I accept the levels of biotechnology practice involving Drought tolerant crops	43.5	26.1	30.4
I accept the levels of biotechnology practice involving Disease resistant crops	30.4	30.4	39.1
I accept the levels of biotechnology practice involving Nutritionally enhanced crops	73.9	26.1	
Valid N (list-wise)	23		

The study sought the opinion of respondents regarding biotechnology practice, 43.5 percent of respondents agreed to a great extent on the levels of biotechnology practice involving herbicide resistant crops while 56.5 percent did not agree at all.

The study sought the opinion of respondents regarding biotechnology practice involving insect resistant crops with 30.4 percent agreeing to a great extent while 69.6 percent disagreed with the statement. On whether respondents accept the levels of biotechnology practice involving slow vine ripening crops 73.9 percent agreed to a great extent and 26.1percent somewhat agreed. Likewise 43.5percent, 26.1percent and 30.4percent agreed to great extent, somewhat and not at all respectively on the levels of biotechnology practice involving drought tolerant crops. Regarding respondents view on the levels of biotechnology practice involving disease resistant crops 30.4percent, 30.4percent and

39.1percent agreed to great extent, somewhat and not at all respectively. Lastly on whether respondents agree on the levels of biotechnology practice involving nutritionally enhanced crops 73.9percent and 26.1percent agreed to great extent and disagreed respectively.

Table 4.6 Support of biotechnology research

	To a great extent	Somewhat	Not at all
I support the importance placed on biotechnology research to Added nutritional value	43.5	26.1	30.4
I support the importance placed on biotechnology research to Improve food security	43.5		56.5
I support the importance placed on biotechnology research to Produce safer foods	69.6	30.4	
I support the importance placed on biotechnology research to Control pests and diseases	69.6	30.4	
I support the importance placed on biotechnology research to Reduce use of insecticides	43.5		56.5
I support the importance placed on biotechnology research to Control weeds	100		
I support the importance placed on biotechnology research to Reduce effects of drought	100	0	0
Valid N (list-wise)	23		

The study sought opinion of respondents regarding their support on the importance placed on biotechnology research to added nutritional value 43.5percent agreed to a great extent, 26.1percent somewhat agreed while 30.4percent did not agree at all. On whether respondents support the importance placed on biotechnology research to improve food security 43.5percent agreed to a great extent while 56.5percent disagreed. Regarding

support by respondents on the importance placed on biotechnology research to produce safer foods 69.6percent agreed to a great extent while 30.4percent somewhat agreed.

Regarding support on the importance placed on biotechnology research to control pests and diseases 69.6percent agreed to a great extent while 30.4percent somewhat agreed.Regarding support on the importance placed on biotechnology research to reduce use of insecticides 43.5percentagreed to a great extent while 56.5percent disagreed. On whether respondents support the importance placed on biotechnology research to Control weeds 100 percent agreed to a great extent while 100 percent also agreed to a great extent on the importance placed on biotechnology research to reduce effects of drought.

4.2.5. Sources of crop biotechnology information

Regarding where respondents get biotechnology information 100percent indicated that they get information from Radio, TV and Newspaper as well as from internet/research. Those who got biotechnology information from Biotech companies 69.6percent agreed while 30.4percent disagreed. Asked on whether respondents got biotechnology information from Research Institutions 43.5percent agreed while 56.5percent disagreed.

Table 4.7 Source of biotechnology information

	Yes	No	Std. Deviation
I majorly get biotechnology information from Radio, TV, Newspaper	100		.00000
I majorly get biotechnology information from Internet/research	100		.00000
I majorly get biotechnology information from Biotech companies	69.6	30.4	.47047
I majorly get biotechnology information from Research Institutions	43.5	56.5	.50687
I majorly get biotechnology information from NGOs	30.4	69.6	.47047
I majorly get biotechnology information from STAK or STAK Members	100		.00000
I majorly get biotechnology information from Government agencies	13	87	.34435
I majorly get biotechnology information from Friends	100		.00000
I majorly get biotechnology information from Scientists/academics	87	13	.34435
Valid N (list-wise)	23		

On the other hand, 30.4 percent agreed and 69.6percent disagreed that they got biotechnology information from NGOs. Additionally 100 percent indicated that they get biotechnology information from STAK or STAK Members.Likewise 13 percent and 87 percent agreed and disagreed respectively that they get biotechnology information from Government agencies. 100 percent of respondents also indicated that they get biotechnology information from Friends and lastly 87 percent and 13 percent indicated that they get biotechnology information from Scientists/academics.

4.2. 6. Factors influencing crop biotechnology perceptions

Regarding respondents' view on whether their stand on crop biotechnology is influenced by their fear of environmental harm, 56.5 percent agreed while 43.5 percent disagreed. Again, 56.5 percent and 43.5 percent agreed and disagreed respectively that their stand on crop biotechnology is influenced by fear of food safety consequences.

Additionally 56.5 percent and 43.5 percent agreed and disagreed respectively that their stand on crop biotechnology is influenced by their fear of genes moving unchecked to other plants, insects, or microorganisms. 26.1 percent agreed and 73.9percent disagreed that their stand on crop biotechnology is influenced by religious/ethical concerns about "tampering with nature."

Table 4.8 Influence on stand on biotechnology

	Yes	No	Std. Deviation
My/our stand on crop biotechnology is influenced Fear of environmental harm.	56.5	43.5	.50687
My/our stand on crop biotechnology is influenced Fear of food safety consequences	56.5	43.5	.50687
My/our stand on crop biotechnology is influenced Fear of genes moving unchecked to other plants, insects, or microorganisms	56.5	43.5	.50687
My/our stand on crop biotechnology is influenced Religious/ethical concerns about "tampering with nature."	26.1	73.9	.44898
My/our stand on crop biotechnology is influenced Fear of loss of business to competitors more advanced in the technology	13	87	.34435
My/our stand on crop biotechnology is influenced Fear negative public perceptions may affect my market	100		.00000
My/our stand on crop biotechnology is influenced Knowledge of its benefits to farmers, society and the environment	69.6	30.4	.47047
My/our stand on crop biotechnology is influenced Knowledge of safety of crop biotechnology	69.6	30.4	.47047
My/our stand on crop biotechnology is influenced Opportunity to increase my seed products range	13	87	.34435
Valid N (list-wise)	23		

Those influenced by the fear of loss of business to competitors who are more advanced in the technology where 13 percent and 87 percent agreeing and disagreeing respectively. While 100 percent agreed that their stand on crop biotechnology is influenced by their fear of negative public perceptions that may affect their market. Those influenced by knowledge of its benefits to farmers, society and the environment were 69.6 percent and 30.4 percent agreeing disagreeing respectively. Likewise those influenced by knowledge

of safety of crop biotechnology were 69.6 percent agreed and 30.4percent is agreed. Lastly 13 percent and 87 percent of respondents agreed and disagreed respectively regarding their stand on crop biotechnology being influenced by the opportunity to increase their seed products range.

4.2.7. Participation in crop biotechnology interpersonal outreach activities

The study sought to find out from the respondents whether they have ever attended a biotechnology workshop 73.9 percent agreed while 26.1 percent have never attended a biotechnology workshop.

Table 4.9 Attendance of Biotechnology functions

	Yes	No	Std. Deviation
Have you ever attended a biotechnology Workshop?	73.9	26.1	.44898
Have you ever attended a biotechnology Congress?	100		.00000
Have you ever attended a biotechnology Seminar?	30.4	69.6	.47047
Have you ever attended a biotechnology Conference?	73.9	26.1	.44898
Have you ever attended a biotechnology Symposium?	30.4	69.6	.47047
Have you ever attended a biotechnology Exhibition?	30.4	69.6	.47047
Have you ever attended a biotechnology Demonstration?	100		.00000
Valid N (list-wise)	23		

100 percent indicated that they have attended a biotechnology congress. 30.4 percent agreed while 69.6 percent disagreed that they have attended a biotechnology seminar. Those who have attended a biotechnology conference were 73.9 percent against those who have never attended 26.1 percent. Those who have attended a biotechnology symposium were 30.4 percent while 69.6 percent have never attended a biotechnology

Symposium. Those who have attended a biotechnology exhibition were 30.4 percent while 69.6 percent have never attended a biotechnology exhibition.

From these results it's evident that majority of respondents have participated in interpersonal, interactive crop biotechnology outreach activities. However, few have attended exhibition meaning that institutions providing biotechnology awareness have not involved many seed companies in their seeing-is-believing tours and other exhibitions.

Table 4.10 Preference of source of biotechnology information

	Yes	No	Std. Deviation
I prefer receiving biotechnology information through Information materials	100		.00000
I prefer receiving biotechnology information through Training workshop/seminar	100		.00000
I prefer receiving biotechnology information through Conference/congress/symposium	87	13	.34435
I prefer receiving biotechnology information through Industry Association (e.g. STAK)	26.1	73.9	.44898
I prefer receiving biotechnology information through Exhibition	13	87	.34435
I prefer receiving biotechnology information through Roundtable meeting	100		.00000
I prefer receiving biotechnology information through Mass media articles	73.9	26.1	.44898
I prefer receiving biotechnology information through Discussions with friends	100		.00000
I prefer receiving biotechnology information through Direct mail	30.4	69.6	.47047
I prefer receiving biotechnology information through Personal research	30.4	69.6	.47047
I prefer receiving biotechnology information through Expert/Scientist	26.1	73.9	.44898
I prefer receiving biotechnology information through Study tour	13	87	.34435
Valid N (list-wise)	23		

The study sought to find out respondents preferences of receiving biotechnology information 100 percent prefer receiving biotechnology information through information materials, training workshop/seminar, through roundtable meeting, or through discussions with friends. 87 percent prefer receiving biotechnology information through conference/congress/symposium while 13 percent did not prefer this mode. 26.1 percent prefer receiving biotechnology information through Industry Association (e.g. STAK)

while 73.9 percent did not prefer this mode. 13 percent prefer receiving biotechnology information through exhibition while 87 percent did not prefer the mode. 73.9 percent prefer receiving biotechnology information through Mass media articles while 26.1 percent did not prefer it. 30.4 percent prefer receiving biotechnology information through Direct mail 69.6 percent did not prefer the method. 30.4 percent prefer receiving biotechnology information through Personal research while 69.6 percent did not prefer this method. Those who prefer receiving biotechnology information through Expert/Scientist were 26.1 percent while the rest 73.9 percent did not prefer this method. Lastly 13 percent indicated that they prefer receiving biotechnology information through Study tour while 87 percent did not prefer this method.

4.3. Summary of Findings

This study found that majority of respondents are aware of policies, laws, bodies and regulations governing crop biotechnology research and trade in Kenya. This study found that awareness of research on crops with disease resistance, insect resistance research, and longer shelf life influenced the formation of perceptions of such crops among respondents. On the other hand, awareness of crops with drought tolerance, enhanced nutrition, and medicinal value did not have any influence on perceptions of such crops.

The study found that majority (69.6 percent) of respondents supported genetic modification of crops but oppose genetic modification of animals, such as fish and cows. The study also found that 100 percent of respondents get information on crop biotechnology from the mass media, friends and STAK. This means information

targeting them should be passed through such mediums for maximum effect. On the other hand the study established that a minority of respondents got information from Research Institutions, Government agencies as well as from internet/research. This is worrying because government and research institutions should be the sources of factual and credible information on crop biotechnology. The government of Kenya, which has developed the National Biotechnology Awareness Strategy (BioAWARE-Kenya) of 2008, should redouble its efforts to provide information on crop biotechnology to this critical audience.

The study also found out that the majority's (56.5percent) stand on biotechnology was influenced by fear of environmental harm; fear of genes moving unchecked to other plants, insects or microorganisms; and fear of food safety consequences. The study also revealed that 73.9 percent of the respondents' stand on biotechnology is not influenced by religious/ethical concerns about 'tampering with nature'. Majority of the respondents 87percent indicated that their stand was not influenced by fear of loss of business to competitors who are more advanced in the technology. However, fear of negative public perception that may affect the market influence the stand of all respondents. Those influenced by knowledge of its benefits to farmers, society and the environment and knowledge of safety of crop biotechnology were 69.6percent. Opportunity to increase seed products range only influenced the stand of 13percent of the respondents.

It was found out that 73.9, 100, 30.4, 73.9, 30.4, 30.4, 100 percentage points of the respondents have attended biotechnology workshop, congress, seminar, conference,

symposium, exhibition and demonstration respectively. From these results its evident that majority of respondents have attended a biotechnology workshop, biotechnology congress, biotechnology conference and biotechnology demonstration while a minority have never attended biotechnology seminar, biotechnology symposium or a biotechnology exhibition.

On preference of mode for receiving biotechnology information 100, 87, 26.1, 73.9, 30.4, 30.4, 26.1percentage points prefer receiving information through information materials, training workshop/seminar, through roundtable meeting, or through discussions with friends; conference/congress/symposium; industry association (e.g. STAK); through exhibition; mass media articles; direct mail; through personal research and through expert/scientist respectively

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides interpretation of the study findings, conclusions and recommendations on the awareness of and perceptions towards crop biotechnology with regards to members of the STAK.

5.2 Interpretation of Study Findings

This study found that majority of respondents are aware of policies, laws, bodies and regulations governing crop biotechnology research and trade in Kenya. This study found that awareness of research on crops with disease resistance, insect resistance research, and longer shelf life influenced the formation of perceptions of such crops among respondents. These findings are inconsistent with the findings of the study done by Park & Parks (2009) who opine that misperceptions and logical inconsistencies have impeded diffusion of the biotechnology in Africa. It therefore shows that the misconceptions are gradually dying out and more people are getting information on biotechnology, this will help ease acceptance of the technology in Kenya.

Biotechnology, as a new scientific development, and raises a lot of perceptions and awareness issues among the stakeholders concerned (Navarro 2009; Nwankwo 2009). Navarro (2009), for example, notes that world opinions on biotechnology vary markedly, according to this study, the acceptance of biotechnology is on crop as opposed to animal

genetic modification. This study shows that members of STAK are more recipient to crop biotechnology and the country at large may not yet be ready for animal biotechnology.

The study also found that 100 percent of respondents get information on crop biotechnology from the mass media, friends and STAK. This shows that the mass media as a tool is very effective in the spread of biotechnology information.

The study also found out that the majority's (56.5percent) stand on biotechnology was influenced by fear of environmental harm; fear of genes moving unchecked to other plants, insects or microorganisms; and fear of food safety consequences. The fears towards biotechnology are unfounded showing that institutions dealing with biotechnology issues have not been able to correctly inform the public on the technology.

It was found out that 73.9, 100, 30.4, 73.9, 30.4, 30.4, 100 percentage points of the respondents have attended biotechnology workshop, congress, seminar, conference, symposium, exhibition and demonstration respectively. Based on the findings, there seems to be sufficient effort by concerned institutions to educate members on biotechnology science.

5.3. Conclusions

Majority of the members of STAK are aware of crop biotechnology and holds positive perceptions towards its products. However, some are apprehensive about trading in biotechnology crops due to concerns among the public with regards to safety of such

crops, which the seed industry members fear could lead to loss of business/market if they started trading in biotechnology crops. The mass media, friends and industry association have been the main sources of crop biotechnology for members of STAK.

5.4 Recommendations

From the findings and discussions above the following recommendations can be made:

- Crop biotechnology communication and outreach campaign targeting seed companies with the aim of demystifying the technologies and explaining the concerns should use mass media, STAK and information education and communication (IEC materials) as the main channels of communication.
- STAK members are willing to trade in biotechnology crops and therefore research institutions like the Kenya Agricultural Research Institute (KARI) and other agencies promoting adoption of crop biotechnology to enhance food security and protect the environment such as the African Agricultural Technology Foundation (AATF) should involve members of STAK more actively in deployment plan for such crops.

- STAK members are ready to trade in biotechnology crops but were concerned about negative perceptions by members of the public with regards to such crops thus there is need to mount a country-wide awareness and behaviour change communication to address public perceptions of crop biotechnology and to inform the seed companies of the environmental benefits of biotechnology crops.

5.5 Suggestion for Further Studies

There is need to study and find out public concerns about safety of crop biotechnology and the best strategies that can be used to mitigate them. This is because positive perceptions of crop biotechnology by members of the public will encourage more members of STAK to enter into trade in seeds of biotechnology crops.

REFERENCES

AfricaBio. 2007. *Introduction to Biotechnology*. Pretoria. AfricaBio Press.

Altman, A., & Hasegawa, P. 2011. *Plant Biotechnology and Agriculture: Prospects for the 21st Century*. New York: Academic Press

Alexander, R. 2009. *Framing discourse on the environment: a critical discourse approach*. New York: Taylor & Francis

Anunda, A.N. Njoka, F. Frerick & Shauri, S. H.. 2009. Assessment of Kenyan public perception on genetic engineering of food crops and their products. In the *Journal of Applied Biosciences. Vol.* 33: *pp. 2027-2036*

Baran, S., & Davis, D. 2011. *Mass Communication Theory: Foundations, Ferment, and Future* Ohio: Cengage Learning.

Berelson, B., & Steiner, G. A. 1964. Human behavior: An inventory of scientific findings. New York: Harcourt, Brace & World

Brossard, D., Shanahan, J., & Nesbitt, T. 2007. *The media, the public and agricultural biotechnology*. Oxon: CABI.

Chauhan, B. 2008. *Environmental Studies*. New Delhi: Firewall Media

Clark, D., & Pazdernik, N. 2010. *Biotechnology: Academic Cell Update* London: Academic Press.

Cooper, J. 2000. *The potential of chaos and fractal analysis in urban design*, PhD dissertation, Joint Centre for Urban Design, Oxford Brookes University, UK

Correa, C. 2010. *Research handbook on the protection of intellectual property under WTO rules*. Glos: Edward Elgar Publishing

Cummings, M. 2010. *Human Heredity: Principles and Issues* (9th ed). Ohio: Cengage Learning

Dadezie, S. 2001. *Biotechnology in Sub-Saharan Africa. Policy Institutional Options*. Nairobi: Acts Press

Diab, L. N. "Studies in Social Attitudes: II. Selectivity in Mass Communication Media as a Function of Attitude-Medium Discrepancy," Journal of Social Psychology, 67:297-302 (December, 1965).

Dainton, M., & Zelley, E. 2010. *Applying Communication Theory for Professional Life: A Practical Introduction* (2nd ed.). London: SAGE

Denzin, N. K., & Lincoln, Y. S. (Eds.). 1994. Handbook of Qualitative Research. Nebury Park, CA: Sage

Dudek, S. 2009. *Nutrition Essentials for Nursing Practice* (6th ed.). London:Lippincott Williams & Wilkins

Festinger, L. 1964. *Conflict, decision and dissonance.* Stanford, CA: Stanford University Press.

Festinger, L. 1957. *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.

Fischer, P., Kastenmüller, A., Greitemeyer, T., Fischer, J., Frey, D., & Crelley, D. 2010. Threat and selective exposure: The moderating role of threat and decision context on confirmatory information search after decisions. Journal of Experimental Psychology: General

Freedman, J. L., & Sears, D. O. 1965. *Selective Exposure*. In L. Berkowitz (Eds.) Adavances in Experimental Social Psychology. Vol 2. New York: Academic Press.

Gathaara, V. N., J. N. Ngugi, D. W. Kilambya &T. S. Gichuki. 2009. Consumers' Perceptions of Biotechnology in Kenya. In the *Journal of Agricultural & Food Information*, Vol. 9(4). The Haworth Press

Gardner, G. 2009. *Biotechnology risks and benefits: Science instructor perspectives and practices*. Ann Arbor: ProQuest

Graham Brookes & Peter Barfoot, 2012. *GM crops: global socio-economic and environmental impacts 1996-2010.* PG Economics Ltd, UK

Greenberg, B. S. 1974. Gratifications of television viewing and their correlates for British Children. In J. G. Bumler & E. Katz (Eds.), The Uses of mass Communications: Current perspectives on gratifications research (pp 71-92). Berverly Hills, CA: Sage.

He, X., Horty, J., & Pacuit, E. 2009. *Logic, Rationality, and Interaction: Second International Workshop, LORI 2009, Chongqing, China, October 8-11, 2009, Proceedings*. London: Springer

Holdrege, C., & Talbott, S. 2008. *Beyond biotechnology: the barren promise of geneticengineering*. Kentucky: University Press of Kentucky

Hartmann, T. 2009. *Media choice: a theoretical and empirical overview*. New York: Taylor &Francis

ISAAA . 2002. *Biotechnology Myths and Facts*. Ithaca, NY: ISAAA

James, C. 2011. *Global Status of Commercialized Biotech/GM Crops: 2011*. ISAAA Brief No. 43. Ithaca, NY: ISAAA.

Jain, K. 2011. *Applications of Biotechnology in Cardiovascular Therapeutics*. London: Springer

Juma, C. 2011. *The New Harvest: Agricultural Innovation in Africa.* New York: Oxford University Press.

Juma, C. & Serageldin, I. (Lead Authors). 2007. '*Freedom to Innovate: Biotechnology in Africa's Development', A report of the High-Level African Panel on Modern Biotechnology, African Union (AU) and the New Partnership for Africa's Development (NEPAD).* Addis Ababa and Pretoria

Karembu, M., D. Otunge & D. Wafula. 2010. *Developing a Biosafety Law: Lessons from the Kenyan Experience.* Nairobi: ISAAA *Afri*Center

Katz, E. (1987). *Communication research since Lazarsfeld*. Public Opinion Quarterly, 51, 525–545.

Khan, F. 2011. *Biotechnology Fundamentals*. New York: CRC Press

Kreuzer, H & Massey, A. 2008. *Molecular biology and biotechnology: a guide for teachers* (3rd ed.) Washington DC: ASM Press

Kothari, C. R. 2004. *Research Methodology: Methods and Techniques*. New Delhi: New Age International.

Lazarsfeld, P. F., Berelson, B., & Gaudet, H. 1948. ‘’The people's choice: How the voter makes up his mind in a Presidential campaign ‘’(2nd Ed.). New York, Columbia University Press.

McCroskey, J.C. & Prichard, S.V.O. 1966. Selective Exposure and Lyndon B. Johnson’s 1966 “State of the union” address. 8. McCroskey, J. C. Unpublished Doctoral Dissertation, Pennsylvania State University.

McHugen, A. 2007. Public Perception of Biotechnology: Biotechnology Journal 27th June 2007

Melendez, R. & Sanchez, V. (Eds.), 2005. *Trading in Genes: Development Perspectives on Biotechnology, Trade and Sustainability.* London. Earthscan

Midiwo, J., & Clough, J. 2010. *Aspects of African biodiversity: proceedings of the Pan AfricaChemistry Network Biodiversity Conference, Nairobi, 10-12 September 2008*. Cambridge: Royal Society of Chemistry

Millar, K., West, P., & Nerlich, B. 2009. *Ethical futures: bioscience and food horizons : EurSafe 2009, Nottingham, United Kingdom, 2-4 July 2009*. Wageningen: Wageningen Academic Publishing

Mills, O. 2010. *Biotechnological Inventions: Moral Restraints and Patent Law*. New York: Ashgate Publishing

Mishra, C. 2009. *Biotechnology Applications*. New Delhi: I. K. International Pvt Ltd

Morrall, P. 2009. *Sociology and health: an introduction* (2nd ed.) Ohio: Taylor & Francis

Mosier, N., & Ladisch, M. 2011. *Modern Biotechnology: Connecting Innovations in Microbiology and Biochemistry to Engineering Fundamentals*. New Jersey: John Wileyand Sons

Mugenda, A. G. 2008. *Social Science Research: Conception, Methodology & Analysis*. Nairobi: Applied Research and Training Services

Mugenda, O. M. & Abel G. M. 2003. *Research Methods: Quantitative & Qualitative Approaches*. Nairobi: ACTS Press.

Murphy, D. 2011. Plants, Biotechnology and Agriculture. Oxfordshire: CABI

Mzinga, J. L. E. 2005. GMOs: Beyond Fact and Fiction. Lusaka. New Horizon Press. Mugambi, K. 2011. Kenya to start growing biotech crops: The Daily Nation March 12, 2011

Nair, A. 2010. *Comprehensive Biotechnology XI*. New Delhi: Firewall Media

Navarro, Mariechel. 2008. *Bridging the Knowledge Divide: Experiences in Communicating Crop Biotechnology*. International Service for the Acquisition of Agri-biotech Applications (ISAAA). Los Baños, Laguna, Philippines.

Navarro, Mariechel, J. (Ed.), 2006. *Communicating Crop Biotechnology: Stories from stakeholders*. ISAAA Brief No. 40. ISAAA: Ithaca, NY

Nwankwo, U. 2010. *Sustainable Biotechnology Adoption in Nigeria to Reduce Food Insecurity: Involving Cooperatives in the Process*. Frankfurt: Peter Lang

Nuffield Council on Bioethics. 2004. *The use of genetically modified crops in developing countries: a follow-up Discussion Paper*. London. Latimer Trend & Company Ltd

Paarlberg, Robert L. 2008. *Starved for Science: How Biotechnology is being kept out of Africa.* Cambridge and London: Harvard University Press

Park, C., & Parks, R. 2009. *The Big Book of Realistic Drawing Secrets: Easy Techniques for Drawing People, Animals, Flowers and Nature*. Ohio: North Light Books

Peczon, B., & Manalo, A. 2009. *Straight Talk on Biotechnology, Volume 1*. Manila: Ateneo de Manila University Press

Persley, G. J. & MacIntyre L. R. (Eds.), 2008. *Agricultural Biotechnology: Country case studies-a Decade of Development*. CABI Publishing.

Putnam, L., & Pacanowsky, M. (Eds.). 1983. *Communication and organizations: Interpretive approach*. Newbury Park, CA: Sage.

Roy, M. 2011. *Biotechnology Operations: Principles and Practices*. Florida: CRC Press

Robbins, P., & Huzair, F. 2011. *Exploring Central and Eastern Europe's Biotechnology Landscape*. London: Springer.

Sadras, V., & Calderini, D. 2009. *Crop physiology: applications for genetic improvement andagronomy*. London: Academic Press.

Sekaran, U. 2000. *Sampling in Research Methods for Business: A Skill-Building Approch*. New York: John Wiley and Sons

Schulz-Hardt, S., Fischer, P., & Frey, D. 2010. Confirmation bias in accuracy-motivated decision-making: A cognitive explanation for biased information seeking. Manuscript under revision.

Schurman, R., & Munro, W. 2010. *Fighting for the Future of Food: Activists Versus Agribusiness in the Struggle Over Biotechnology.* Minneapolis: U of Minnesota Press

Secretariat of the Convention on Biological Diversity. 2000. *Cartagena Protocol on Biosafety to the Convention on Biological Diversity: text and annexes*. Montreal: Secretariat of the Convention on Biological Diversity.

Severin W. J., & Tankard, J. W. 2000. *Communication Theories: Origins, Methods and Uses in Mass media*. New York: Longman.

Shan, G. 2011. *Immunoassays in Agricultural Biotechnology*. New Jersey: John Wiley and Sons

Stacks, D., & Salwen, M. 2010. *An integrated approach to communication theory and research*(2nd). New York: Taylor & Francis.

STAK. 2008. *Seed Trade Association 2008*. Retrieved March 15, 2012 from http://www.businessadvocacy.org/dloads/STAK%20Brochure%20Vol.IV%2008%20Mar%2008.pdf

STAK. 2011. *Kenya Launches seed National Policy,* 2011. Date retrieved March 15, 2012 from http://stak.or.ke/policy/national-seed-policy.html

Sudhir, M & Shinde, G. 2009. *Applied Biotechnology*. New Delhi: I. K. International Pvt Ltd

Swanson, D. L. 1977. The uses and misuses of uses of gratification. Human Communication Research. Vol 3. pp 214-221.

Sweeny, K., Melnyk, D., Miller, W., & Shepperd, J. A. 2010. *Information avoidance: Who, what, when, and why*. Review of General Psychology, 14(4), 340-353.

The Technical Centre for Agricultural and Rural Cooperation (CTA). 2002. *Public Awareness: A manual for agricultural NGOs and research institutions in Africa.* Wageningen, The Netherlands: CTA Press.

Traynor, P., Marta, A., & Lionel G. 2007. Strategic Approaches to Informing the Public about Biotechnology in Latin America. In Electronic Journal of Biotechnology. Retrieved from http://www.ejbiotechnology.info/content/vol10/issue2/full/12/index.html

United Nations .2009. *Yearbook of the United Nations 2006, Volume 60*. Washington DC: United Nations Publications

US Department of Labor .2008. *Occupational Outlook Handbook*. New York: Skyhorse Publishing Inc.

Waldmüller, K. 2008. *Social Awareness - An Introduction to the Model*. Norderstedt: GRIN Verlag

West, R., & Turner, L. 2010. *Understanding Interpersonal Communication: Making Choices in Changing Times* (2nd ed.). Ohio: Cengage Learning

White, B., King, I., & Tsang, P. 2011. *Social Media Tools and Platforms in Learning Environments*. London: Springer

Wingenbach, *et al*. 2003. "Agricultural communications students' awareness and perceptions of biotechnology issues". *Journal of Agricultural Education. Vol. 44, No. 4, pp 80-93*

Wood, J. 2010. *Communication Mosaics: An Introduction to the Field of Communication* (6th) Ohio: Cengage Learning.

Wood, J. 2010. *Communication theories in action: An introduction.* New York: Wadsworth.

Yount, L. 2008. *Biotechnology and Genetic Engineering* (3rd ed.). New York: Infobase Publishing

Verzosa, Cecillia Cabanero. 2003. Strategic Communication for Development Projects. The International Bank for Reconstruction and

Development/The World Bank, USA. Retrieved from http://siteresources.worldbank.org/EXTDEVCOMMENG/Resources/toolkitwebjan2004 pdf.

Zaikov, G. 2008. Biotechnology: state of the art and prospects for development. Toronto: Nova Publishers

Zillmann, D., & Bryant, J. 1985. Selective Exposure to Communication. 19, Hillsdale, NJ: Lawrence Erlbaum

Appendix I: Questionnaire

Introduction

My mane is Daniel Otunge, I am a Master of Arts Student at the School of Journalism, University of Nairobi. I am the principal researcher in this research for my MA Thesis, whose main goal is to determine the levels of awareness of and perceptions towards crop biotechnology by seed companies that are members of the Seed Trade Association of Kenya (STAK). I would like to humbly request you to participate in this study by answering the questions below. I wish to take this opportunity to assure you that your participation is voluntary and that answers you provide will be treated with strict confidence and shall only be used for the purposes of this thesis and shall not be disclosed to any third party. Kindly note that the thesis will directly benefit STAK and African Seed Trade Association (AFSTA) especially in designing appropriate biotechnology communication and awareness strategies for the benefit of the seed industry in Kenya.

I would greatly appreciate if you could provide answers to the following questions at your earliest opportunity for collection later.

Thank you for in advance for your cooperation and support!

Daniel Otunge (0731 990046; daniel.otunge@gmail.com)

Demographic Information

Please check the personal data below that currently apply to you:

1. Gender: Male [ ] Female [ ]

2. Age: under 25 [ ] 25-30 [ ] 31-40 [ ] 41-50 [ ] 51-60[ ]

3. Name of Company……..

4. Position……..

5. STAK membership

Ordinary member ☐

Associate member ☐

6. Years of membership

☐ Below 5 years

☐ 5-10 years

☐ 1-15 years

☐ Above 16 years

7. Are you aware of crop biotechnology or genetically modified crops?

YES ☐

NO ☐

8. Awareness of polices governing, laws, bodies and regulations governing crop biotechnology research and trade in Kenya

Are you aware of the following:	**YES**	**NO**
Biosafety Act 2009		
National Biosafety Authority (NBA)		
National Biotechnology and Biosafety Development Policy 2006		
Biotechnology Awareness Creation Strategy (BioAWARE Kenya) 2008		
GMO Labeling Regulation		
Environmental Safety Regulation		

Biosafety regulations on Trade		
Cartagena Protocol on Biosafety		

9. Name at most 10 List genetically modified crops (biotechnology crop) you are aware of

	Biotechnology crop
1	
2	
3	
4	
6	
7	
8	
9	
10	

10. Are you willing to produce, package and sell genetically modified crops

Yes ☐ Give

reasons…….

……

……

……

……

……

……

No ☐ Give

reasons…….

……

…….

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……..

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…….

11. I am aware of the following crop biotechnology research

Crop Biotechnology research leading to:	**YES**	**NO**
Crops with insect resistance		
Crops with disease resistance		
Crops with herbicide tolerance		
Crops with drought tolerance		
Protein enriched tubers		
Saline tolerant crops		
Protein enriched cereals		
Nutritionally enhanced cereals		
Crops requiring lesser chemical fertilizers		
Nutritionally enhanced vegetables and fruits		
Crops with longer shelf life periods		
Crops containing hormones for better human health		
Crops containing vaccines against human		

diseases		

12. Please select appropriately from the table below

I accept the levels for genetically modified organism involving:	**To a great extent**	**Some what**	**Opp ose**
Food crops			
Non-food crops			
Animals			
Microorganisms			
Forests/landscape plants			
I accept the levels of biotechnology practice involving:			

Herbicide resistant crops			
Insect resistant crops			
Slow vine ripening crops			
Drought tolerant crops			
Disease resistant crops			
Nutritionally enhanced crops			
I support the importance placed on biotechnology research to:			
Added nutritional value			

Improve food security			
Produce safer foods			
Control pests and diseases			
Reduce use of insecticides			
Control weeds			
Reduce effects of drought			
Others, (specify)			

13. I majorly get biotechnology information from the following sources

Source	**YES**	**NO**
Mass Media (examples, eg Radio, TV, Newspaper, if yes)		
Internet/research		

Biotech companies (examples if yes)		
Research Institutions (examples if yes)		
NGOs (examples if yes)		
STAK or STAK Members		
Government agencies (examples if yes)		
Friends		
Scientists/academics		
Others (specify)		

14. My/our stand on crop biotechnology is influenced by:

Factor	**YES**	**NO**
Fear of environmental harm.		
Fear of food safety consequences		
Fear of genes moving unchecked to other plants, insects, or microorganisms.		
Religious/ethical concerns about "tampering		

with nature.”		
Fear of loss of business to competitors more advanced in the technology		
Fear negative public perceptions may affect my market		
Knowledge of its benefits to farmers, society and the environment		
Knowledge of safety of crop biotechnology		
Opportunity to increase my seed products range		
Others (specify if yes)		

15. Participation in crop biotechnology awareness forum:

Have you ever attended a biotechnology:	YES	NO
Workshop?		
Congress		
Seminar		

Conference		
Symposium		
Exhibition		
Demonstration		

16. Identify at least FIVE MOST preferred methods of receive crop biotechnology information?

Preferred method of receiving crop biotechnology information	Tick at least 5
Information materials such as booklets, pamphlets, CDs, newsletters	
Training workshop/seminar	
Conference/congress/symposium	
Industry Association (e.g. STAK)	
Exhibition	
Roundtable meeting	
Mass media articles	

Discussions with friends	
Direct mail	
Personal research	
Expert/Scientist	
Study tour	