CONSUMER AWARENESS ON GENETICALLY MODIFIED CROPS IN KENYA.

Submitted in partial fulfillment of the requirements of the Bachelor of Laws Degree, Strathmore University Law School

By

RAID ADAM

078155

Prepared under the supervision of

MARTIN MBAYA

FEBRUARY 2018

Word count12500words (excluding footnotes and bibliography)

Table of Contents

Acknowledgments.

I would like to take this opportunity to pay my respects to 'Miami base' and God the omnipotent. We give thanks

I, RAID ADAM, do hereby declare that this research is my original work and that to the best of my knowledge and belief, it has not been previously, in its entirety or in part, been submitted to any other university for a degree or diploma. Other works cited or referred to are accordingly acknowledged.

Signed: .....

Date: .....

This dissertation has been submitted for examination with my approval as University Supervisor.

Signed:.....

[Supervisor's Name]

Abstract.

This research paper is based on consumer awareness with much emphasis on health and access to information with regards to genetically modified crops. The main objectives of the study were to investigate the current emerging trends on genetically modified crops, the current consumer concerns such as health and awareness about genetically modified crops, the current legislation in Kenya to ensure safe research of genetically modified crops and legislation in place that deals with consumer awareness on GMcrops, and finally the study sought out to find out if there is a correlation between economic impacts associated with GMcrops and tradeoff of health in countries that are currently producing GMcrops. The scope of the study was narrowed to focus on the Kenyan jurisdiction with other jurisdictions that produce GMcrops being the pivotal points of discussion in order to assess the veracity of GMcrops if introduced into the Kenyan market. The study discovered that there is indeed a wide gap when it comes to consumer awareness with regards to GMcrops, and lack of proper enforcement methods when it comes to public institutions that have been charged with ensuring the right information is provided to the consumer with regards to GMcrops. The study also discovered that there is indeed a negative correlation between economic impacts and health in countries producing GMcrops as health is ignored over economic benefits of GMcrops. There is also lack of adequate regulation of public institutions charged with consumer awareness and safety issues because such institutions operate almost independently with little or no oversight. An area for improvement that is recommended by the study is for public institutions tasked with issues concerning GMcrops to work synchronically in order to ensure safe research is conducted and consumer awareness is realized. Consumer awareness can be realized through such public institutions engaging in vigorous consumer awareness campaigns by using more than one medium of dispensing information e.g. social media and the internet, television documentaries about GMcrops, engaging various sections of the public not just the farmers and informing them of the benefits and implications of GMcrops etc. consumer awareness can only be achieved if only these public institutions honestly and rightfully undertake their constitutional and statutory duties to inform the consumer about their rights.

List of abbreviations.

COK-Constitution of Kenya 2010.

WHO-World Health Organisation.

FAO-Food Agriculture Organisation.

GMO's-Genetically Modified Organisms.

GMcrops-Genetically Modified crops.

GM-Genetically Modified.

BT- Bacillus Thuringiensis.

CPA-Consumer Protection Act Kenya.

CPAC-Consumer Protection Advisory Committee.

NBA-National Biosafety Authority.

KEPHIS-Kenya Plant Health Inspectorate Services.

KALRO-Kenya Agricultural and Livestock Research Organisation.

KEBS-Kenya Bureau of Standards.

GMA-Groceries Manufacturers Association.

CEC-The Commission of Environmental Cooperation.

List of cases.

Kenya small scale farmers v cabinet secretary ministry of education & 4 others.

Oluf Johnson v Paynesville Farmers Union Cooperative Oil co-op.

Robert J. Bennet, and Ann, Bennet, and Raymond C v Larsen company.

Vernon Hugh Bowman v Monsanto Co.

Diamond v Chakrabarty.

List of legal instruments.

Constitution of Kenya 2010.

Cartagena protocol.

Consumer protection Act (Act no. 46 of 2012).

Biosafety Act (Act no. 2 of 2009).

Standards Act Kenya (Act no. 496 of 2012).

Public Health Act Kenya (Act no. 242 0f 2012).

Chapter 1.

1.1Introduction. Background of the problem.

The famous chef, author, and television personality Anthony Bourdain once remarked, *"I would like to see people more aware of where their food comes from. I would like to see small farmers empowered. I feed my daughter almost exclusively organic food."*[1]Modern science has experienced dramatic and erratic changes in biotechnology to the extent that now biotechnology is being adopted or the idea is being uprooted by African countries including Kenya. Biotechnology refers to the use of living organisms to make, develop or modify products or processes for specific use. Biotechnology has been used in food production, packaging, crop growing, animal rearing, and also in medicine. For purposes of this project, our focus is narrowed down to crops that are been genetically bio-engineered such as maize, cotton, and soy.

Genetically Modified Crops (GMcrops) are derived from organisms whose genetic material (DNA) has been modified in a way that does not occur naturally like the introduction of a gene from a different organism.[2] Most existing genetically modified crops have been developed to improve yield. World Health Organisation, (WHO) and the Food Agriculture Organization, (FAO) established a protocol for evaluating the safety of GMOs, which they say has the potential to introduce toxins and new allergens,or cause nutritional changes in foods and other unexpected effects.[3]The most common GMcrops seeds in the market today is the *Bacillus thuringiensis* (Bt). This refers to transgenic plants expressing insecticidal proteins from bacterium, the plant is resistant to diseases and unfavorable weather conditions which is a revolution in agriculture. Bt has become a major insecticide because genes that produce Bt toxins have been engineered into major crops grown on 11.4

---

[1]https://www.brainyquote.com/quotes/anthony_bourdain_552939?src=t_organic_food on 29 September 2017.

[2]http://www.who.int/topics/food_genetically_modified/en on 29 September 2017.

[3]http://www.consumerreports.org/cro/magazine/2015/02/gmo-foods-what-you-need-to-know/index.htm. On 28 September 2017.

million ha worldwide in 2000. [4] The potential ecological and human health consequences of Bt plants, including effects of non-target organisms, food safety, and the development of resistant insect populations, are still being compared for Bt plants and alternative insect management strategies and are yet to be formulated on a worldwide spectrum.

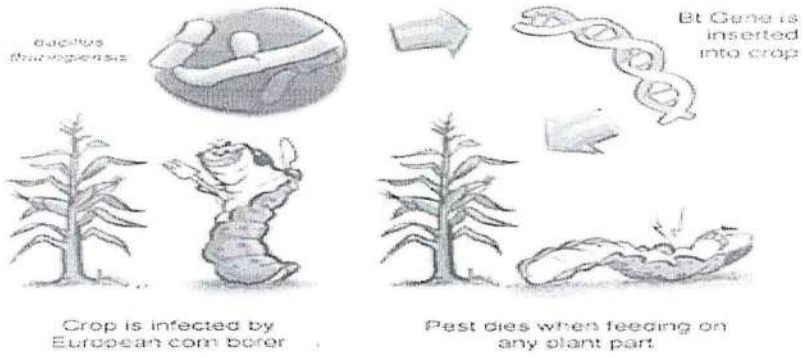


Figure 1. *Animated image of effect of GMcrops on pests.*

In Kenya, the approval of genetically modified organism's projects is aligned with Vision 2030 flagship projects. The *National Biosafety Authority*has reviewed more than one application involving environmental release and placing on the market of a genetically modified crop of BT maize, and cotton for conducting national performance trials.[5]However, there have been no conditions on safety and health provisions for the trial. This lack of concern over the rights of the consumer clearly shows that consumer health needs are likely to be ignored in future at the expense of developmental goals. The Bio-safety Act passed into law in December 2008 aimed at minimizing risks posed by genetically modified organisms is yet to carry out public consultation on labeling laws and their enforcement. The Act even goes ahead to stipulate penalties of infringement on labeling laws. Section 12 of the *Bio Safety Act* states that contravention of labeling regulations attracts a fine of up to twenty million shillings or imprisonment of a term not

[4] Abbott E 2000, 'Media coverage of GMOs in the USA and UK', http://www.nysaes.cornell.edu/comm/gmo/ on 29 September 2017.

[5]www.ke.biosafetyclearinghouse.net on 12 May 2017

exceeding 10 years, or both.[6] The Authority is yet to show methods of enforcement of the labeling regulations.

1.2Statement of the problem.

Poor consumer awareness and protection with regards to GMO's

Legislations in place to address consumer concerns is poorwhen it comes to issues of health and access to information. Policies on GM crops do not address consumer concerns such as health and safety of foods consumed. The purpose of this dissertation is to study current legislation and other variables in place and see whether the right to consumer information is being achieved. Once inadequacies of our current laws are realized, a formidable solution can be realized through this research paper.

1.3Purpose of the study or general objective.

The purpose of the study is to assess the current legislation in place with regards Genetically Modified crops, and assess whether consumer awareness and access to information is being achieved by bodies tasked with regulation of GMcrops.

1.4Research questions or specific objectives.

- The objectives of the study are:
- To study emerging trends that have developed around GMcrops around the world and in Kenya.
- To analyze legal issues that arise from GMcrops.
- To make a comparative analysis between economic impacts and consumer health concerns to see whether a tradeoff exists.
- To critically assess the CPA and Biosafety Act Kenya to see whether consumer awareness can be achieved.

[6] Legal notice no.40, *The Bio safety (Labeling) regulations (2012)*, (Act no.2 of 2009).

1.5 Justification of the study.

The constitution of Kenya article 46 forms a basis on which consumers rights can be achieved with regards to GMOs. It states that;[7] Consumers have the right to goods and services of reasonable quality, right to information necessary for them to gain full benefit from goods and services, right to the protection of their health, safety, and economic interests, and to compensation for loss or injury arising from defects in goods or services. Article 46 further states that Parliament shall enact legislation to provide for consumer protection and for fair, honest and decent advertising, this Article applies to goods and services offered by public entities or private person. Consumers are essentially the citizens of Kenya and thus their rights should be respected and protected by the law. Should there be the adoption of GMOs into the Kenyan agricultural sector and economy, research and trials should be transparent and contain human safety mechanisms. This research paper aims to provide guidance and elaborate further on the consumers rights both globally and nationally with regards to GMO.

1.6 Literature review.

Kenya faces major challenges of food security, globally countries facing inadequacies with food security have adopted GMO's such as United States of America, Brazil, India, South Africa etc. The GMA (Grocery Manufacturers Association) consists of over three hundred members in the consumer packaged foods and closely related fields that use genetically engineered products. Examples of such companies include Kellogg co. (cereals, toaster pastries etc.) Land O' Lakes (maker of plant nutrients, pest control products and other farming chemicals) General Mills (cereals) Kikkoman (soy sauce and canned foods) Monsanto (seeds, weed control products) post foods (cereals) Solac (soy products in processed and packaged foods of all types). A vital question to ask is whether consumers of these products are well aware of the genetic makeup of such products?

The world health organization (WHO) defines genetically modified organisms (GMOs) as those organisms in which the genetic material has been altered in a way that does not occur

[7] Article 46, *Constitution of Kenya,* (2010).

naturally.[8] The technology used allows selected individual genes to be transferred from one organism to another, also between non-related species. Such methods are used to create genetically modified plants, which are then used to grow GM food crops. WHO indicates that individual foods and their safety should be assessed on a case-by-case basis.*Toxicity* and *allergenicity*; are specific components thought to have nutritional or toxic properties, nutritional effects associated with genetic modification; and any unintended effects which could result from the gene insertion. WHO declares that the GM products that are currently on the international market have all passed risk assessments conducted by national authorities. However, there is not enough published information concerning the risk assessment by these national authorities

The Cartagena Protocol to the Convention on Biological Diversity outlines provisions for public awareness and participation which require for parties to promote and facilitate public awareness, education, and awareness on the sale and transfer, handling and use of living modified organisms in relation to conservation and sustainable use of biological diversity, taking into account risks to human health, ensure that public awareness and education encompass access to information on living modifies organisms, and to consult the public with regards to GMO's.[9]Cartagena Protocol 2000 also states that national approval of GMO's should be based on informed consent, for approval a complete risk analysis is needed.

A journal published on consumer response to genetically modified foods showed that consumers selected randomly from a nationwide sample. The consumers were selected from a nationwide sample were requested to respond to a mail survey asking them to rate hypothetical cornflake products defined by different levels of brand, and GMO attributes. The results showed that consumers belonged to one of three segments. Consumers in one segment (brand buyers) had a very huge preference for a national brand product, while consumers in a second segment (price pickers) strongly preferred a low-priced product. Consumers in the third segment (safety pickers) sought to avoid cornflakes with GMO content. The study showed that consumers with a high level of risk aversion regarding

[8] http://www.worldhealthorganisation.com/html. on 17 April 2017

[9] Article 23, *Cartagena Protocol to the convention on biological diversity*, (2000).

GMO's belonged to the safety seekers segment than those with low aversion to risk. Likewise, those consumers that tended to believe that GMO's would have a positive effect on health and food quality likely belonged to the brand buyers or the price pickers segment. The implications of this research on policy makers and producers revealed that consumer segmentation might support the use of labels clearly identifying the GM content of foods. This feature would enable members of this segment to make choices consistent with their preferences.[10]

A study looking at consumers in relation to GMO's was addressed at the 71st World Congress of the International Association of seed crushers found that consumers in Europe were skeptical to GMO products, this was contrasted with the USA where consumer confidence is high. Proposed solutions to increase consumer confidence in GMO products would entail companies offering a choice of GM, non-GM or identity-preserved (IP), and organic foods. The study asserts that labeling a product 100% is impossible since companies must prove that nowhere in the line of production did the product come into contact with anything GM. Products that contain GMO-origin proteins or DNA must be labeled as such. Products with less than 1% traceable GMO, to qualify, the product must be inadvertent and careful adherence to IP must be proved by certification throughout the production system. No label is necessary if such strict protocol is followed. The research concludes that more research is necessary into GMO's that have specific interest to consumers, such as canola oil and low saturated fat soybean oil.[11]

Drawing from such unrealistic laws, Consumer participation should be enforced by the relevant bodies tasked with this purpose in Kenya. Genetically modified crops must be properly scrutinized and tested. Educating consumers of all ages on spending power must be conducted for purposes of promoting freedom of choice and access to information. Consumers need to know the nutritional content of various GM crops, laws such as labeling and traceability laws must be emphasized, enforced and followed by any company

---

[10]Firestone. D. 'Physical and chemical characteristics of oils, fats, and waxes.' 1st edition, ISBN, (2006) 87.

[11] Gregory Baker, and Thomas Burnham, 'Consumer Response to Genetically Modified Foods: Market Segment Analysis and Implications for Producers and Policy Makers'. *Journal of Agricultural and Resource Economics* (2001), vol.26, 387-403.

wishing to produce GM crops in Kenya. A clear distinction should be drawn between impacts of GMO's on small scale farmers and large-scale farmers. Higher and better yields, pest resistant crops are some of the advantages that both small scale farmers and large-scale farmers enjoy. Large scale farmers stand to benefit more since such farms use modern farm technology methods that increases production and profits. Small scale farming is dense in sub-Saharan Africa, farmers could face challenges such as GM crops could lead to uncontrolled large scale spread of transgenes within a small-scale farm. Such a scenario will result in impurities in harvest thus preventing development and export options

1.7 Scope of the study

The research shall focus on GMO crops in Kenya as this is the main geographical region of interest. To fully understand and capture the key aspects of consumer protection and consequential effects of GMOs, other jurisdictions such as America, India and Europe where consumer freedoms have been realized shall also be used to weigh the risks and benefits involved with the innovation of GMOs. Emphasis on BT maize, fruits and vegetables genetically modified will be discussed in the paper.

1.8 Research methodology.

The research paper will take a positivism philosophy which will use an objective approach while relying on facts and quantitative data to discuss the issue of consumer awareness. An inductive approach will be used to find answers to the research objectives, a conclusive research method will be used to try and provide conclusive answers to the research problem.Secondary data from previously published journals, newspapers, books, conference papers, online portals and other internet sources.This is advantageous because of low cost and ease of acquiring information as well as quick pace. Qualitative data from case studies and various secondary data will be used to address the research problem. The research purpose through the research methodology aims to inform the consumer with regards to GMcrops and the general public at large in Kenya.

1.91Limitations of the study.

The research shall focus mainly in the Kenyan context, with significant research material being derived from American, Indian and European jurisdictions. The research shall be limited because of financial cost, ability to access certain information and conflicting data on the topic.

1.91Chapter summary.

Chapter one has introduced the study. It has been observed thatGM crops have the potential to improve food quality, increase harvest yields, and decrease dependency on certain pesticides, however before entering the market, their safety needs to be scrutinized and analyzed. This includes a detailed analysis of allergenic risks, as the safety of allergic consumers takes priority. Consumer awareness and information should also be diligently dispersed by the relevant biosafety authorities. It is safe to say that restrictions should be put in the regulation of research, marketing and distribution of GM crops in Kenya.

I. **Chapter 2** will provide the conceptual framework. This chapter willdiscuss aspects of GM crops related to consumer protection and legal issues that arise with this regard.

II. **Chapter 3** will explore case studies. These case studies will analyze case studies from an economic perspective in different jurisdictions which produce GM crops and identify any socio-economicissues that arise from the case studies.

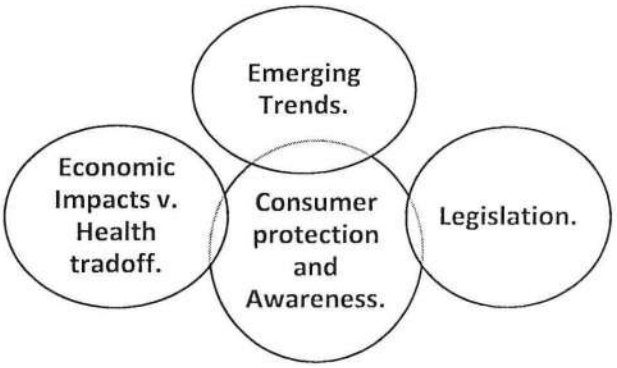
III. **Chapter 4** will explore health risks associated with GM crops, international Case law and legislations in relation to GMcrops. This chapter will study the health and legal issues that consumers ought to be aware of. Chapter four shall conclude by forming a comparative analysis between economic and consumer rights based on chapter three and chapter four.

IV. **Chapter 5** will undertake an analysis of the consumer protection Act, the Biosafety Act with regards to GM crops. The chapter will critically study relevant sections of the CPA and the Biosafety Act and assess whether these statutory bodies are fulfilling their mandate with regards to consumer awareness and addressing health risks of GMcrops. Chapter five will end by offering a conclusion and recommendations to the study.

Chapter2

2.1 Conceptual framework.

The conceptual framework will be discussed in four parts namely;emerging trends, consumer protection, economic impacts v health tradeoff, and legislation. The central and underlying theme of the paper is consumer awareness and protection, with the latter themes being secondary themes that are discussed in the consecutive chapters.



2.2 Emerging trends in the GMO sector.

Emerging trends in this research paper is to be understood as modern developments since the inception of genetically modified foods. Emerging trends is also to be understood for purposes of this research paper as recent scientific innovations with regards to gene manipulation and the long-term effects sustainable agricultural efforts.

In order to understand emerging trends, it is important for us to look at the history of GMO's at least briefly in order to understand how the industry has developed over time. It is worth noting that, since the advent of agriculture which was about 12,000 years ago, farmers have strived to improve their yields, durability of crops, disease resistant crops and generally superior to conventional seeds. Human's overtime preferred qualities of different crops to others and eventually used to breed different crops with others in order to get the best results. A simple example would be the sweet potato crop which wasn't discovered until 8,000 years ago when sweet potatoes were bred out of the swollen parts of regular potato roots. *Gregor Mendel* whom is considered to be the modern father of genetics due

to his hybridization experiments studied and researched on breeding of plants and animals of different species in the *1880's*. He mainly experimented with pea plants between *1856* and *1863*, his work was later used in genetic engineering. Later on in *1954*, two scientists Watson and Crick described DNA as having a double helix shape which paved way for genetic engineering. In *1970*, Monsanto Corporation employed the chemist John Franz to redevelop glyphosate as an herbicide which later came to be known as "roundup ready" seeds. In *1973* biochemists Stanley Cohen and Herbert Boyer developed a method to cut specific parts of DNA and attach them to other DNA organisms and later in *1976* biotechnology was commercialized allowing companies to insert different genes in food, animals, medicine and many others scientific fields. The U.S supreme court ruled that genetically foods could be patented and in *1988* scientists inserted genes into soybeans making it easier for farmers to control yields, soon after other crops were genetically modified such as corn, maize, potatoes, cotton, sugar with the intention of making these crops resistant to diseases, pesticides and herbicides. Throughout this historical period of GMO's, little effort was done to ensure that GMO's are safe for human consumption and health risks posed by GMO's have been thwarted as either negative propaganda or baseless and unsubstantiated claims. Knowing this history is important because it helps the study in assessing and analyzing laws and emerging trends in various parts of the world with regards to genetically modified crops, and the impact labeling laws have on GMO crops. The research paper shall focuson historical and emerging trends in various countries, and in Kenya.

2.3 Consumer protection.

Consumer protection is envisaged in our constitution under Article 46 and sections of the consumer protection Act that deal with food and beverages. Consumer protection essentially deals with fair and honest representation of goods to the consumer, timely information delivered to the consumer in order for them to make an informed choice, penalties involved with misrepresentation of goods to the consumer and remedies available to the consumer in cases of breach of contractual terms, nutrition content with regards to goods directly consumed by the consumer, and quality control mechanisms in place to ensure that consumers consume safe goods approved by a national accreditation body such as KEBS. The paper shall assess genetically modified crops sale and distribution in line

with fair trade practices, consumer rights, quality and quantity determination of GMO's, and rights and obligations with specific consumer agreements.[12] Under the public health Act, health authorities are tasked with the protection of unwholesome food, the protection of food and foodstuffs with an aim to secure health of consumers.[13] The paper will also focus on farmers as they are also buyers and growers of genetically modified organisms because farmers play an important in the GMO's process and therefore their rights as consumers should not be overlooked. Different studies have shown that pesticides used to control weeds have a negative effect on farmer's health both externally and internally as recent developments in India have showed that herbicides and pesticides can cause respiratory disorders and skin burns if the herbicides and pesticides come into contact with the skin during spraying the crops.

2.4 Economic and health impact tradeoff.

The economic benefits of GMO's has implied to improve both social and economic spheres of life. Governments that have given a green light on production and distribution of GMO's earn revenues through taxing manufacturers and licensing growers and manufactures making an economic tradeoff at the expense of consumer concerns. The government should not only benefit from the industry but also make sure that social and health concerns of GMO's are checked and addressed in order ensure safety of consumers, and also as a duty to the people they serve. Governments in addition to collecting revenues may also form Bio-safety institutions to check and monitor various organs involved with genetically modified organisms in their respective country. For producers, it has increased net profits of companies dealing in GMO's due selling seeds in large quantities and reaping benefits that come with patenting GMO's and issuance of licenses to farmers to use their seeds. For farmers, two types of famers come to mind i.e. small scale farmers and large scale farmers. Small scale farmer's benefit less from growing GMO's compared to large-scale farmers because of acreage of land planted. Large-scale farmers stand to benefit more in because higher yields are produced and thus it is the most effective method to plant GMO's. Small scale farms face issues such as gene trespass to be discussed in

---

[12] Part II, Part IV, *consumer protection Act*, (Act no.46 0f 2012)

[13] Section 130, 131, 135, *Public Health Act*, (Act no. 242 of 2012).

chapter 3, and this is due to small farms being located in close proximity to each other and this affects the yields and quality of crops. GMO's should stand to benefit both types of farmers in an equitable manner for it to be widely adopted in Kenya since most farmers in Kenya are small-scale farmers. The study will further analyze the *Economic and health impact of genetically modified crops* globally by using case law from jurisdictions such as USA, Southern and Northern Africa, India and EU countries in order to critically study and draw an analogy between health of consumers and the economy of the nation as to whether or not a tradeoff exists.

2.5 Legislation.

Kenya with regards to legislation has taken tremendous steps to adopt a bio-safety Act that is in line with the Cartagena protocol that deals with genetically modified organisms. According to the *COK 2010,* consumers *"have a right to goods and services of reasonable quality, right to information necessary for them to gain full benefit from goods and services, right to the protection of their health, safety and economic interests, right to compensation for loss or injury arising from defects in goods or services".* The constitution also states that parliament is to enact legislation to provide for consumer protection and for fair, honest and decent advertising.[14]

The biosafety Act acts the primary governing statutory law in Kenya that addresses processes of conducting field trials and approval of GMO's into the market. There is not much case law and precedence in Kenya yet that discusses genetically modified crops and therefore in order to understand how countries have interacted with GMO's with regards to law. We shall borrow case law from other jurisdictions that have adopted GMO's to assess the impacts of GMO's in different social, environmental and economic scenarios. The study shall also examine the principles and objectives of the Bio Safety Act in Kenya, this includes facilitation of responsible research, and analyze the decision-making process in the transfer, handling and use of genetically modified crops and related activities.[15]

---

[14] Article 46, *Constitution of Kenya* (2010).

[15] Part 1, preliminary. Sec.3 & sec.4, *Bio safety Act* (Act no.2 of 2009),

Legislation in protecting citizen rights is necessary considering a vast amount of research showing health hazards in both crops and animals that have been genetically modified. A case in point would be a wide Ban on Monsanto maize in European countries such as Greece, Hungary, France and Austria. In April 2009, the agriculture Minister in Germany, *"Ms. Aigner, announced a ban on cultivation and sale of Monsanto maize. Free labeling laws were introduced in 2008 May"*, [16] and the reasons cited were that crops and animals pose a health hazard for the population at large. Consumer protection is key in this field because consumers have a right to choose between GM crops and organic foods. Legislation should aim to strengthen consumer rights through instituting oversight mechanisms to check and regulate the production, sale and distribution of GM crops around the country. Laws should include what kind of chemicals are prohibited in the growing of GM crops that are associated with diseases. With the mounting data on GM crops, a logical presumption can be made that it could be plausible for GMO's to cause diseases in humans.[17] It is on this basis that legislation is necessary to ensure that GMO foods are safe for human consumption. Therefore, a framework of laws should be created to achieve the goal of balancing economic rights vs. consumer protection. Adequate public education and participation is important to make the public aware of its effects. The subsequent chapters having developed a conceptual framework shall focus on principles of emerging trends, consumer protection, economic impacts and risks associated with GMO's and finally current legislation from different jurisdictions that have adopted genetically modified foods in analyzing consumer safety concerns.

[16] http://www.gmo-free-regions.org/gmo-free-regions/germany.html on 12 Jun 2017

[17] http://www.aaemonline.org/gmo.php on 12 Jun 2017

Chapter 3.

3.0 An economic impact of GMO's on the world v health tradeoff.

Economically speaking, GMcrops have a positive impact on the economy as we shall see in this chapter. However economists usually ignore other variables that inform or affect consumer choice in an economy such as health, information and awareness. If you read an economic paper on GMcrops you will be amazed by how much progress it can bring to an economy. However, this chapter seeks to point out the economic aspects of GMcrops and also identify economic challenges brought out by the technology. Case studies conducted in various countries shall be analyzed and draw special attention to consumer protection, and economic impacts v health tradeoff.

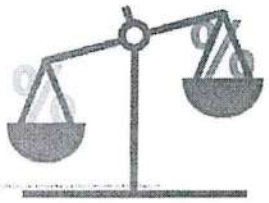


Figure 2. A weighing scale symbolising an economic tradeoff.

3.1 Case study. World Trade Model. An economic analysis of the impacts associated with the production of GMO's.

3.2 Population as a driving factor to increase production of GMcrops.

A study was conducted using a spatial equilibrium to create a world trade model. Soybean and corn are the main GM products grown around the world.[18] The study showed that empirical evidence from the study reveals adoption of GMO production technology increases the quantity traded, and reduce the pressure on food prices although the major trading countries obtaining most benefit and profit. Thomas Malthus in his population theory suggested that the growth of population will be more rapid than the food supply

[18] https://www.card.iastate.edu/faculty/profiles/giancarlo_moschini/sobolevsky-moschini-lapan-ajae.pdf on 19/11/2017.

which turned out to be incorrect by fifty years of data. The supply of food has exceeded demand globally through improvement in crop production technology, higher yields. Consumer confidence is still lacking despite immense advancements in technology. Reasons why consumers lack confidence include health risks associated with genetically modified and environmental impacts. Many Scientists predicted that population would grow at a faster rate than food supply, however because of the inception of the 'green revolution', food per capita on average rose and prices of food gradually dropped.

The prediction of a Population explosion in the future to come was believed to be accompanied by an increase in demand for food. Without GMO's, the total acreage of land planted will not be increasing in the forthcoming years thus, advanced technology will be needed in feeding the growing population. The United Nations in July 2015 projected that worlds population to reach 8.5 billion by 2030, 9.7 billion by 2050 and exceed 11 billion in 2100. The Reasons cited for such a population explosion has been the recent growth in developing countries. UN under-secretary-general for Economic and Social affairs further noted that understanding the demographic changes that are likely to occur in the future is key in implementation of a new development agenda.[19] Having discussed population as a driving factor for the increase of genetically modified produce, it is imperative to compare developing countries and developed countries in relation to consumer acceptance.

3.3 Developed countries compared with developing countries in relation to expenditure spent on food.

Uncertainty in relation to human health exists when people consume GMcrops. European countries have strict laws concerning GMcrops as well as related products and processes. Such issues may be ignored by developing countries because of problems of food security. The ratio of expenditure on food to GNP in many developing countries is at approximately fifty percent. If price on food is increased, it may raise the expenditure on food. However such an increase on food may not affect developed countries since the ratio of expenditure on food is below two percent. Thus keeping in mind such considerations, regulations and

[19] http://www.un.org/apps/news/story.asp?NewsID=51526#.WHUsCvl97IV on 14 November 2017.

the extent to which the consumers accept vary between developed and developing countries. [20]

Concluding remarks of the study indicate that humans need GMcrops and related products. The study holds that the production of corn and soybeans has the ability to increase quantity traded and reduce prices of food. Developed countries would stand to benefit from GMO technology as contrasted to developing countries with weak or no food regulating bodies. A limitation to this study is the assumption that trading countries would stand to benefit the most from adopting a GMO production technology i.e. using GMO production technology, while importing countries do not fully use/adopt this technology. If importing countries were to adopt such technology, the impact of GMO will be much larger than earlier stated.

3.4 Case study 2. Socio-economic impacts of Bt cotton- A case study of Karnataka.

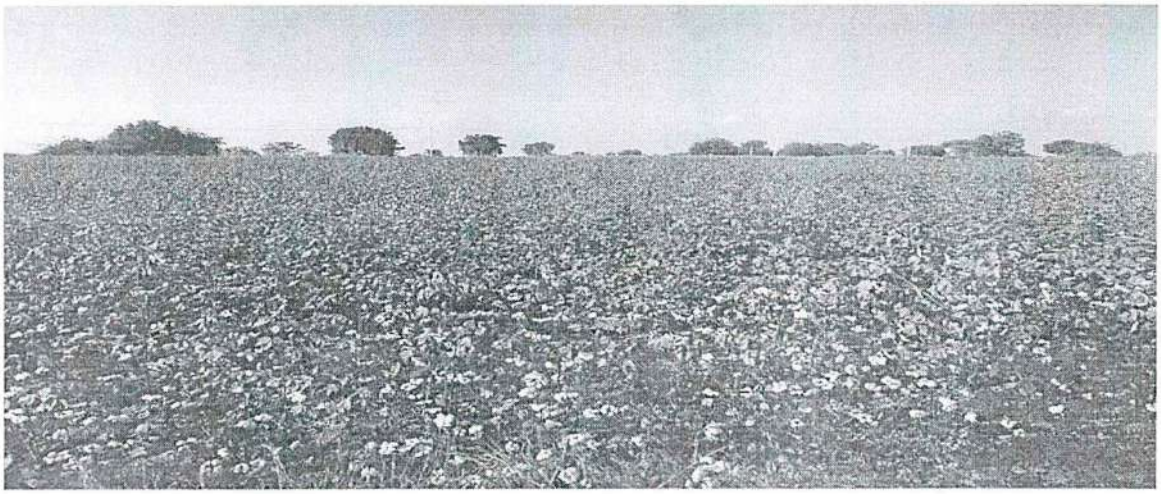


Figure 3. A Bt cotton field in the state of Karnataka, India.

Karnataka is a state in south-western India that grows Bt cotton on a large scale. The reasons attributed to this are higher yield owing to extermination of the bullworm and drastic reduction in application of chemical insecticides for bullworm. This study is important because it identifies a socio-economic disparity between consumer farmers of small and large scale farms. Given the prevalence of Bt crops in Karnataka, the study was

[20] www.agbioworld.org/biotech-info/articles/biotech-art/need-GMOs on 21 December 2016.

carried out to assess the impact of the crops to theeconomy. The methodology used to collect data was done by selecting 60 random farmers during 2007-2008.[21]

The results of the study found that Bt farmers in Karnataka were more than non Bt farmers by a majority of 66.6% total land holdings. An important result relevant to this study showed that expenditure was higher in Bt cotton than in non Bt cotton largely due to high costs of purchasing the Bt cotton seeds.[22]On the issue of expenditure on pesticide sprays, it was found that Bt farmers over used synthetic sprays which in turn was hazardous to human health.

The total yields were recorded were much higher by 30% for Bt cotton farmers than non-Bt cotton farmers and this was largely attributed to landholding size. The study also showed that Bt cotton farmers achieved higher gross return compared to non Bt cotton farmers, and in both cases, higher returns was attributed to the total land on which the crop was grown i.e. the larger the size of land planted, the larger the benefits derived. It was also found that Monsanto Bt cotton which was used by some famers was inferior to non Bt cotton in terms of yields. This resulted to non Bt farmers realizing more profits than Bt farmers.

On the issue of farmer's response to Bt technology, the results were classified into three categories positive, negative and neutral respectively. Based on yields, farmers had a positive impact on the final yields of the product. On the contrary, they had a negative on the response that the technology did not reduce costs in production. Under socio economic factors, it was found that farmers' incomes could potentially increase, their standard of living could be improved and increase employment. However, the research failed to consider health and environmental risks posed by Bt cotton and only points out that Bt positive externalities exceeds negative ones.[23]

---

[21] http://ageconsearch.umn.edu/bitstream/109418/2/7-VR-Kiresur.pdf

[22] Bagi, F.S. 'A logit model of an extension agent's choice to visit individual farms'. *Canadian Journal of Agricultural Economics*, (1984), 125-14.

[23] Hugar, L.B. and Patil, B.V. 'Research Report on Techno economic Impact of Bt Cotton Technology in Karnataka State' (Unpublished), University of Agricultural Sciences, Dharwad, (2007).

The conclusion of the research shows that more than 80% of total land area of cotton planted in India is Bt cotton and the benefits of Bt cotton have been fewer than anticipates. Bt cotton in contrast to non Bt cotton has higher returns. Non availability of quality seeds have been a constraining factor for adoption of Bt cotton. More research is recommended by the study to further look into the health associated effects caused by Bt cotton. This study is one of the many examples of the economic effects that GMO's have on farmers and the region where it is cultivated. Such studies seem to persistently ignore the consumer and health associated risks spanning from GMO's. Only positive remarks are deduced in favor of GMO's which would suggest bias internationally with regards to discussions on GMO's.

3.5 Case study 3.

3.6 Corn: Genetically Modified Drought-Tolerant and Royalty Free seed selling in Africa. An economic analysis

Bt maize is maize that has been genetically modified to manifest the cry 1Ab gene that confers resistance to a number of major lepidopterian pests, especially the stem borer complex. In previous years, Bt maize containing the 1Ab gene has been adopted commercially in Canada, USA, South Africa etc. In developing countries, BT maize has advantages such as increased yields, better food security, effective pest control, BT maize does not require the equipment, knowledge and information is required for insecticide applications thus reducing farmers risk to chemicals and pesticides. Reduced mycotoxin levels by damage caused by stem borers allows fungi to develop leading to rotting of the stalk and cob plus accumulation of mycotoxins. Studies conducted in France show with BT maize there was a significant reduction in damage caused to the stem and cob by stem borer pest as well as a reduction in the amount of tissue infected fungi.[24] BT maize also brings about an economic advantage. In Argentina, where BT maize comprises about fifty

[24] Hammond BK, Campbell C, Pilcher T, A. Pietri, G Piva, 'A review on comparative data concerning fusarium mycotoxins in Bt maize and non-Bt isogenic maize.' *Mycotoxin International Research Journal*, (2010), 141-145

percent of maize grown in the country. Out of this economic advantage, 79% of the benefit accrued to the provider of the seed, and 21% to the farmer by increased production. [25]

Safety of Bt maize is premised on the notion that it has been grown in South Africa, United States, Canada and Argentina and other countries. If we base our argument on enshrined principles states under the Cartagena protocol, the approval for any GM crop requires extensive testing and independent scientific review of safety to human health and the environment. Studies conducted on the direct effect of Bt crops on organisms that feed on crop tissues has shown no short term negative impacts[26]. The study concludes that there is a need to include measures of how ecological functions are affected by transgenic crops.

Kenya is in the infant stages of conducting field trials of GM maize. A petition filed in the High Court of Kenya; ***Kenya Small Scale Farmers V Cabinet Secretary Ministry Of Education & Attorney General- second*** respondent. The petition involved a general challenge based on constitution of Kenya on the protection of Rights and Fundamental Freedoms[27] seeking to block lifting of the ban on GMOs in the country. GMOs have been banned in Kenya since 2012, however it was never gazetted and ranks only as an executive order that was issued by the cabinet secretary. The petitioner argued that various international reports scientifically point out that GMOs are harmful to man and nature and small scale farmers will be affected both economically and socially. The court against the petitioners, the application was dismissed on the basis of failure to establish a prima facie case with the likely hood of success. Having drawn a presumption from the above case that Kenya has removed the ban on genetically modified foods, it is necessary to examine some of the economic challenges posed by genetically modified foods on Kenya which are discussed below.

---

[25]Hopp E. 'case study of a real biotech solution: Argentina: a "soybean republic" or a bet to future?' Agricultural biotechnology International Conference, (2004), cologne, Germany.

[26]Losey JE, JJ Obrycki, RA Hufbauer, 'Biosafety considerations for transgenic insecticidal plants: non-target herbivores, detritivores and pollinators.' Encyclopedia of plant and science, (2004).

[27] Art.23 (3), & Art.24, *Constitution of Kenya* (2010).

3.7 Economic challenges arising from GMO's.

The government of Kenya and the biotech industry are seeking to promote genetically modified organisms due to the economic benefits derived from the technology may however be far from true. Growing of GMcrops may however prove to prove to increase costs to farmers, consumers and the economy in general.[28] The loss could further stretch to the loss of land or decrease in land value, increase in environmental costs due to contamination, and costs incurred by non-GMO farmers are some of the economic challenges posed by biotechnology.

The country is seeking to promote GMcrops in order to increase income of farmers and for crops to become more competitive on the global market. However, a look at the United States shows such economic gains to be far from true since the number of organic farmers have grown overtime, large scale farmers seemingly stand to benefit from the technology compared to small scale farmers. A recent study was carried out to check whether incomes of farmers had increased and the results were variable, and farmers who were actually growing Bt corn were losing money. Increased dependency due to farmers growing seeds under contract from biotechnology companies that have monopolized the industry by buying out seed companies in U.S.[29]

GM seeds are also more expensive to buy and technology costs further places a burden on the farmers costs. In the U.K and U.S, there has been loss of markets for GMcrops because consumers have increased rejected GMfoods nationally and internally respectively. Another economic challenge would be increased costs for non-GM farmers because of increased costs in making sure that their crops are protected from genetic pollution.[30]

---

[28] https://friendsoftheearth.uk/sites/default/files/downloads/economic_impacts_gm_crops.pdf on 12 November 2017

[29] https://www.soilassociation.org/media/4905/policy_report_2002_seeds_doubt.pdf. On 17 December 2017

[30] 'Scenarios for co-existence of GM, conventional and organic crops in UK agriculture.' Joint research Centre, (2002), www.jrc.cec.eu.int/GECrops/ on December 7 2017

Further to conclude economic challenges posed by GMcrops, it would be prudent to look at a paper by Calestous Juma on genetically modified crops in Africa. On average, agriculture accounts for 30-40 percent of sub-Saharan Africa's overall GDP and employs about 64 percent of the labour force. The professor states that one misconception about GMOs is the importation of genetically modified foods but it is rather about building up requisite capacity to diversify the technological capacity to diversify the technological options needed for long-term agricultural adaptation. Investment in agriculture is needed and higher technical training is necessary for creation of larger markets. The main barriers lie in the existence rigid regulatory systems and uncertainty over public acceptance of transgenic foods and that the problem can be addressed by focusing on industrial crops such as Bt cotton[31]. The late professor advocated for implementation of policies such as agricultural innovation, creation of presidential offices for science and technology, and encourage biotechnology champions in African countries. However, no negative consequences such as the legal and health consequences that come with the adoption of GMOs in Africa is discussed by the professor. Investing heavily in GMcrops will be costly to the government because a lot of government resources will have to be used and this might look like a push for GMO's being prioritized over other government projects, and yet the economic principle of comparative advantage could be used instead. Overlooking health and safety issues of the consumer is one aspect that has led to a negative outlook of genetically modified organisms around the world, and Africa, and to not discuss them is simply turning a blind eye on the matter.

Therefore, Kenya needs to carry out more research to assess the economic impact of Bt maize, cotton and related Seeds on farmers at a consumer level. Having discussed the economic impacts of GMO's, chapter four shall assess the health risks associated arising from BT crops specifically cotton, maize and soybean. Case law discussing pertinent issues on consumer protection shall also be discussed in chapter four.

---

[31] Calestous Juma, "Leap- frogging in African Agriculture: The case of genetically modified crops". Harvard Kennedy School, (2014).

4.1 Chapter 4. Legal and health issues that affect the consumer.

In this chapter, I intend to discuss consumer concerns in relation to health, consumer awareness, and the various laws from different jurisdictions that have dealt with cases on GMcrops. Chapter four will focus on legislation particularly case law, emerging trends of GMcrops around the world, and lastly consumer health and awareness with regards to GMcrops.

4.2 Legal issues arising from GMcrops. A look at the rest of the world.

Consumer protection under the law cannot be achieved unless we look at the whole issue of GMO's as a whole and not only from an "economic, feed the hungry in Africa approach". A consumer could be caught off-guard with legal issues if he/she is a farmer or a buyer of the end product. It is based on this understanding that I believe these issues affect the end-consumer and therefore should be discussed in this chapter. Under international jurisdictions, the following legal issues arise that could affect the consumer and yet still, could offer insight nonetheless to the consumer;

4.3 Trespass, genetic drift and transboundary pollution.

The growth of GMO's has increased over the years in terms of the increase in countries applying the technology to their farming techniques. Certain risks such as health risks, environment concerns and the genetic diversity of food crops have caused countries to apply precautionary principles to introduction of GMO's into the market. Such a precautionary principle grants a country the right to refuse dissemination of GMO's in the market if there are health and environmental risks concerned. One risk posed by GMO's is the spread of altered genes to neighboring conventional crops or to different species. Certain crops cross-pollinate through the air like maize, or when a farmer grows GMO crops, they could potentially contaminate a fellow land-owner farmer's crops. This kind of pollination does not only apply to farms in close proximity but also transboundary pollution i.e. countries. This is known as *"Genetic Drift"*.[32] Trespass is when someone enters the premises of another without authorization and causes harm to the property.

---

[32] Hillary P, 'Drift of Patented Genetically Engineered Crops: Rethinking liability theories' *Texas law review* (2003), 4.

Genetic drift is not considered as trespass because it is involuntary. Pesticides sprayed on crops travels through the air could damage a land owners crops who does not spray their crops with the pesticide. A ruling by the Minnesota Supreme Court, *Oluf Johnson V. Paynesville Farmers Union*ruled that pesticide drift does not constitute a claim for trespass.[33]

The western Australian Supreme Court however ruled the same on 3 September 2015 in the case of *Marsh v Baxter* where it dismissed claims genetically modified (GM) canola grower Michael Baxter should compensate neighbour Mr. Marsh after canola swapes were suspected to have blown up over the fence in 2010.[34] Marsh sought $85,000 in damages, but was ordered to pay a whopping $804,000. Western Australia (WA) maintains a moratorium (a temporary prohibition of an activity) on the growing of genetically modified crops since 2003. A general exemption for growing GM Canola in WA was issued in 2010. The GM canola seed allegedly contaminated Mr. Marsh's certified organic mixed farm. It resulted in Mr. Marsh losing his organic certification due to GM contamination. He sued for damages.[35] Remedies of the law can be challenging and expensive, the case offers more insight on the topic of genetic trespass and causing immediate unwanted harm to the owner. The doctrine of mutual co-existence between GM crops and organic crops was defeated in the above case. Such cases do not take into account the rights of the grower/farmer in the sense that cases against GMcrops fail in courts of law.

On the point of transboundary pollution, the case of Mexican maize comes to mind. In 1998, Mexico adopted a moratorium on growing maize. The reason for the moratorium was to stop transgenes from entering their maize population from United States. The moratorium remained in effect until 2004 when research from a Californian university found that transgenes were being grown in the Mexican state of Oaxaca. The commission

---

[33] Oluf Johnson v Paynesville Farmers Union Cooperative Oil co-op. *Supreme Court of Minnesota, 802 N.W.2d 383*, (2012).

[34]http://www.farmweekly.com.au/news/agriculture/cropping/general-news/gm-case-prompts-calls-for-coexistence/2742324.aspx?storypage=0 on 7 December 2017

[35]Rahmann G &Aksoy U. "GMO agriculture versus organic agriculture- genetic trespass, a case study." Organic World Congress 2014, Istanbul, 13-15 Oct. (available on eprint, ID 23960)

of Environmental cooperation (CEC) conducted a study on the effects of transgenic maize and found that transgene maize existed in the Mexican maize population and that it was impossible to completely eradicate them.[36] The moratorium stayed in place until 2004 when Mexico passed a law on biosecurity of GMO's and this led to a number of agro-industrial firms applying for licenses to grow GM maize. However in 2013, this process was halted through a class action brought in front of the Mexican courts by a group of citizens who sought out to protect the native landraces of maze in Mexico from cross-pollination by transgenic maize. This group consisted of mostly farmers and consumers of maize claiming that, transgenic maize threatened the biodiversity of traditional varieties grown by subsistence farmers and small scale farmers. The case was however dismissed due to lack of standing on the part of the plaintiffs.[37] The fight over transgenic maize in Mexico still persists until today.

4.4 Strict liability.

This arises when someone engages in an abnormally dangerous activity, the person harmed by the one who engages in the dangerous activity is liable to damages. For strict liability. Proof of negligence or recklessness is unnecessary. In *Bennet v Larsen*[38] the court held that planting of GM crops does not qualify as ' abnormally dangerous activity. The supreme court of Wisconsin USA stated that the fact that a federal regulatory system has conducted numerous tests on GMOs and approved for national use, places doubt on strict liability offense of a company.

---

[36] NAAEC is a multinational body formed as part of NAFTA, which addresses environmental concerns between Canada, the United States, and Mexico.

[37] Press Release, 'Semillas de Vida, Tribunal Federal Suspende Toda la Siembra de MaízTransgénico', available at http://www.semillasdevida.org.mx/index.php/documentos/articulos/93-boletinesde-prensa/86-articulo-2-muestra (Oct. 10, 2013), (on file with The University of the Pacific Law Review).

[38] Robert J. Bennet, and Ann, Bennet, and Raymond C v Larsen company, *Wisconsin Supreme Court, 118Wis. 2d 681,* (1984).

4.5 Patent infringement.

Figure 4. *A satirical cartoon about Monsanto's patent infringement.*

A major legal issue arising with genetic drift is patent infringement. Seed Companies issue patents on seeds genetically modified in order to protect their intellectual property interests. A landmark case in the United States delivered in the Supreme Court *Bowman v. Monsanto co.*[39] affirmed the decision by the Federal Circuit that the patent exhaustion doctrine does not permit a farmer to plant and grow, saved patented seeds without permission of owner of the patent. The case involves Bowman who purchased transgenic soybean seeds from a local grain elevator for his second crop of the season. Bowman replanted the seeds and Monsanto filed a lawsuit on patent infringement against him on the basis that Monsanto, sold their seeds to customers under a limited use license that prohibited them from purchasing their seeds and saving them for replanting for the next season, and to only purchase seeds to only grow for one season. The court held that the act of bowman replanting the seeds constituted an authorized making of the patented product.

This case acts as a basis for explaining the concept of patent exhaustion. Patents exist to enable the inventor exclude others from using, selling and offering to sell or import the patented material without the inventors consent. The doctrine exists simply as a matter of good public policy with the intention to limit the patentee's rights with respect to goods sold and to also discourage unwarranted compensation. When a patent is exhausted, the patentee no longer has the right to exclude the activities of ordinary use, resale, and

[39] Vernon Hugh Bowman v Monsanto Co. *Supreme Court of United States, 596 U.S.* (2013).

ordinary repair of the article thus once these patents expire, farmers will be free to plant and save the GM seeds without licensing from Monsanto.

In the Bowman case, Monsanto invented and patented a genetic modification called roundup ready that enables plants to survive from exposure to glysophate. Because the patent is easily replicated through replanting, Monsanto sells seeds on a limited use license called the "Monsanto Technology/stewardship Agreement". Such self-replicating technology brings out a serious problem of accidental infringers who have no idea that they are in possession of goods that are patented. The doctrine of patent exhaustion does little to protect accidental infringers of patents. As for Bowman, this does not apply because he had the intention to reuse Monsanto's seeds without compensating them. A recommending remark to solve this would be for the doctrine to establish a patent exhaustion rule focused on exploitation would be a better law in dealing with accidental infringers, while purposeful or willful infringers such as Bowman would be liable.

On case law of patentability of genetic modifications, in *Diamond v. Chakrabarty*[40] the respondent applied for a GM oil-eating bacterium but was rejected by a patent examiner. The decision was upheld on appeal on the grounds that living things are not patentable subject matter. The Supreme Court however concluded in its ruling that *"anything under the sun that is made by man', even if it is a living organism, was patentable..."* This decision meant that GMO plants can be patented and seed producers have the right to patent their genetically engineered seeds.

4.6 Labeling laws as a form of consumer protection.

Labeling forms the basis of consumer protection from GMO'S. Labeling laws enable the consumer to distinguish products which are organic from GMO's. In the USA, the state of Vermont, through the Vermont legislature passed a Bill mandating that all GMO foods be labeled by July 2016. It is the first American state to enforce labeling laws without including a trigger provision the law. The European commission has labeling rules that enable citizens to have a right to comprehensive information about the content and composition of food products, this enables the consumer to make an informed choice while

[40] Diamond v Chakrabarty, *Supreme Court of unites states, 447 U.S. 303* (1980).

buying products.[41] Consumers in cases of food have the right to honest and accurate information. Labeling also acts as a form of consumer protection. Consumers play a vital role in the economic and political society, the European policy in favor of consumers seeks to promote consumers right to information and education, and the right to organize and defend their interests.[42] Various provisions are given under the policy such as product labeling and packaging, protection of consumer's economic and legal interests, quality of goods and services etc. Regulation on the Provision of food information to consumers entered into application on 13 December 2014 and to be applied in December 2016, states that an obligation arises from the producer to provide nutrition information to consumers.[43]Countries that have adopted GMO crops have provisions for labeling in their national laws that encourage consumer education and provision of information. Currently, 64 countries around the world require labeling of genetically modified foods.[44] It should be understood that, without effective labeling laws the consumer is ignorant when it comes to choice between choosing GMO products and organic products. Labeling laws should not only be seen on paper, but also effected through enforcement. Having stated and explained the legal issues involved with GMcrops, we shall now look at the health associated risks involved with GMcrops.

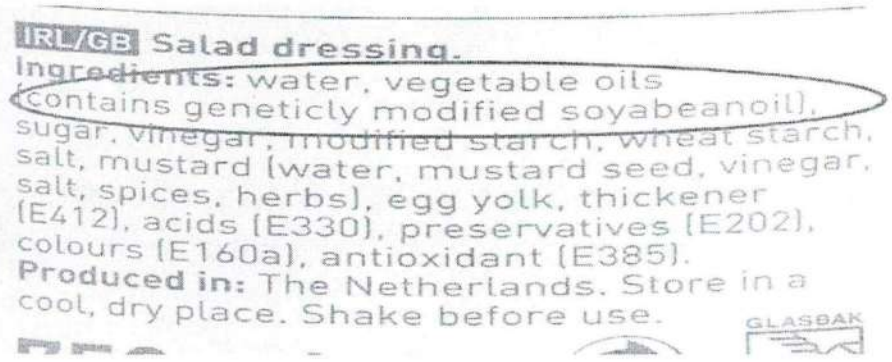


Figure 5. *Image showing labeling requirements on EU products.*

[41] https://ec.europa.eu/food/safety/labelling_nutrition_en on 14 December 2017

[42] http://eur-lex.europa.eu/summary/chapter/consumers.html on 14 December 2017

[43] http://ec.europa.eu/food/safety/labelling_nutrition/labelling_legislation_en on 17 December 2017

[44] www.Justlabelit.org. on 3 January 2017.

4.7 Health associated risks.

When we buy or consume food, we have an expectation that the food is free from any disease causing bacteria and for crops especially, the crop has been grown according to reasonable safe standards. A consumer ought to know that what they are purchasing is safe for consumption without any doubt. However, Concerns about GMOs having potential toxicity and allergen issues has risen with time. Mounting evidence shows that there is absence of peer reviewed scientific studies that have showed adverse health effects. Such studies have further gone on to show that dietary DNA has no direct toxicity itself.[45] Contrary to popular belief by the proponents of GMOs, health concerns could be a primary concern through the production of new allergens, increased toxicity, antibiotic resistance and decreased nutrition.

In the west, Food allergy affects approximately five percent of children and two percent of adults in the United States thus is a major health concern.[46] Allergic reactions occur when normally a harmless protein enters the body stimulating the immune system[47]. Such allergies may occur when the novel protein in the GM food is derived from a source that causes allergies in humans or from a source that has never been consumed as human food.

Although no allergic reactions arising from the consumption of GM food has been confirmed, counter-evidence suggests that some GM products could cause an allergic reaction.

---

[45] http://www.minnesotalawreview.org/wp-content/uploads/2013/11/Helme_MLR.pdf on 2 December 2017

[46] Bakshi A. 'potential adverse health effects of genetically modified crops' *J Toxicol Environment Health B crit Review*, (2003), 34.

[47] Jonathan A. Bernstein. 'Clinical and laboratory investigation of Allergy to Genetically Modified Foods' University of Cincinnati, Ohio, USA. (2003)

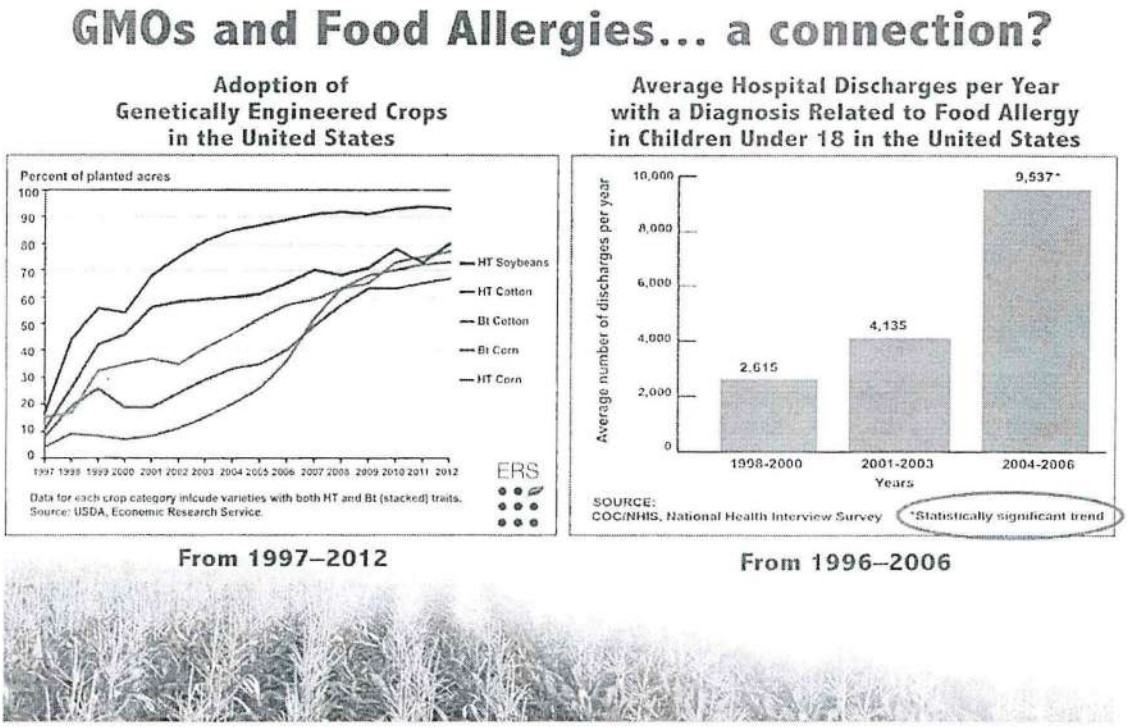


Figure 6. *A comparative chart showing a connection between increase in allergies and adoption of GMO's in USA from 1996-2012. .*

In 2012, a research team led by Gilles Eric Seralini at the University of Caen in France published a study in 'food and Toxicology' found that rats exposed to genetically modified maize were more likely to develop tumors and died earlier. Effects of GM maize were studied for 2 years using rats. This report described the first life-long rat feeding study investigating possible toxic effects arising from tolerant GM maize. Data shows that pathological symptoms were noticed. Enhanced tumor and mortality rates were further observed, disturbances to the male liver were as a result of chronic intoxication, the study showed that female rats developed mammary tumors, and were less affected in the liver due to their physiology being better adapted to estrogen metabolism. The pituitary organ got disabled and in males, liver congestion occurs. Male rats developed and presented four times more large palpable tumors than controls which occurred 600 days earlier. Up to 14 months, no animals showed any signs of tumors while 10-30% of treated females per group developed tumors. [48] Due to the serious conclusions drawn from this research the

[48] Gilles. Eric Seralini, "Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize" university of Caen, (2012), 22.

scientist came under so much criticism and the paper got retracted. The study has however, after years been republished with three expert reviews and the findings are the same as the retracted paper.

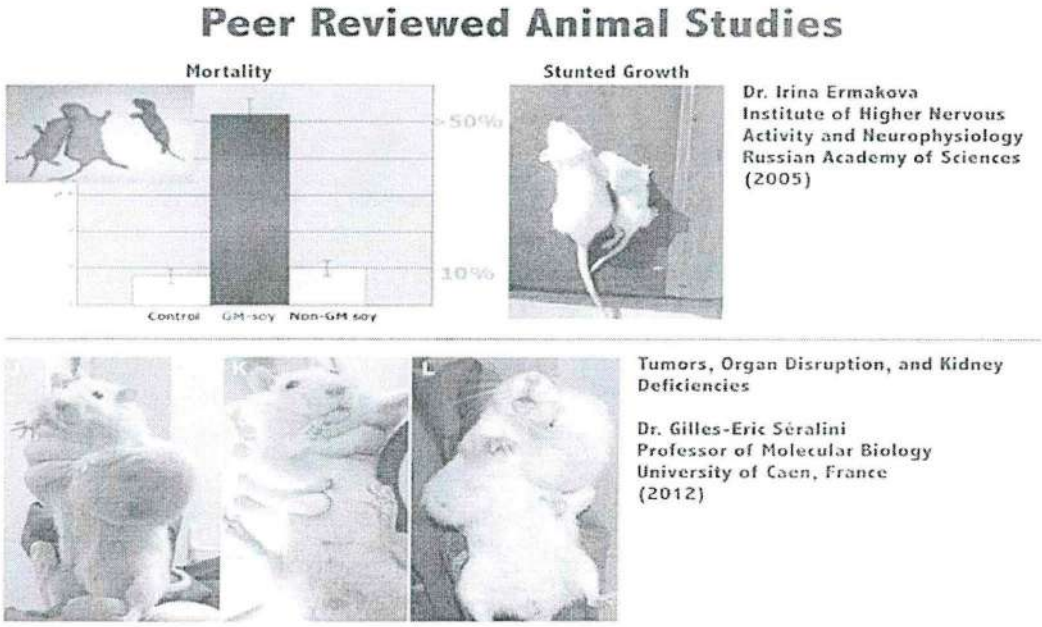


Figure 7.*Peer reviewed studies showing growth deficiencies in rats arising from consumption of GMO's.*

4.8 Increased toxicity.

Most plants produce substances that are toxic to humans, and plants that humans consume produce toxins at low levels that do not result in adverse health risks. Concerns about inserting toxins into a plant at higher levels could be dangerous to human health. Such a health risk can arise during the insertion of the gene into the plant, other genes in the plant can become damaged during this process thus causing the plant to change its production of toxins. Although such effects have not been observed in GM Plants, they have been observed through conventional breeding methods creating safety concerns. A case in point would be potatoes bred for increased disease resistance producing high levels of glycoalkaloids[49]. With that being said, GMOs being resistant to herbicides makes many farmers spray large quantities of the herbicide and research showing commercial soybean

[49] Matthews D, Jones H, Gans P, Coates S, Smith LM. "Toxic secondary metabolite production in genetically modified potatoes in response to stress." *American Chemical Society*, 2005, 35.

sold contains quantities of herbicide and roundup glyphosate which is a dangerous toxin to humans if ingested.[50]

4.9 Antibiotic resistance.

For a crops to form antibiotic resistance, bacteria develop resistance to antibiotics by creating antibiotic resistance genes by natural mutation. There is a major concern that bacteria living in the gut of humans could develop antibiotic resistance gene from GM crops before DNA becomes completely digested.[51] Scientific research is yet to be conducted proving this claim, some experts suggest in this case that antibiotic resistance genes should not be used. Over the years numerous research has been conducted and nothing threatening has been found. The studies in summary show the following[52] that the probability of a successful transfer of an antibiotic resistance gene to a bacterium is very low. Ampicilin and kanamycin, which are the most commonly used marker genes, are widespread in organisms that cause diseases. Tests done on the stools of humans of people not taking antibiotics indicates that in 60 percent of cases, more than ten percent of bacteria had resistance to one type of antibiotic. It is also important to know that whenever we consume fruits and vegetables we consume antibiotic resistant microorganisms from soil which do not have known negative side effects. It is assumed that if GM plants with antibiotic resistance genes are planted over a large area, the rare event of gene transfer to other organisms could become significant and thus if studied on a long-term could show a change in antibiotic resistance from consuming GMO's.

4.10 Decreased nutritional value.

Theoretically speaking, if you plant tobacco on your farm and later decide to plant food crops you notice a change in the growth of crops and taste too. The taste of the crops develop a bitter taste due to tobacco affecting the nutrients of the soil. With that being said, a genetically modified plant could have lower nutritional quality than its organic foods by

---

[50] http://nutritionstudies.org/gmo-dangers-facts-you-need-to-know/ on 16 October 2017

[51] http://enhs.umn.edu/current/5103/gm/harmful.html on 3 October 2017

[52] http://www.gmo-compass.org/eng/safety/human_health/46.antibiotic_resistance_genes_threat.html on 30 October 2017

making nutrients unavailable or indigestible to humans. Glufosinate which is a herbicide used to control weeds is sprayed on crops but degradation is blocked by the transgene that modifies it slightly. When glufosinate resistant GMO maize or canola is consumed, weeks or months later, the herbicide becomes slightly modified and chances are the herbicide still exists,[53] and thus could potentially cause harmful health effects in the long-term.

This chapter has discussed the major legal and other related concerns that the consumer ought to know about GMcrops. We have witnessed how the courts from different jurisdictions deal with matters related to GMO's and they all uniquely have ruled in favor of GMO's. Vital issues that affect the consumer such as health have been watered down to merely speculation. Countries implementing GMcrops have generally made a tradeoff by choosing to realize developmental goals at the expense of health and awareness of the consumer. For consumer awareness and protection to be achieved in Kenya, the relevant biosafety authorities ought to conduct independent research to assess whether the above concerns hold any water before proceeding to adopt GMcrops into the market.

[53] Droge W, Boer I, and Puhler A. "Transgenic plants containing the phosphinothricin-N-acetyltransferase gene metabolize the herbicide L-phosphinothricin (glufosinate) differently from untransformed plants" *Bielefeld university journal*, 187(1), (1992), 142-151.

5.1 Chapter 5. Analysis and review of current legislation of GM crops in Kenya with regards to consumer safety and awareness.

This chapter deals with current legislation in Kenya that tackles issues to do with consumer protection and genetically modified organisms. In Kenya, we are blessed to have a Consumer Protection Act which is responsible for setting and enforcing consumer standards. This Act is further backed by Article 46 *Constitution of Kenya* which is on consumer protection. We also have a Biosafety Act in place that deals with formulation of policy on genetically modified crops. It is these two Acts of parliament that we shall use to assess whether consumer protection and awareness is being achieved as envisaged under our constitution. Chapter five will focus on emerging trends, legislation, and consumer awareness and protection.

5.2 Scope of the consumer protection Act with regards to consumer awareness and health on GMcrops.

The CPA Kenya was created to provide protection for the consumer, and prevent unfair trade practices in consumer transactions. The *Act* covers many goods in the market but our concern is only with goods that are consumables i.e. food. A consumer is defined under section 2 *CPA 2012* to mean a person whom particular goods or services are marketed in the ordinary course of the supplier's business, any person who has entered into a transaction with a supplier in the ordinary course of the supplier's business, unless such transaction is exempt from the *Act*, any user of particular goods or a recipient or beneficiary of particular services, irrespective of whether that user, beneficiary was a party to a transaction concerning the supply of those particular goods and services, and finally a franchise in terms of a franchise agreement which applicable in terms of the Act. The *CPA 2012* also defines Consumer Agreements to mean any agreement between a supplier and a consumer in which the supplier agrees to supply goods or services for payment.

Kenya is still in its early stages with regards to policy on genetically modified foods as earlier mentioned. The CPA 2012 provides for liability of businesses that sell sub-standard goods to consumers and places a requirement that regulators involve consumers when making decisions about services and products. The Act requires suppliers to comply with

consumer agreements and that goods supplied are of merchantable quality. This applies to goods being of standard quality.[54]

Class proceedings are also provided for under the section 4 *CPA* which states that a consumer can commence class proceedings on behalf of a dispute arising out of a consumer agreement despite any term in the consumer agreement that purports to prevent the class proceeding from happening. If this section is to be interpreted correctly, an unfair term would be a term like issuing limited resale and growth licenses by seed companies to unsuspecting farmers, the farmers can thus bring a class action suit under the Act. Other provisions under the Act concerning consumer rights and awareness includes estimates, a consumer is not to be charged above the discussed price and if the consumer agreement has provisions for estimates, the supplier is not supposed to charge the consumer more than ten percent of the estimate.[55]

When dealing with genetically modified crops, it is safe to say that honest representation of the goods in question is vital to enable the consumer make an informed choice. Section 12 *CPA* in this case does not limit the generality of what constitutes false presentation. A key note on this goods a false presentation would occur where goods or services are of a particular standard, quality, style, grade or model where they are not, and also a false representation that the person who is to supply the goods or services has sponsorship, approval, performance characteristics, benefits or qualities that they do not have.[56] This would mean that GMcrops if sold, should they fail to satisfy conditions that were stated and presented by GMseed companies or agents, it would constitute false representation e.g. Bt maize sold to farmers under the guise of increased yields and increased profits and this turns out not to be true, it would amount to false representation on the part of the supplier and thus would be liable. The Act under section 13 *CPA* provides for unconscionable representation which constitutes an unfair practice under the Act. Such a representation would occur when the principal ought to know that the consumer is unable to protect their interests under the agreement due to ignorance, disability, illiteracy or inability to

[54] Section 5, *Consumer Protection Act* (Act no. 46 0f 2012)

[55] Section 6, *Consumer Protection Act* (Act no.46 of 2012)

[56] Section 12,*Consumer protection Act* (Act no.46 of 2012)

understand the language of the agreement or similar factors, the consumer transaction is excessively one sided in favour of some party other than the consumer. With regards to GMcrops, most Kenyan farmers are illiterate and therefore it would be difficult for them to make an informed choice due to various factors such as need for money, inability to fully understand terms of a GMagreement and consequences that arise thereto. The onus would lie with the GMseed Company to make them fully understand the terms of the consumer agreement before moving forward.

Transparency is required for the consumer to make an informed choice of whether or not to purchase the product in question. The Act establishes the Kenya Consumers protection Advisory committee (CPAC).[57] The committee is tasked with the promotion of participation in consumer education programmes, the dissemination of consumer issues with a view to proposing corrective measures, providing advice to consumers on their rights and responsibilities under appropriate laws, and also making available information affecting the interest of consumers.[58]CPAC is charged with the mandate to ensure that consumer rights in all aspects of law are protected. The committee could therefore work in tandem with the Biosafety Authority to ensure that consumer awareness is achieved with regards to genetically modified organisms since everyone in one way or the other is a consumer, information ought to be gathered on GMcrops by the Biosafety Authority and shared with CPAC in order to ensure that all legal channels concerning information dispersion have been covered.

To solidify this point of mutual cooperation, under section 94 *CPA* 2012, it states that there shall be consumer representation on all regulatory bodies and appointing bodies are to have due regard to accredited consumer organizations and the advisory committee in making such appointments. The Bio-safety Authority in this case would fall under this category as a regulatory body of GMOs. The consumer Protection is does not however provide for issues to do with patented products, which is an issue greatly affecting GMOs. Health concerns are also not provided for in the Act and yet a consumer has a right to know about goods affecting their health. More policies under the consumer advisory committee need to

[57] Section 89,*Consumer protection Act* (Act no.46 of 2012)

[58] Section 90, *Consumer Protection Act* (Act no.46 of 2012)

formulated and implemented under the current consumer protection Act in order to include all matters information wise that are relevant to the consumer.

5.3 Scope of the Bio-safety Act.

Regulation of genetically modified organisms is governed by the Biosafety Act, the Biosafety Act in its mandate is tasked with facilitating transparent, science-based and predictable processes for making decisions on the handling, use and transfer of genetically modified organisms, ensuring protection for the safe transfer of genetically modified organisms that may have an effect on health and environment, and to facilitate research and minimize the risks that may be posed by GMOs.[59] Under section 2 *of the Biosafety Act*, *Biosafety* is defined as the avoidance of risk to human health and safety, and the conservation of the environment as a result from the use of genetically modified organisms. *Section 3* of the Act limits scope of the act by stating that *"The act does not apply to GMOs that are pharmaceuticals for human use"*. The Bio-safety authority is established under section 5 *of the Biosafety Act*, and the objects of the authority are to;

Exercise general supervision and control over the transfer, handling and use of GMOs with a view to ensuring the safety of animal and human health, and provision of adequate level of protection to the environment, promoting awareness and education among the general public in matters relating to Biosafety. The authority is further tasked with the establishment of a Bio-clearing house through which information concerning GMOs is made available to the general public, (consumers). The authority also has the mandate to co-ordinate research, surveys, collection and dissemination of information about research findings in matters relating to GMOs [60]

If a person wishes to engage in GMO's, section 18-19 *of the Biosafety Act* provides for a written approval is needed by the authority if a person to conduct activities involving GMOs in the country, placing on the market GMOs, and also a person wishing to import into Kenya genetically modified organisms has to obtain written approval of the Authority. As we very well know by now, information regarding GMO's is important and the

---

[59] Section 4, *Biosafety Act*, (Act no. 2 of 2009)

[60] Section 7(1), & 7(2),*Biosafety Act* (Act no.2 of 2009)

Biosafety Act advocates for transparency of information, and failure to fully disclose information that could change the evaluation of risks posed by GMOs would be committing an offence under the Act. The offence attracts a penalty of two million shillings, or imprisonment for a term not exceeding ten years or both.[61]

Public awareness and education shall be promoted by the authority concerning biosafety matters. So far, in September 2016, the authority approved environmental release of Bt cotton for purposes of conducting National performance trials. If GM cotton variety is released, the biosafety authority and other government agencies monitor the cotton for a period of 20 years to assess whether there are any post release adverse effects. An application submitted by the Kenya Agricultural Research Organization (KALRO) and African Agricultural Technology Foundation (AATF) in June 2015 seeking environmental release, cultivation and placing on the market of Bt maize was granted conditional approval by the authority. The approval is not for cultivation, importation or placing on the market Bt maize. Currently, National performance trials (NPTs) are being conducted on the crop. The information concerning national field trials was published under the Kenya Gazette, but due to our ever evolving technology, it is safe to say that not many Kenyan citizens have access or read the Kenya Gazette. This is a big problem because the Biosafety Authority is not doing due diligence when it comes to informing consumers about GMO's. The authority could instead of just publishing information through the Kenya Gazette, use other channels of communication that consumers are more aware of e.g. newspaper publications, social media sites, broadcasting GMO information through the various television networks we have etc.

5.4 Labeling under the Biosafety Act.

Subsidiary Legislation under the Biosafety Act includes *The Biosafety (Labelling regulations,2012)* is contained in the Act, the objective of such regulations is to ensure that consumers are made aware of food that is genetically modified so as to enable them make an informed choice, and to facilitate traceability of genetically modified products for

[61]Section 34, *Biosafety Act* (Act no.2 of 2009)

purposes of risk management.[62] Labelling requirements include but are not limited to products containing, consisting of genetically modified organisms or food or feed containing GMOs placed on the market in accordance with the Act.[63]

Exemptions under section 5 *of the Biosafety regulations* further states that labelling requirements shall not apply to food, feed containing GMOs in proportions of less than 1% of the total weight, highly refined food, also where the effect of refining process is to remove novel DNA, and food intended for consumption and sold from food premises e.g. restaurants, hotels and vendors. Kenya has developed labeling regulations through the *Kenya Bureau of standards (KEBS)* so as to enable consumers choose between *GMOS and organically grown foods. Code KS 2224 on labeling,* was recently revised to align it with the *Biosafety Act* and also a standard of surveillance. The challenge however comes in enforcement of the labelling standard. [64]

Under section 7 *Biosafety(labeling) regulations 2012*, when labelling products consisting of GMOs, operators are to ensure that for pre-packaged products the words *'genetically modified'* in the name of ingredient or food should appear on the label, and for non-pre-packaged products the words 'genetically modified organisms' or genetically modified (name of organism)' shall appear on the label.Currently, there are various products both pre-packaged and non-pre-packaged in the Kenyan market that do contain GMO's but do not state that their products contain any genetic altered/modified material, and this works to the detriment of the consumer due to lack of knowledge to enforce such measures. Further, additional labelling requirements are also provided for cases where food produced using biotechnology contains a knew factor that is known to cause allergic reactions in particular sections of the population, the level of anti-nutritional factors or natural toxicants are significantly different in comparison to existing conventional foods, seeds or ingredients used to produce GMOs and the gene modification raises cultural, ethical and religious concern regarding the origin of the genetic material used in the genetic modification e.g. if let's say packaged beef sausages containing some genetic material of

---

[62] Section 3, *Biosafety (Labelling) Regulations, 2012* (Act no.2 of 2009)

[63] Section 4, *Biosafety (Labelling) Regulations, 2012* (Act no.2 of 2009)

[64] www.ip-watch.org. on 27 May 2017

pork would raise a religious and ethical issue and thus should be clearly labeled on the product . Such information should be stated clearly labeled on the product for the consumer to see in order for them to make an informed choice.

Section 8 of the Biosafety regulations requires for genetically modified organisms to be labelled in a manner that is not misleading or deceptive or likely to create a wrong impression regarding the composition in any way, and that clear printed statements indicating a product is GMO Free are to be placed on products that claim to be Gm free. This is to be supported by approved after valid tests have been conducted and proper documentation of handling practices[65]. So far, the above labeling regulations are still yet to be enforced by the Biosafety Authority thus consumer awareness is still void. *Section 12* of Biosafety regulations states that, a person who contravenes the provisions of the regulations set forth above commits an offence and is liable on conviction, a fine not exceeding twenty million shillings or to imprisonment for a term not exceeding ten years, or both.

5.5 Labeling regulations under the Standards Act Cap 496 laws of Kenya.

Section 3 of the *Standards Act* establishes the Kenya Bureau of Standards and its functions are to promote standardization, to undertake or encourage educational work in line with standardization, among other functions.[66]*Code KS 2225:2009*was drafted under the standards Act to address the standardization of GMO's in Kenya. Labeling requirements under the regulation state that labeling of feed, food or ingredients containing genetically modified organisms or products derived from genetically modified organisms shall be considered after they have undergone appropriate food safety assessment in accordance with the standards Act, where food, feed or ingredient containing or derived from genetically modified organisms is displayed for sale, labelling shall include the statement *"genetically modified"*. Labelling information shall indicate a change in composition, nutritional value, intended use, and any other characteristics or properties which the food, feed, or ingredient derived from genetically modified organism differs from the conventional counterpart, Where a food or feed consists of a single ingredient or where

[65] Section 8, *Biosafety (Labelling) Regulations, 2012* (Act no.2 of 2009)

[66] Section 3, 4, *Standards Act Kenya*, (Act no. 496 of 2012)

there is no list of ingredients; the words "genetically modified" or "produced from genetically modified (name of the ingredient or organism) shall be in the labelling information e.g. "maize flour produced from GM maize". The regulation further prohibits claims which cannot be substantiated and also claims which could give rise to doubt about the safety of similar food or which could arouse or exploit fear in the consumer.[67]

5.6. Interview with the CEO of biosafety with regards to consumer protection on GMcrops.

On 29th January 2017 I had the opportunity of speaking to the CEO and director of technical services of the Biosafety Authorityprofessor *Dorington Ogoyi*, concerning matters of consumer safety. The professor explained that the core purpose of the Authority is to ensure safety with regards to GMO's in Kenya. He explained that the Authority has in place regulations torestrict import, export and transit of GMO's. For such products, prior approval is required from the authority and the destination country if the goods are in transit. This was the case before the ban on GMO's in Kenya as currently the Authority does not issue approvals for GMO's. On the issue of banning GMO's he pointed out the case of *Unilever v Aromats*[68] where the authority had to confiscate their products due to the current ban on GMO's in Kenya. Consumer safety is achieved by the Authority through various ways such as surveillance activities where agents are stationed at various border points and airports to check and test products that are coming into the country suspected to be GMO's. The authority also conducts random sampling of products from various supermarkets and food stores to check whether the sampled products contain any trace of GMO's. On the issue of consumer awareness, the Authority conducts annual Biosafety conferences, and attends agricultural shows with an aim of educating farmers on GMO's and safety aspects related thereto. According to the professor, consumer awareness has not fully been realized but newspapers as a medium has been used to invite submissions from the public, but such submissions have not been helpful because of lack of information by the consumer regarding GMO's. As for farmer awareness, the Authority is not tasked with farmer safety as this duty falls under KEPHIS and KALRO respectively. The current status

[67] Kenya standard 2225:2009, "genetically modified organisms and derived products-labeling of food and feed" (KEBS 2009).

[68] http://www.cofek.co.ke/index.php/did-you-know-that/14-news/711-unilever-queries-biosafety-body-s-mandate-in-new-aromat-case-twist on 29 Jan 2018.

of GMO's in Kenya is still under experimentation. The Authority has issued approval for contained use of Maize, gypsophila and Monsanto's Bt cotton. When I asked the professor why the authority has already approved GMcrops for contained use, he responded by saying that the current ban was going to be reviewed and eventually lifted and that is why GMO experiments were granted approval by the authority.

5.7. Inefficient regulation.

The Biosafety Authority is the overall regulatory body for GMO's in Kenya. However the authority does not have an oversight body to check whether it is fulfilling its mandate in accordance with Article 46 of the constitution in ensuring that consumer information and awareness is achieved. Recommendations by Professor Kameri Mbote in her research termed *"Regulation of GMcrops and foods: Kenya Case Study,"* Takes a keen look on aspects concerning regulation of GMO's. Professor Mbote explains that although Kenya has trained a big number of regulators, however few of them remain in government due to low remuneration. Infrastructure for regulation has not been modified to accommodate GMOs. There is absence of regulatory capacity in KEPHIS to regulate GMOs, and lack of synchronization between regulatory bodies.[69]

Kenya plant inspectorate service is a government parastatal that acts as one of the enforcement bodies of the regulations and guidelines together with the National Biosafety Authority. KEPHIS is responsible for conducting National Performance trials for GMOs only after National Biosafety Authority approves testing. There is ongoing work on genetically modified plants under KEPHIS and this information is available on their website. The website shows that currently, testing GMO varieties for release is ongoing, and they are also testing seeds to ensure gene purity and also confirming that ordinary permits for non-GMO material are not used to introduce un-authorized GMO into the country.[70] The parastatal does not state the method it uses to assess health risks that arise with GMcrops and how information concerning GMO's is to be relayed to the consumer.

---

[69] Patricia Kameri-Mbote. "Regulation of GMO Crops and Foods: Kenya Case Study." Associate Professor of Law, Faculty of Law, UON (2005).

[70] http://www.kephis.org/index.php/biosafety on 7 January 2017.

The biosafety authority does not discuss legal issues arising from genetically modified products such as, issues regarding patenting, gene trespass, strict liability offences related to GMcrops and health risks involved. For example, what would happen if a farmer replanted crops from GMseed purchased for one season ignorant of the consequences that would befall them? Provision of information and education to consumers is still insufficient because not many farmers, food buyer's etc., really know the great but diverse implications that come with adoption of GMOs in the country.

Conclusion and recommendations.

This chapter presents a summary of the key findings and discussions. The study had the objective of assessing consumer protection with regards to legislation, emerging trends and also the tradeoff between economic impacts of GMcrops and health of a consumer.

Following the research findings and discussions in the preceding chapters; this study thus concludes that;

GMcrops have a big impact not only on the economy, but also the citizens of the nation. Health is a vital and insatiable good to man and any threat to it should be severely checked and assessed by the relevant bodies tasked with ensuring that no health risks are posed by any goods or services. Daunting evidence of the risks posed by the long-term effects of GMcrops if ignored, could pose a major health risk to the consumer and thus the consumer Protection Act and the National Biosafety Authority should formulate policies that are positively geared towards addressing the health risks posed by GMcrops, and also have a strict policy towards implementation of these health policy guidelines. Regulatory bodies tasked with regulation and enforcement of GMcrops should broaden their scope to include clear guidelines of how to address information dispersion to consumers since current methods are proving to be ineffective. The Consumer Protection Advisory Committee and the National Biosafety Authority both being independent statutory bodies, can coordinate in research, share information where consumer safety and awareness is concerned. As a consumer, information is a good in itself because it is the main determinant of choice of whether to choose one good over another. With this simple concept in mind, the consumer has the right to fair and honest representation of the goods of which they intend to purchase and thus, the National Biosafety Authority should strictly enforce labeling regulations under the Biosafety Act so as to satisfy the reasonable standard of consumer awareness with regards to GMcrops. A progressive approach towards consumer safety and awareness should be adopted and this can be done by; organizing free educational seminars and community workshops on GMcrops of which consumers are encouraged to attend, taking the consumer into perspective by incorporating various consumer ideas and concerns into policy, and holding consultations with various independent consumer groups and organizations in order to achieve a consumer based approach when it comes to dealing with GMcrops. More research needs to be done so as to assess the health risks posed by

GMcrops and the research should be done by an impartial or independent body or organization and its findings and recommendations should be forwarded to the National Biosafety Authority for assessment and consideration. Consumer safety and awareness is a priority in the modern age we live in and should be taken seriously by the national regulatory bodies, because modern science has proven to be evolutionary and yet destructive. As the saying goes, *"you are what you eat"*, you therefore have a fundamental right to know *where, how*, and *what* you are consuming.

Bibliography.

1. Abbott E 2000, 'Media coverage of GMOs in the USA and UK', http://www.nysaes.cornell.edu/comm/gmo/ on 29 September 2017.
2. Firestone, D. 'Physical and chemical characteristics of oils, fats, and waxes.' 1st edition, ISBN, (2006) 87.
3. Gregory Baker, and Thomas Burnham, 'Consumer Response to Genetically Modified Foods: Market Segment Analysis and Implications for Producers and Policy Makers'. *Journal of Agricultural and Resource Economics* (2001), vol.26, 387-403.
4. Bagi, F.S. 'A logit model of an extension agent's choice to visit individual farms'. *Canadian Journal of Agricultural Economics*, (1984), 125-14.
5. Hugar, L.B. and Patil, B.V. 'Research Report on Techno economic Impact of Bt Cotton Technology in Karnataka State' (Unpublished), University of Agricultural Sciences, Dharwad, (2007).
6. Hammond BK, Campbell C, Pilcher T, A. Pietri, G Piva, 'A review on comparative data concerning fusarium mycotoxins in Bt maize and non-Bt isogenic maize.' *Mycotoxin International Research Journal*, (2010), 141-145.
7. Hopp E. 'case study of a real biotech solution: Argentina: a "soybean republic" or a bet to future?' Agricultural biotechnology International Conference, (2004), cologne, Germany.
8. Calestous Juma, "Leap- frogging in African Agriculture: The case of genetically modified crops". Harvard Kennedy School, (2014).
9. Rahmann G &Aksoy U. "GMO agriculture versus organic agriculture- genetic trespass, a case study." Organic World Congress 2014, Istanbul, 13-15 Oct. (available on eprint, ID 23960).
10. Gilles. Eric Seralini, "Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize" university of Caen, (2012), 22.
11. Matthews D, Jones H, Gans P, Coates S, Smith I.M. "Toxic secondary metabolite production in genetically modified potatoes in response to stress." *American Chemical Society*, 2005, 35.

12. Droge W, Boer I, and Puhler A. "Transgenic plants containing the phosphinothricin-N-acetyltransferase gene metabolize the herbicide L-phosphinothricin (glufosinate) differently from untransformed plants" *Bielefeld university journal*, 187(1), (1992), 142-151.
13. Patricia Kameri-Mbote. "Regulation of GMO Crops and Foods: Kenya Case Study." Associate Professor of Law, Faculty of Law, UON (2005).
14. Losey JE, JJ Obrycki, RA Hufbauer, 'Biosafety considerations for transgenic insecticidal plants: non-target herbivores, detritivores and pollinators.' Encyclopedia of plant and science, (2004).
15. 'Scenarios for co-existence of GM, conventional and organic crops in UK agriculture.' Joint research Centre, (2002), www.jrc.cec.eu.int/GECrops/ on December 7 2017.
16. Hillary P, 'Drift of Patented Genetically Engineered Crops: Rethinking liability theories' *Texas law review* (2003), 4.
17. Press Release, 'Semillas de Vida, Tribunal Federal Suspende Toda la Siembra de MaízTransgénico',http://www.semillasdevida.org.mx/index.php/documentos/articulos/93-boletinesde-prensa/86-articulo-2-muestra (Oct. 10, 2013), (on file with The University of the Pacific Law Review).
18. Bakshi A. 'potential adverse health effects of genetically modified crops' *J Toxicol Environment Health B crit Review*, (2003), 34.
19. Jonathan A. Bernstein. 'Clinical and laboratory investigation of Allergy to Genetically Modified Foods' University of Cincinnati, Ohio, USA. (2003).