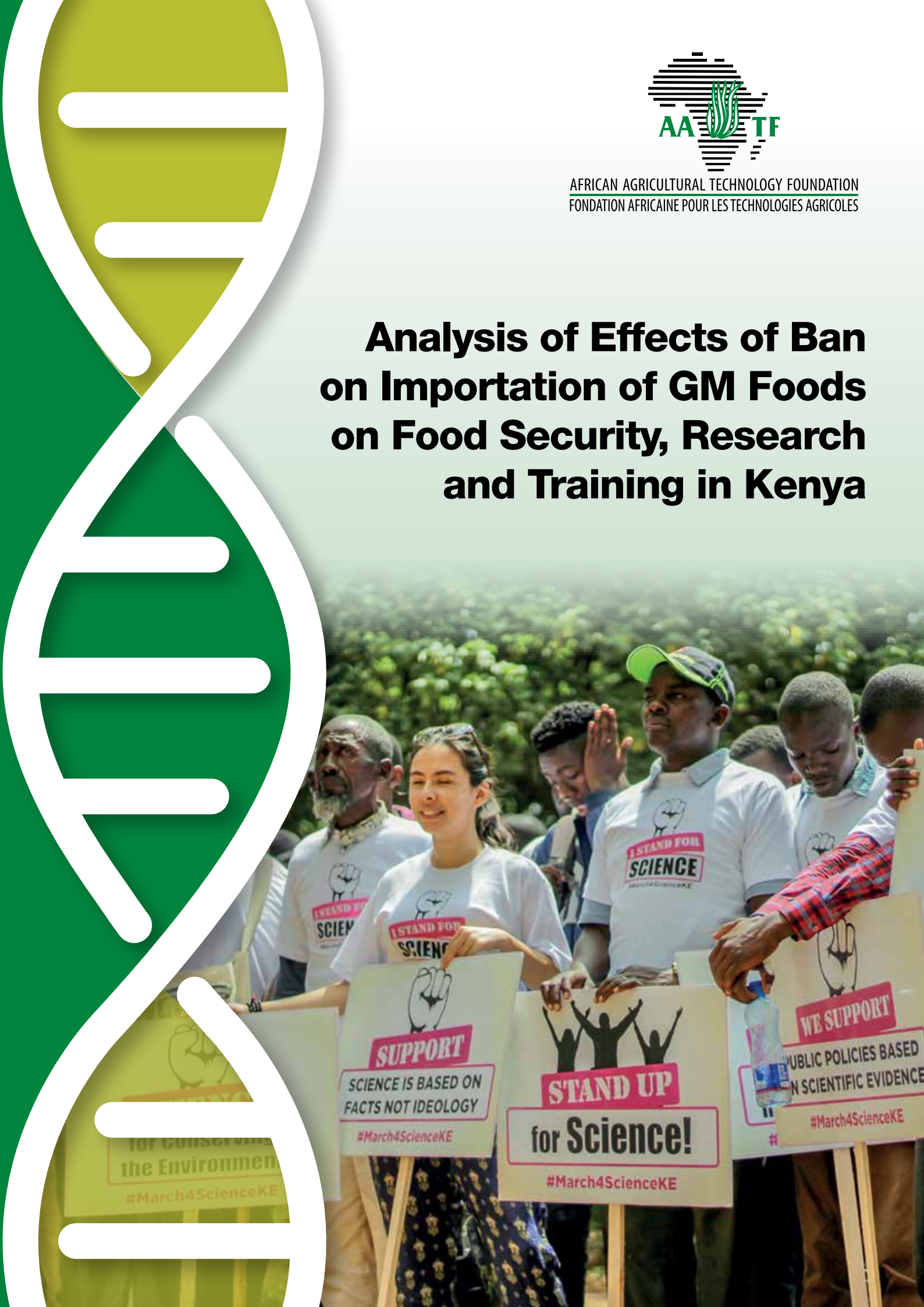
AFRICAN AGRICULTURAL TECHNOLOGY FOUNDATION
FONDATION AFRICAINE POUR LES TECHNOLOGIES AGRICOLES

Analysis of Effects of Ban on Importation of GM Foods on Food Security, Research and Training in Kenya



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Executive Summary

Despite Kenya posting one of the highest levels of food and nutritional insecurity, the Government of Kenya banned importation and consumption of foods derived from genetic engineering (GM foods) in October 2012, on the basis that there was insufficient evidence to show that GM foods were safe. The African Agricultural Technology Foundation (AATF) commissioned the Kenya University Biotechnology Consortium (KUBICO) to conduct a study to determine the impact of the four-year-old ban on food security, research and training, and to identify opportunities for investment in biotechnology and agribusiness in Kenya. The study sought to determine whether the ban had any role in the escalating food prices and reduced enthusiasm among students training in biotechnology, and development partners funding such projects. The study, combining desk review with interviews and a survey, focused on 13 large scale millers that command 90% of Kenya's milling volume, 10 small scale millers, five major manufacturers likely to use GM grain, two regulators, and six public biotechnology training and research institutions. Analyses of desk review, secondary data, and questionnaires/interviews indicated that the ban on GM foods imposed in 2012 has heightened food prices, affected food distribution mechanisms and threatened the country's current and future food security. Results showed that the ban, initially intended for importation and consumption, has now terminated progress in agriculture and food security research, causing many biotech research and development projects to stall. It was clear from the study that the ban lacked scientific and legal merit, essentially precipitated by an erroneous publication that has since been retracted. The study identified several opportunities for investment in biotechnology and agribusiness in Kenya, a country where food deficits are frequent, and where local millers and manufacturers are willing to use GM grains. The study recommends that the ban on GM foods be lifted, and millers be allowed to freely source for cheaper grains, to lower food prices and maintain food safety and product quality standards. Further, harmonisation of GM policy across the East African Community is recommended to enhance cross border trade in cereals, especially maize.

Chapter 1: **General Introduction**

Background

Kenya remains food insecure with frequent imports and food aid dependency, despite agriculture being its main economic activity. Although Kenya committed at least 10% of the national budget in 2003 to achieve a 6% growth rate in the agriculture sector, food sufficiency for the country has remained elusive. In recent years, the country has posted one of the highest levels of food and nutritional insecurity, poverty and environmental degradation (NEPAD, 2011; World Bank, 2011). Food shortages mainly result from lower production, postharvest losses, suboptimal agricultural and food trade policies, and distribution mechanisms (EAC Food Security Action Plan, 2011). This is aggravated by high food prices, food safety concerns, low nutrition, and overreliance on one staple food crop. The main staple for Kenya is maize, grown by over 90% of Kenya's 3.5 million small-scale farmers. However, the annual maize production falls below consumption, leading to imports from Tanzania and Uganda. Frequently, maize import from Tanzania and Uganda alone does not meet domestic consumption needs. In 2008–2009, for example, the two neighbouring countries were unable to supply enough to meet the deficit, forcing Kenya to turn to the larger international market with imports from South Africa, Malawi, the United States, Brazil, and Argentina.

Problem and justification of the study

In 2012, the government banned importation of genetically modified (GM) foods following publication by a team of scientists in France, claiming that rats developed tumors when fed on either Roundup-ready or Roundup-tolerant genetically modified (GM) maize. With frequent crop failures, and a steadily rising population, Kenya's food production currently falls below its domestic need. This deficit necessitates frequent imports to supplement local production. With declining regional and worldwide sources of non-GM grains, the ban restricts the sources of grain imports for the manufacturing and milling sector. The grain available in the country, and also from Tanzania and Uganda, especially maize, is often of low quality, contaminated with high levels of aflatoxins mainly due to improper drying and storage. In order to maintain safety standards, millers previously (before the ban) relied on high quality grain from countries that predominantly grow GM. Because maize from these countries is often cheaper in the international market, importation would make consumer prices lower. GM foods are one of the key products of biotechnology hence a ban on these products makes Kenya an unattractive destination for investment in biotechnology. This has led to a drop in funding for biotechnology research and product development and low enthusiasm among students pursuing training in biotechnology.

As food security in the country worsens, several approaches have been proposed, such as bringing more land under irrigation, fertiliser subsidies, and expansion of food reservoirs. However, the effect of the four-year-old ban on GM foods, which ultimately impacts on

food availability and consumer prices, has not been evaluated. This survey analysed how the ban on GM foods impacts the milling and manufacturing sectors, biotechnology research and training, and highlighted opportunities for investment in biotechnology and agribusiness in Kenya. Data from this survey will be a valuable tool for decision making in government, and for priority resetting by investment partners in Kenya's economic recovery pathway.

Research questions

(i) Is the ban on importation of GM products responsible for high food prices?
(ii) How many people lost their jobs in the milling and manufacturing sector following the ban on GM foods?
(iii) Are students shying away from biotechnology courses after the ban was imposed on GM products?
(iv) What opportunities exist for investment in biotechnology and agribusiness in Kenya?

Study objective

The objective of this study was to determine how the ban on GM foods affects food security, research and training, and to identify opportunities for investment in biotechnology and agribusiness in Kenya.

Chapter 2: **Desk Review**

Introduction

This chapter covers the review of literature to establish whether the ban on importation of GM products has any impact on the rising food prices in Kenya. The desk review also sought to identify opportunities for investment in biotechnology and agribusiness. The chapter outlines the methodology used, results obtained, and their interpretation.

Review Methods

The desk review was conducted through government records, institutional reports, databases, peer reviewed journals and books, online searches, and reports in print media. The review focused on: national grain production and consumption data; predictions of production-consumption nexus to 2050; grain food imports; global grain price comparisons (GM with non-GM; local with imported grains), and the ban on GM food importation.

Review Results and Discussion

National grain production and consumption

Kenya produces 2.8 million metric tonnes annually

Maize is the main staple food in Kenya for a large proportion of the population in both urban and rural areas. Kenya's corn production remains constrained by underlying factors such as soil acidification due to continuous multi-year use of Diamonium Phosphate (DAP) fertiliser, lack of access to improved seeds, and the impact of maize lethal necrosis disease (MLND). According to statistics from US Department of Agriculture, Foreign Agricultural Service (USDA-FAS), maize production levels oscillated between 2.5 and 3.5 million tonnes between 2006 and 2013. In fact, Kariuki (2015) gives an annual estimate of 2.8 million tonnes and provides a forecast under different improvement scenarios to 2030 (Table 1).

Table 1. Estimated national maize consumption and three production scenarios, in million metric tonnes (MMT), 2014-2030 (Kariuki, 2015)

Year	Consumption (MMT)	Status quo: prod constant (MMT)	Optimistic scenario: 50% increase (MMT)	Scenario: Prod increase 125% (MMT)
2014	4.0	2.8	2.8	2.8
2015	4.1	2.8	2.9	3.1
2016	4.2	2.8	3.0	3.3
2017	4.4	2.8	3.1	3.6
2018	4.5	2.8	3.2	3.9
2019	4.6	2.8	3.3	4.1
2020	4.7	2.8	3.3	4.4
2021	4.9	2.8	3.4	4.6
2022	5.0	2.8	3.5	4.9
2023	5.2	2.8	3.6	5.2
2024	5.3	2.8	3.7	5.4
2025	5.4	2.8	3.8	5.7
2026	5.6	2.8	3.9	6.0
2027	5.8	2.8	3.9	6.2
2028	5.9	2.8	4.0	6.5
2029	6.1	2.8	4.1	6.7
2030	6.3	2.8	4.2	7.0

Annual consumption stands at 4 million metric tonnes

The most consumed grain in Kenya is maize (71%), followed by wheat (21%), then rice (8%) according to FAOSTAT (2012). **Maize consumption in Kenya is estimated at 100 kilogrammes per person per year, which translates to approximately 35 million bags (about 4 million metric tonnes) per year. It is therefore evident that production at 2.8 million metric tonnes cannot sustain current demand of 4 million metric tonnes** (Table 1). Assuming a constant per-person consumption rate and steady population growth, it is estimated that maize consumption will increase from the current 4.1 million metric tonnes to 8.6 million metric tonnes by 2050. Maize is the most popular and staple cereal in Kenya, Tanzania, and the Democratic Republic of Congo (DRC). It is gaining popularity even in countries where other substitutes have historically predominated the diets such as Ethiopia, Uganda, Rwanda and Burundi. This suggests that regional demand will continue to outstrip supply, thus putting a strong upward pressure on consumer prices.

Maize deficit predicted to worsen in coming years

Kenya currently faces an annual deficit of 1.2 million metric tonnes. Without aggressive change in the agriculture sector, as Kenya's population and the demand for maize increase, the deficit in maize production is projected to grow each year (Gichuhi and Odwe, 2015; Figure 1).

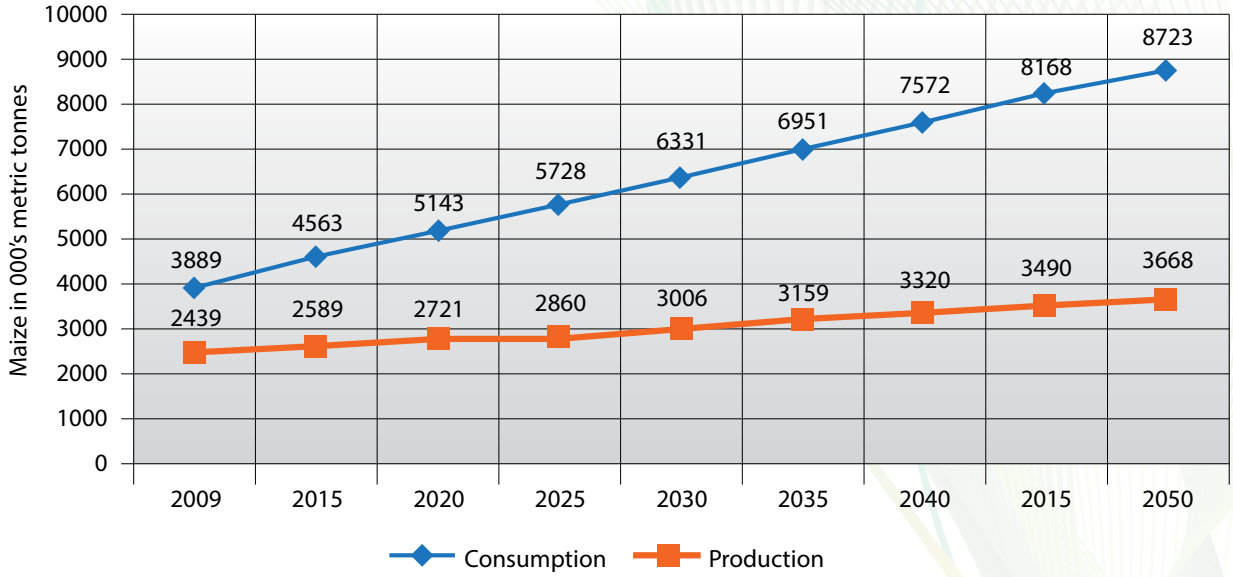
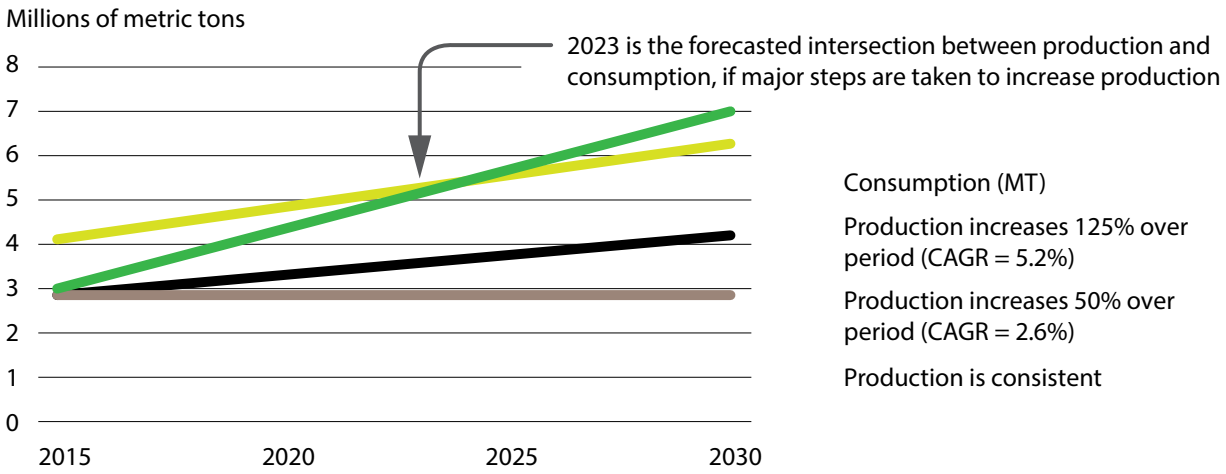


Figure 1: Projected maize production and consumption in Kenya to 2050. Source: Gichuhi and Odwe (2015). Deficit is predicted to increase every year.

The Government of Kenya (GOK) and the county governments in the maize growing areas have initiated measures to increase yields, including distribution of certified seeds and alternative fertilisers to farmers. GOK is also implementing the second pilot phase of the Galana/Kulalu irrigation project in the North Coast region, and production on a further 500,000 hectares was expected by 2016. However, recent data indicate that even if the most aggressive steps are taken and current production increased by over 100%, production can only match consumption needs for Kenya in 2023 (Kariuki, 2015; Figure 2). In fact, the slight increase in production volume over the last two decades has been attributed to more land area being cultivated, rather than improvements in yields (Kariuki, 2015).



Source: Author's comsuption based on assumptions about trends in population growth, maize production and constant per capita consumption.

Figure 2: Three maize production scenarios. Source: Kariuki (2015). It is projected that even with the best steps that increases production by 125%, production will not meet demand until after 2023.

Farm level production constraints

Conventional farming in Kenya is typically characterised by continuous tilling of land and intensive use of inputs such as insecticide regimes, irrigation and heavy fertiliser application. These practices often lead to poor soil quality and depletes agriculture's natural resource base, jeopardising current and future productivity. More than three quarters of Kenyan food is produced from conventional farming by smallholders despite serious production challenges including degradation and nutrient deficient soils, soil borne and plant pathogens and pests, unreliable rain-fed farming, high postharvest loses, poor farming skills and limited access to and utilisation of appropriate agricultural technologies. Other agricultural challenges include continued climate shifts leading to unexpected storms and floods. Under these constraints, **innovative methods of production are required to shift thousands of households to achieve higher productivity, profitability and resource use efficiency, while enhancing ecosystem sustainability**. The main food crops grown by smallholder farmers in Kenya are categorised into four major groups: cereals (maize, sorghum, millet, rice), grain legumes (beans, pigeon peas, green grams), roots and tubers (potatoes, sweet potatoes, cassava, yams, arrow roots), and horticultural crops (tomatoes, cabbages, other vegetables and fruits).

Need for change in farming systems

Kenya has one of the world's highest population growth rates, with expected population increase from the current 46.8 to 97.2 million people by 2050 (Kariuki, 2015). The population in rural areas is expected to rise by 52 percent, placing serious burdens on land, other natural resources, food supply, and employment. This population explosion is driving up food demand, particularly for maize. **The steadily increasing population, together with the declining and variable agricultural environments witnessed recently necessitates a paradigm shift in agricultural systems. Genetic engineering (GE; GMO for simplicity) has offered climate resilience and biological robustness to crops, and is a potential pathway out of poverty and malnutrition for millions of households**. Genetically modified crops (GM crops), especially cereals, are now frequently encountered in international markets and will soon be joined by those being developed within the region such as WEMA Bt maize. The insect-protected and drought-tolerant maize developed under the WEMA project is set to undergo national performance trials (NPTs), paving way for commercialisation. However, like in some parts of the world, the entry of biotech products in trade value chain in Kenya has met some challenges and occasional resistance emanating largely from a lack of information on the development, safety and regulation of the products.

Grain and food imports

Increase in food imports over the years

Food imports in Kenya have been growing rapidly. For example, in 2010, food imports accounted for 2.96 percent of Kenya's gross domestic product (GDP), at a value of US$1.2 billion for 2.5 million metric tonnes (FAOSTAT, 2012). By 2011, food imports had grown to 3.94 percent of Kenya's GDP, equaling US$1.65 billion for 3.2 million metric tonnes of

food (Figure 3). In the last one and half decades, the country has experienced years of heightened food insecurity and dependence on imports and emergency humanitarian assistance. For example, in 2009, Kenya imported 16.8 million bags of maize (GoK, 2010). Worst food deficits appear to correspond with severe droughts. Most notable droughts occurred in 1997, 2000, 2004, 2005, and 2009 (Gichuhi and Odwe, 2015). These droughts were declared a national disaster, mostly resulting into emergency food support to millions affected by famine.

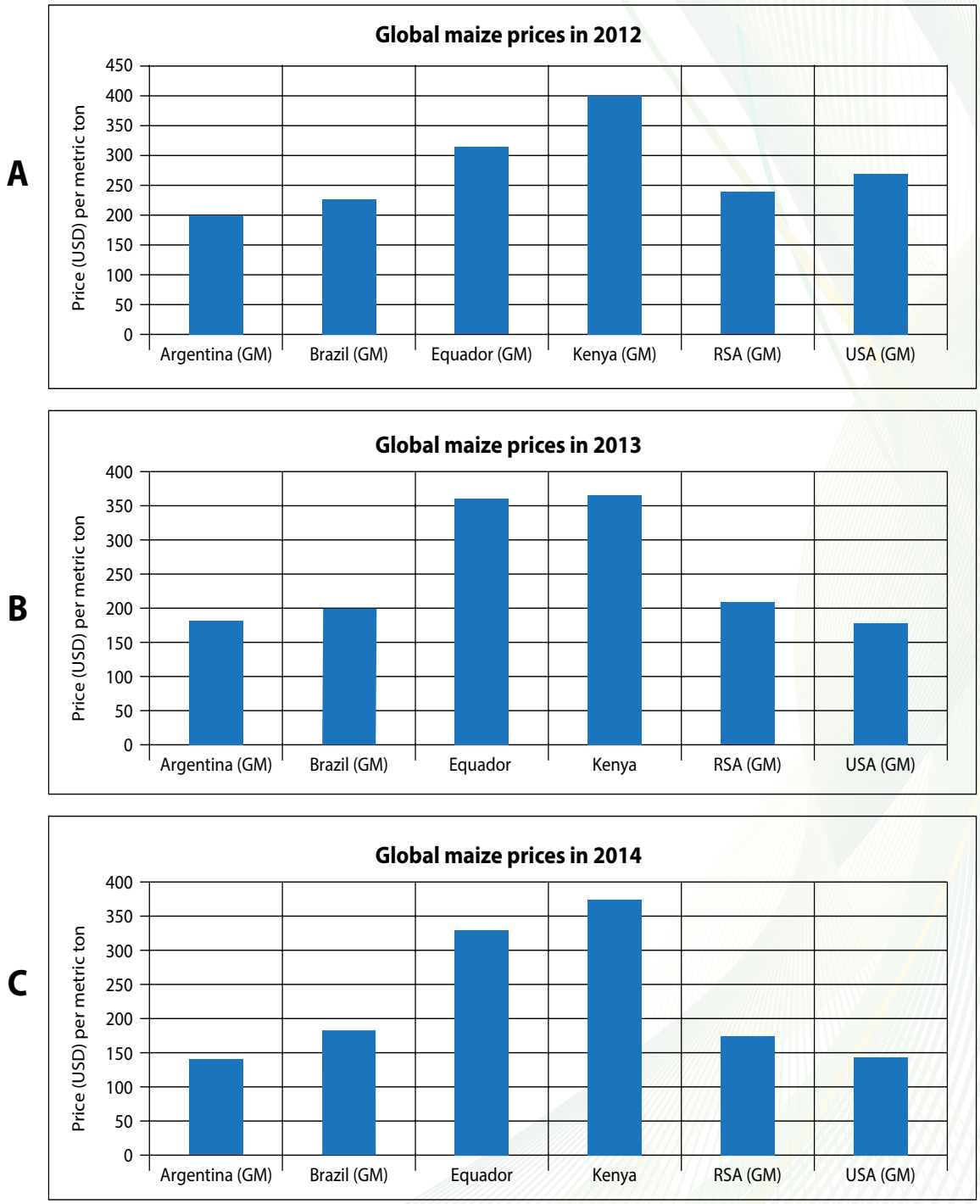


Figure 3: Volume of maize imports and exports, 1961-2012. Source: FAOSTAT (2012)

Global grain prices show GM maize to be cheaper than non-GM

This study compared global maize prices (in US dollars per metric tonne) from four countries that grow GM maize and two countries that have never grown GM maize between the years 2012 and 2014 (FAOSTAT, 2014). Comparisons showed maize to be consistently cheaper in countries that predominantly grow GM maize (Figure 4). This has been confirmed by the Kenya Cereal Millers Association (CMA), which explained that when shipment costs are factored in, GM maize is still cheaper by about 30% compared to non-GM maize (http://www.bbc.com/news/world-africa-13991466).

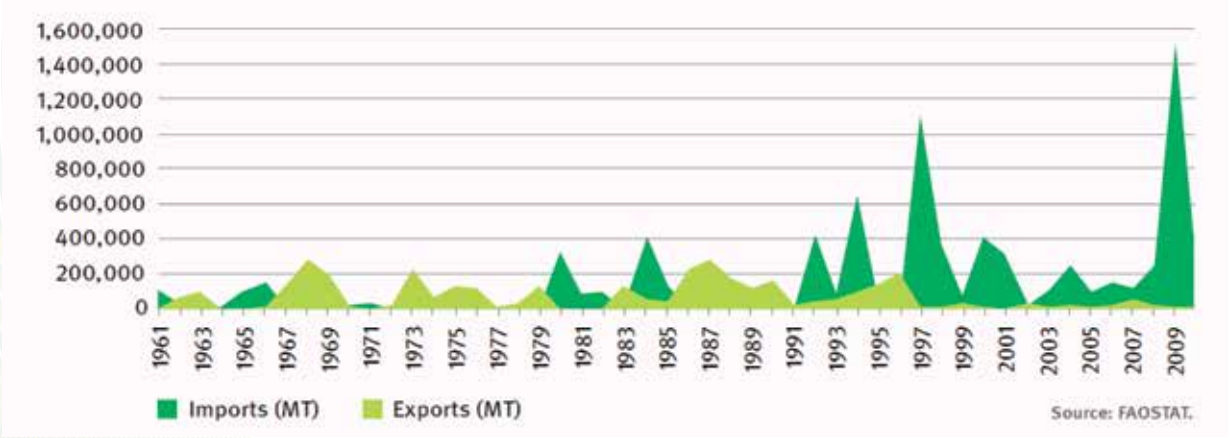


Figure 4: Global maize prices for Argentina, Brazil, Equador, Kenya, RSA, and USA between 2012 and 2014. Global prices are averaged over a 12 month period. Maize is consistently cheaper in countries that predominantly grow GM maize, and show a steady annual decline.

While prices in Kenya and Equador, which do not grow GM maize, remained relatively high, prices in countries that largely grow GM maize showed a declining trend, possibly due to increasing acreage of GM maize fields. Argentina, Brazil, RSA, and USA have tremendously increased their acreage under GM crops in the last few years. For example, adoption of GM maize in Argentina was 65% in 2012, rising to 70% in 2013 and 74% in 2014 (Figure 5).

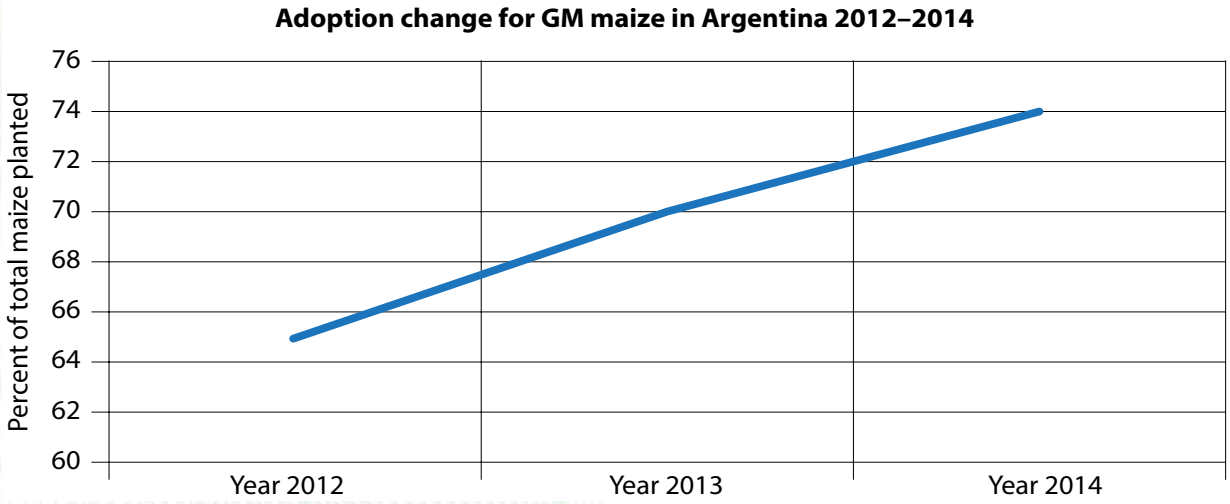


Figure 5: Adoption of GM maize in Argentina between the years 2012 and 2014. Proportion of hectares under GM maize in relation to total maize cultivation increased every year. Data source: European GMO Socio-economic Bureau (ESEB, 2016).

Although maize from countries that predominantly grow GM is cheaper (Figure 4), millers and manufacturers cannot currently import from these countries due to existing restrictions. Whereas it is desirable that Kenya exports more than it imports for net economic gain, import patterns show that maize accounts for less than 10% of total grain imports (Table 2). The highest grain import (by volume and cost) is wheat (62%), followed by rice (about 20%), then maize (10%; Table 2).

Table 2: Imports of major foods in Kenya in 2011. The main import was wheat, while maize accounted for less than 10%. Source: KEPHIS; FAOSTAT (2012).

Rank	Commodity	Quantity (MT)	Value (1000 USD)
1	Wheat	1467709	457146
2	Rice	358031	191082
3	Maize	258525	88757
4	Palm Oil	165702	206260
5	Sugar Raw centrifugal	149935	121663
6	Sugar Refined	114626	99195
7	Tea	99762	168541
8	Cake of Soybeans	69215	14523
9	Sunflower Cake	61575	9583
10	Sorghum	58223	19466

Ban on GM food imports

Ban followed an erroneous publication linking GMO to cancer

The infamous 'Cabinet ban' on GM foods has remained shadowy for the fourth year now, with the most popular version claiming that the Cabinet, during its 16th meeting on 8 November 2012, directed then Health Minister Beth Mugo to ban importation of GM foods into Kenya with immediate effect, citing a lack of proof that GM foods were not a public health risk. The directive followed the publication of results from a two-year study involving feeding of rats on a herbicide (Roundup) and Roundup-tolerant GM maize (Roundup Ready) by a team of French scientists in September 2012. Publishing in the Elsevier Journal 'Food and Chemical Toxicology' (Séralini *et al.*, 2012), the authors interpreted observed tumours in rats to be caused by genetic modification as well as the glyphosate that forms 'Roundup' herbicide.

Publication was retracted for being erroneous

The publication by Séralini *et al.* (2012) was on 28 November 2013 withdrawn by both the journal, *Food and Chemical Toxicity*, and the publisher, *Elsevier Science*, following an elaborate investigation on the data presented and the review process, which revealed that

the study was based on flawed data and interpretation (Food and Chemical Toxicology, 2014). The High Council for Biotechnology (HCB; a team of scientific experts commissioned by the French Government on 24 September 2012 to provide an opinion on the paper by Professor Séralini's team) found that the publication failed to establish relationship between GM foods and tumour. Further, the European Food Safety Authority (EFSA) found this study to be of insufficient scientific quality for safety assessments.

ESEU republishes the work to remind the world of bad science methods

In May 2014, six months after the withdrawal of the paper by Séralini *et al.* (2012), it was republished in a different Journal, 'Environmental Sciences Europe' (ESEU). This was done by the second journal to retain useful discussions that emanated from the publication, rather than to disseminate its content, as clearly stated by the Journal via a clear and concise caveat at the beginning: '*Progress in science needs controversial debates aiming at the best methods as basis for objective, reliable and valid results……In this sense, ESEU aims to enable rational discussions dealing with the article from G.-E. Séralini et al by re-publishing it. By doing so, any kind of appraisal of the paper's content should not be connoted*' (Séralini et al. 2014; Page 2). This means that (1) from these debates, readers will know the faults with methods and analysis used by Séralini's team, and (2) the journal does not in any way approve of the data and interpretation.

Séralini finally says tumours are not caused by GMO

In a more recent publication in the premier journal *PLOS ONE* (Mesnage *et al.*, 2015), Séralini's group surprised the world when they concluded that tumours observed in the famous Séralini *et al.* (2012) resulted from environmental contaminants in the feeds used, and not from genetic modification, and as such, animal feeding trials (like the one they published in 2012) are unreliable due to feed contamination worldwide (Appendix 1).

Government of Kenya appoints a task force to advise on GMO

In October 2013, the Government of Kenya, in cognisance of possible negative effects of maintaining the ban on GM foods, appointed a taskforce through the Ministry of Health to investigate the grounds on which the ban was based (Gazette Notice No. 13607; Appendix 2). The taskforce submitted a confidential report to the Minister for Health in 2014, but until now (September 2016), no decision had been taken. Several happenings show the ban on GM foods to be shrouded in deep mystery:

- The Taskforce, largely understood by the public to have been appointed and gazetted in October 2013, had already submitted their report by September the previous year, even before mounting public participation, which was conducted two years later in 2014 (Appendix 3).
- Confidential letters indicate that the Taskforce was appointed by then Health Minister Beth Mugo in December 2012 (Appendix 4), contrary to public 'knowledge'

that her successor James Macharia appointed and gazetted the taskforce in 2013.

- Senator Beth Mugo (then Minister for Public Health) has denied ever discussing the matter of GM foods in Cabinet.
- Confidential letters exchanged between the Head of Public Service and several line Ministry Permanent Secretaries in 2011 and 2012 suggest that the ban was predetermined.

Ban on GM foods is illegal

The Biosafety Act, 2009 (with its implementing regulations) outlines steps to be taken when a new risk is identified, and when a GMO or its product is to be withdrawn from the market. Of specific mention is that a ban on GMO must be contained in a legal notice. A 'ban' such as the one described in Kenya, is devoid of a legal basis and provisions of written law, and more specifically, is in contravention of the provisions of the Biosafety Act 2009, as the only authoritative legal framework enacted to regulate activities involving GMOs. A mere public pronouncement by the Minister is devoid of any legal basis and authority and the same cannot establish legitimate rights or expectations. This position was advanced by KUBICO during court proceedings in the Aromat case of July 2014, in which KUBICO was admitted as expert witness (Petition No 308; National Biosafety Authority/Republic versus Unilever East Africa). With the robust technical backup from KUBICO, Unilever put a winning case, forcing the National Biosafety Authority to withdraw, opting for an out of court settlement.

Most plausible ways to get the ban lifted

Legally, there is no enforceable ban on GM foods in Kenya. However, one cannot import the products because NBA is implementing the 'ban'. Although the ban is illegal, the complex and cryptic circumstances under which it was imposed suggest that the most efficient way to get it lifted is through a parliamentary decision. In this case, an organisation with good public standing and political networks among parliamentarians can sponsor a petition in Parliament. This remains the most efficient and plausible means to get the ban lifted. Other options, but which have limitations, include seeking legal redress. This means suing the National Biosafety Authority (with Ministry of Health and Attorney General as additional respondents). Lobbying the Presidency, which has been touted as best route, however, seems unsuitable due to the cryptic and shadowy manner in which the ban was (and is) handled. Both ways, however, require to be backed with a robust pressure from the populace in a bottom-up approach.

Although lacking a legal backing, the ban may severely affect manufacturing and milling sectors, affecting food supply, consumer prices of finished products, and ultimately jobs for thousands of Kenyans. This study was conducted to ascertain the effect of the ban on these sectors, optimistic that such data will enable the government make a more informed decision. We describe the methods used in the study; results obtained, and provide guidance on what government actions will improve food security, trade, business development and job retention.

Chapter 3: **Interviews**

Introduction

This chapter provides an outline of the methodology that was used in the study. It describes the research design, population of the study, sample and sampling techniques, data collection methods as well as data analyses.

Interview Methodology

Study design

Using a descriptive design, the study sought to evaluate the impact of ban on importation of GM foods on retail food prices, food security and safety, biotechnology research and human resource development in biotechnology as well as identifying existing opportunities for investment in biotechnology and agribusiness in Kenya.

Population

The target population in this study included large scale millers, small scale millers, manufacturers (that likely use maize/corn, soybean, canola), government agencies that regulate GMOs and those that control imports, and government biotechnology training and research institutions. Contact was first made with potential respondents through telephone and email for their participation. A cover letter was attached to explain the purpose and relevance of the research, and to seek their consent to participate in the study. Willing institutions were then enrolled for the study. The sample numbers and the rationale for each category is presented in Table 3.

Table 3. Rationale for inclusion, and number of institutions surveyed in the study

Category	No. of institutions	Rationale
Large scale millers	13	Control over 91% of the milling volume in Kenya
Small scale millers	10	Contribute to a sector-wide analysis and insights
Manufacturers of edible products	5	Commonly use maize/corn, Soybean and Canola in finished products
Government regulatory agencies	2	Keep reliable records of imports and authorisation
Public biotech training and research institutions	6	Evaluate impact on grants, training and research

Sampling design

Study design is important in research as it constitutes the blueprint for the collection, measurement, and analysis of data. It aids the scientist in the allocation of limited resources by posing relevant questions capable of capturing objectives of the study. In this study, a combination of both closed and open ended questions was used for either ranking or scoring.

Sampling technique

Purposive sampling technique was used to select the respondents. This method was adopted to allow the researcher to capture data from respondents whose operations would be affected by the ban on GM foods. For the milling sector, respondents were categorised as large scale or small scale based on their milling volumes and workforce. Only universities known to conduct research in and offer biotechnology courses were sampled. Two categories of regulatory agencies were sampled: those that regulate GMOs and those that control grain imports.

Sample size

Denscombe (1998) observed that the sample must be carefully selected to be representative of the population. In cases of subdivision, Mugenda and Mugenda (2003) emphasise that the researcher must accurately accommodate such subdivisions during data analyses. In this study, 13 large scale millers accounting for 91% of the total milling volume in Kenya and 10 small scale millers accounting for less than 10% of total milling volume were sampled. Five manufacturers of edible products – the only ones known to use GM materials – were sampled. In addition, 2 government regulatory agencies as well as 6 biotech training and research institutions were sampled.

Data collection methods

Quantitative data collection techniques were used in this study. Data was collected using standardised self-administered questionnaires developed by the researcher on the basis of research objectives. The questionnaires were designed and subsequently pre-tested to ascertain the suitability of the tool prior to actual administration. Pre-testing was conducted by administering questionnaires to five (5) respondents who were randomly selected from the sample size of 36. This was to enable the researcher fine tune the questionnaire to enhance objectivity and efficiency of the process. The questionnaire comprised two parts: the first part entailed questions on the background information on the respondents and their sector. For millers and manufacturers, the second part contained questions on raw materials, target market, the ban and its effect on production volume, human resources and food prices. The second part for research and training institutions comprised questions on student admissions, student transfers between courses, research grants and their training capacity. In this part, regulators were expected to provide data on imports, cargo diversion and their regulatory capacity. The full content of questionnaire is presented in Appendix 5.

Data analysis methods

The data obtained from the study was analysed using both qualitative and quantitative techniques. The Statistical Package for Social Science (SPSS-version 17) was used for data analysis. Both descriptive and inferential data analysis techniques such as frequencies, cross tabulations and correlations were employed. In order to reveal which responses were most preferred, coefficient of variation, which is a quotient of mean and standard deviation, was used to mitigate for outliers. Such analyses were useful in determining the significance between and among variables in terms of trends, impacts as well as statistical significance.

Interview Results and Discussion

In this study, Managing Directors and Chief Executives (CEOs) of participating institutions provided the data. In a few cases, Technical Directors or General Managers were involved with full approval of their CEOs. For the universities, the Vice-Chancellors granted participating authority to Academic Registrars or Grants Administrators who are the custodians of admissions and financial records.

Manufacturers rely on external sources of raw materials

Whereas large scale millers account for over 90% of milling volume, none of them relied solely on grain produced within the country. All large scale millers and manufacturers obtained their raw materials from more than one country (Figure 6). These raw materials generally contain maize/corn, soybean, rice and wheat, with a few containing canola and cotton. Reliance on external sources of raw materials can be attributed to the low local supply compared to the demand. Under such circumstances, importation is required to meet the milling capacity. In Kenya, it is estimated that 1.62 million tonnes of grain is milled annually. When sources of quality raw materials are limited or restricted, millers operate below optimal capacity, thus affecting food supply and consumer prices.

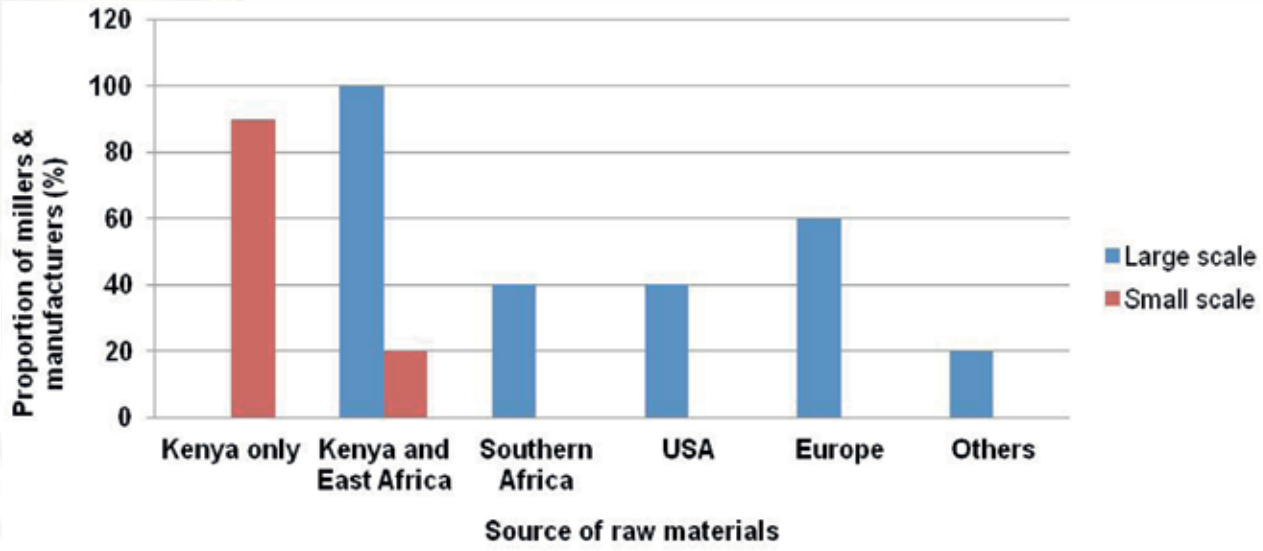


Figure 6. Sources of raw materials for millers and manufacturers in Kenya.

Large scale millers relied on raw materials from Kenya, East Africa, Southern Africa, USA, Europe, and other countries.

Ban on GM foods caused revenue loss through cargo diversion

Data from this study showed that Kenya imported more than 15,000 metric tonnes of GM grain per year before October 2012. However, these imports terminated immediately following the ban on GM foods (Figure 7). Although the restriction was imposed on importation, it has consequently affected transits, with no permits for transit being issued after 2012 (Figure 7). Kenya is a key entry port for food supplies to landlocked countries such as South Sudan, Uganda, Rwanda and Burundi. Issuance of transit and import permits attracts a fee payable to the Government of Kenya. Considering that the landlocked countries continue to receive supplies from countries known to grow or trade in GM products, Kenya has lost revenue from the diverted cargo and transit permits, thus reducing the government's revenue base.

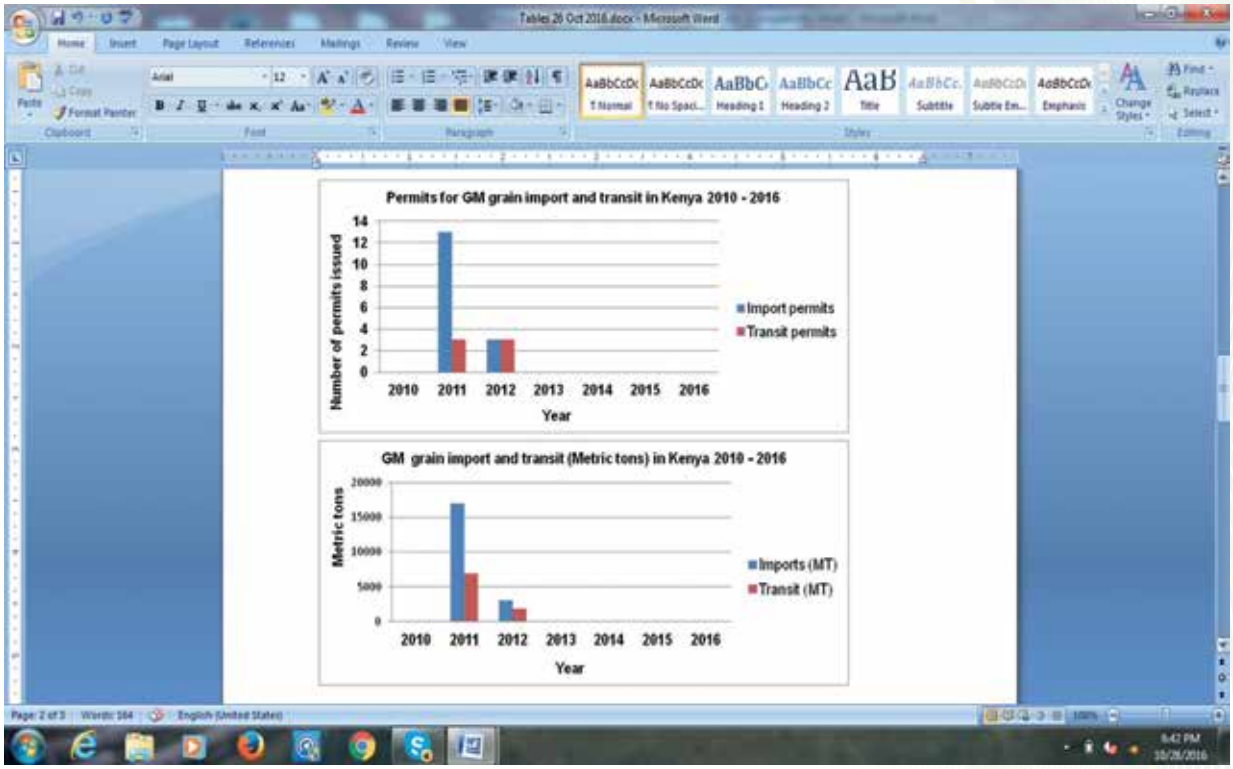


Figure 7: GM grain import and transit volumes in Kenya between 2010 and 2016. All imports and transit terminated following the ban in October 2012. Minimal volumes for 2012 represent shipment made before the government ban later that year.

Ban affected food prices

This study showed that the ban on GM foods severely affected sources of raw materials for most of the large-scale millers and manufacturers (60%), who had to cope with highly escalated prices of raw materials (Figure 8). **The ban resulted in increased food prices, either moderately (40%) or severely (40%). As a consequence, most of the millers operated at below 30% capacity and had to also reorganise their human resources as a result of the ban** (Figure 8).

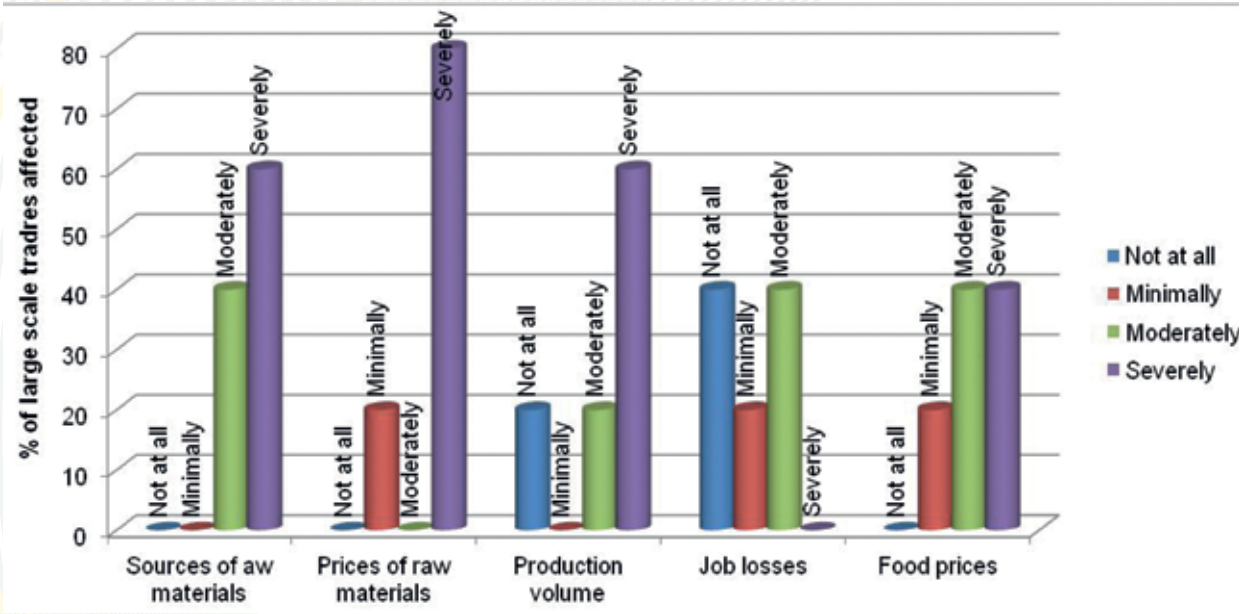


Figure 8. Effect of GM ban on raw materials, production, job losses and consumer prices in Kenya. The values show that respondents were severely affected in acquiring raw materials, prices of raw materials, production volume, and even food prices.

Analysis of maize import volumes and maize consumer prices for Kenya between 2010 and 2016 showed a tight negative correlation, with a coefficient $r = 0.93$. In the analysis, imports for a particular year were calculated by adding the year under analysis plus the preceding year. Years of high imports recorded the lowest consumer prices and vice versa (Figure 9).

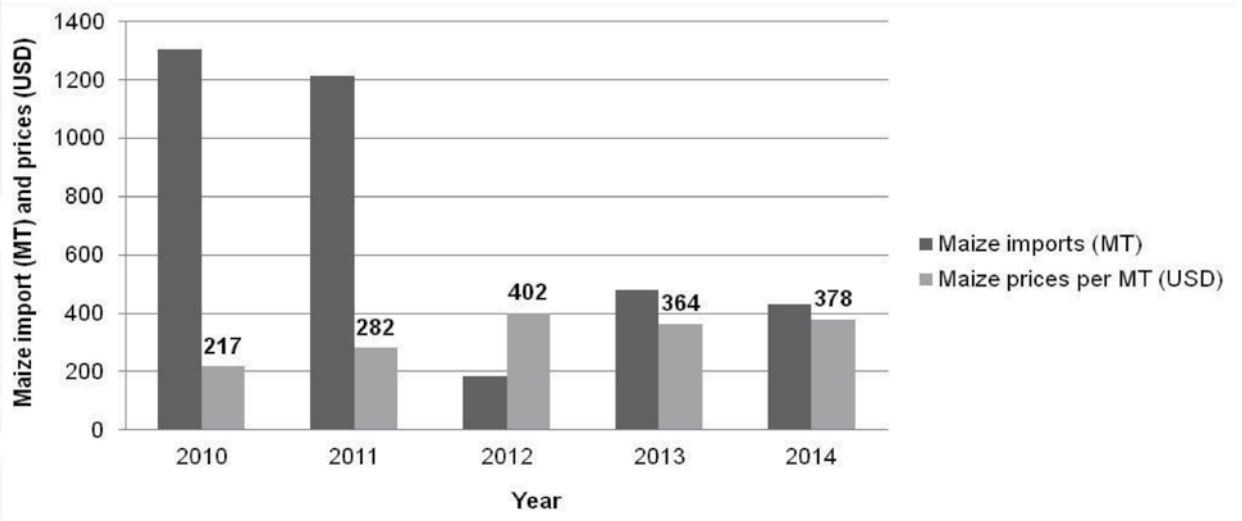


Figure 9. Maize imports and prices in Kenya 2010–2014. High levels of import appear to reduce consumer prices.

Millers willing to use locally developed GM materials

Despite importing most of the raw materials from other countries, all millers and manufacturers expressed willingness to use local raw materials improved through genetic modification, as long as the products had improved quality, and were reliably available within the country (Figure 10). For a few traders, the products also had to be cheaper. Millers indicated that quality of raw materials was the most critical consideration, followed by price. Locally developed raw materials will save manufacturers import costs and duty, thereby reducing overall production costs.

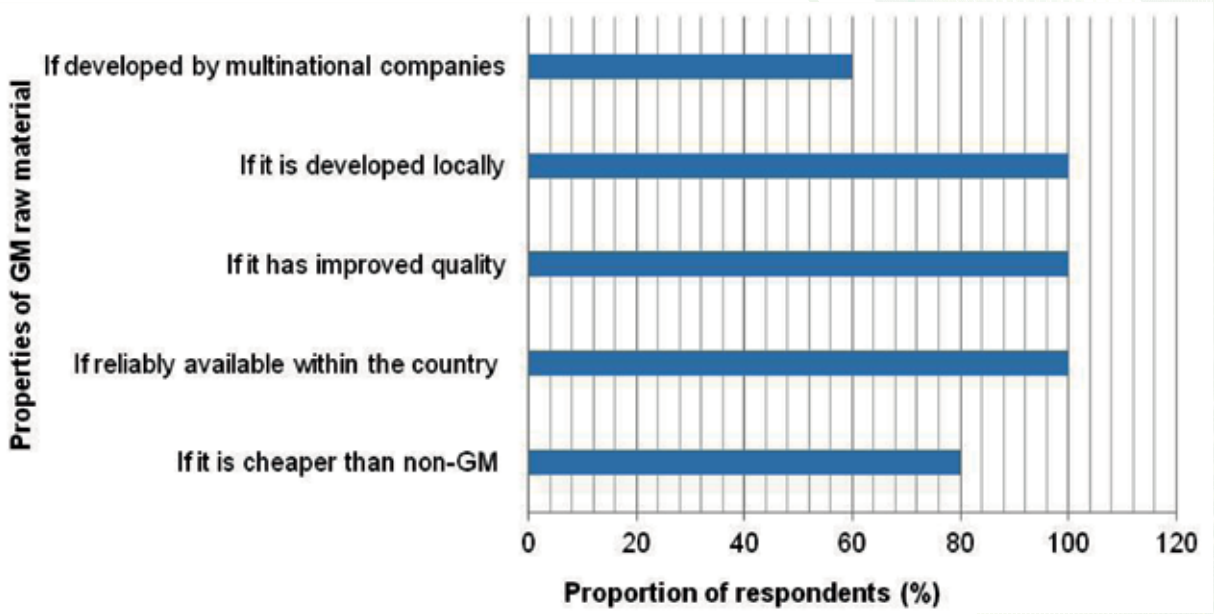


Figure 10. Willingness to use local raw materials improved through genetic modification. All respondents were willing, as long as the raw materials are reliably available and have improved quality.

Kenya's capacity to develop and regulate GM demonstrated

This study found that all 22 applications for laboratory level and 12 confined field trials (CFTs) submitted to the National Biosafety Authority (NBA) were approved (Table 4). Applications and approvals for these trials demonstrated physical and human capacity to conduct and regulate GM research in Kenya. The fact that all submitted applications met approval criteria and were subsequently approved suggested that NBA prepared applicants adequately, and showed the regulators' competency to objectively review applications. Further, the results underscored NBA's ability to perform environmental risk assessments, leading to approval of CFTs. The results also indicated that competency within the regulatory system is enhanced through the use of reference labs, Institutional Biosafety Committees (IBCs), expert reviewers, market surveillance, qualified and competent staff, compliance monitoring, awareness promotion and public education.

Table 4. Number of applications and approvals for GM laboratory and field research in Kenya between 2010 and 2016. All applications were approved within the same year.

	Contained Use		Confined Field Trial	
	Applications	Approvals	Applications	Approvals
2010	1	1	1	1
2011	7	7	3	3
2012	3	3	2	2
2013	0	0	2	2
2014	8	8	2	2
2015	1	1	2	2
2016	2	2	0	0

Drop in grants for biotech research

All the six universities surveyed offered training and research in biotechnology. The institutions demonstrated capacity for biotechnology research through the presence of qualified and competent staff, plant transformation facility, DNA analysis laboratory, bioinformatics platform, facility for animal models, toxicology lab, Institutional Biosafety Committees (IBCs), and Ethical Review Committees (ERCs).

Whereas the total grant amount held by the universities has increased over the period 2010 to 2016, grants specific to biotechnology research plummeted after 2012. In 2016, the total grants held stood at USD 50.7 million, against USD 35.1 million in 2010 (Table 5). Although funding for other fields increased, most of the universities were faced with cuts in biotechnology funding and inability to win new ones. This cut in funding for biotechnology projects can be attributed to the existing ban on consumption of GM foods. Development partners are never enthusiastic in funding projects whose products will not have immediate impact on the lives of the people.

Table 5: Total grants, and grants for biotechnology, held by a combination of six universities surveyed, between the years 2010 and 2016. Funding for biotechnology plummeted after 2012.

Year	Total funding (million USD)	Biotech funding (million USD)
2010	35.1	1.55
2012	36.3	3.82
2014	46.0	1.30
2016	50.7	0.20

Students shunning biotech training

Examination of the number of students applying for, and transferring between biotechnology and other courses across the six public universities surveyed, revealed a greater number of transfers from biotechnology. In each of the years between 2010 and 2015, more students left biotechnology than those that joined the course (Figure 11). **Although the transfers can be attributed to other reasons, the ban on GM foods, one of the key products of biotechnology, greatly contributed to a lack of interest in biotechnology.** A review of Press statements by students regarding the ban indicated a general fear of not being able to practice or get jobs upon graduation (http://www.businessdailyafrica.com/image/view/-/3076660/medRes/1256957/-/maq2jc/-/march.jpg).

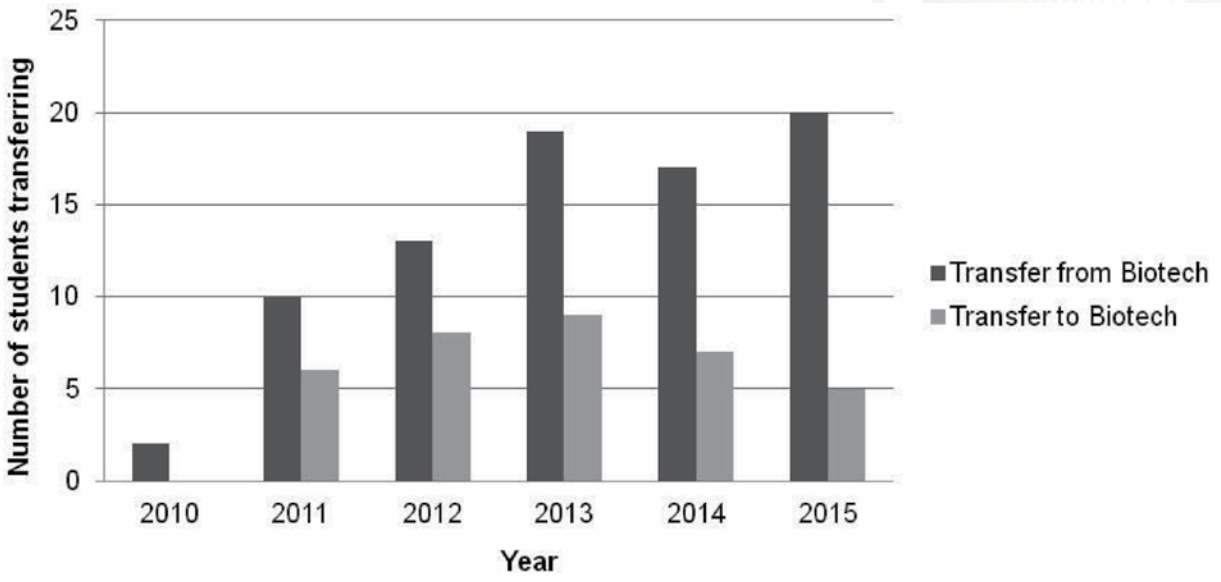


Figure 11. Student transfer from and to biotechnology courses at six public universities surveyed. More students transferred from biotechnology than those opting for biotechnology from other courses. Biotechnology was still at infancy by 2010 at many of the universities.

Chapter 4: **General Discussion**

Introduction

This chapter discusses the results obtained from desk review as well as interviews with key manufacturers, millers, researchers and trainers. It unpacks and interprets the results in relation to the research questions and study objectives.

General discussion of results

This study sought to determine how the ban on GM foods in Kenya affects food security, research and training. It sought to determine whether the ban on importation of GM products was legally or scientifically justified, and whether it is responsible for the high food prices. This section analyses the impact of the ban on agricultural progress and food security, and discusses available opportunities for investment in biotechnology.

Ban has heightened food prices and affected food supply

The ban on importation of GM products severely affected sources of cheaper raw materials for 60% of the large scale millers and manufacturers. By restricting the sources of quality raw materials, the ban reduced production volumes (total installed corn milling capacity is estimated at 1.62 million tonnes per annum), resulting into limited food supply, and increasing retail prices of finished products. Comparisons showed maize to be consistently cheaper in countries that predominantly grow GM maize, as confirmed by the Kenya Cereal Millers Association (CMA). The association showed that GM maize is cheaper by about 30% compared with non-GM maize. Analysis of maize import volumes and maize consumer prices for Kenya between 2010 and 2016 showed a negative correlation (r = 0.93), where years of increased imports recorded the lowest consumer prices and vice versa. Consumer prices are also affected when quality of raw materials is compromised, leading to high rates of rejection of finished products at quality assurance stage. This study showed that much of the maize from local farmers was often wet, diseased, rotten, and had high levels of aflatoxins mainly due to improper drying and inadequate storage facilities. Limited availability of quality maize is further exacerbated by reducing yields from farms, making flour processing expensive, and pushes consumer prices upward. Unless drying and storage limitations are resolved, millers will continue to rely on imported grain to maintain safety standards.

Ban slows progress in agriculture and food security research

The Constitution of Kenya (2010) affirms the right of every person to be free from hunger and to have food of acceptable quality. However, the agricultural sector still faces many challenges, including reduction of agricultural land, low agricultural production and productivity, poor marketing, market uncertainties, low value addition to agricultural products, and high post-harvest losses. The increasing population, together with declining

and variable agricultural environments witnessed recently necessitates a paradigm shift in agricultural systems. Genetic engineering (GE; GMO for simplicity) has offered climate resilience and biological robustness to crops, and is a potential pathway out of poverty and malnutrition for millions of households. To overcome some of these production challenges, several GM crops are being developed within the region such as *Bt* maize. However, the developers have been denied a permit to enter the insect protected maize for national performance trials (NPTs), to pave way for commercialisation and cultivation by farmers. However, the entry of biotech products in the trade value chain in Kenya has met some challenges emanating largely from a lack of information on the development, safety and regulation of the products. The current ban on GM foods affects research and technology development, technology delivery and adoption of GM products intended to have immediate impact on the lives of the people.

Ban on GM foods is illegal, and followed an erroneous publication

The ban on GM foods, which was never gazetted, is devoid of a legal basis and provisions of written law, and is in contravention of the provisions of the Biosafety Act, 2009 as the only authoritative legal framework enacted to regulate activities involving GMOs. Illegality of the ban notwithstanding, NBA has implemented it since 2012. The taskforce allegedly appointed in 2013 to advise on safety of GMOs, is understood to have submitted a report in 2014, which is yet to be acted on. The government ban on GM foods was founded on an erroneous publication which was later retracted following a thorough re-evaluation and only republished by another Journal to archive mistakes in scientific methodology and interpretation (Appendix 1). Indeed, the senior author recently published another work, clarifying that tumors observed in the famous Séralini *et al*. (2012) resulted from environmental contaminants in the feeds used, and not from genetic modification (Mesnage *et al*., 2015).

Opportunities for investment in biotechnology

This study has identified several opportunities for investment in biotechnology and agribusiness in Kenya. These include: a promising local market for *Bt* maize, investment opportunities in the maize supply industry including innovations for drying and storage, and local expertise in biotechnology available for partnership.

Promising local market for Bt maize

The study has shown that millers and manufacturers are willing to use locally developed GM products, as long as they are of improved quality and reliably available in Kenya. This willingness is an investment opportunity for GM crops such as *Bt* maize, which has gone through confined field trials (CFT) and is now awaiting National Performance Trials (NPT), before eventual release to farmers. A high adoption rate is expected for *Bt* maize and similar innovations in Kenya where more than 90% of subsistence farmers grow maize, which is also the staple for most households.

Investment in the maize value chain

Kenya faces an annual deficit of 1.2 million metric tonnes of maize, a trend projected to grow bigger each year. Despite several efforts by the government, studies indicate that production cannot match consumption needs for Kenya in the next few decades, regardless of steps taken. This study identified several lucrative interventions in the production chain, imports or processing.

In this study, comparisons of global maize prices showed maize to be consistently cheaper in countries that predominantly grow GM maize (Figure 4). Generally, prices in countries that largely grow GM maize showed a declining trend, possibly due to increasing acreage of GM maize fields. For example, Argentina, which has tremendously increased its acreage under GM crops in the last few years (rising from 65% in 2012 to 74% in 2014), revealed the lowest and most stable maize prices compared to Brazil, Equador, Kenya, RSA, and USA between 2012 and 2014.

This survey found that much of the maize from local farmers is wet, diseased, rotten, and contain high levels of afflatoxins thereby making millers to rely on imported grain maize to maintain safety standards. This presents not only an opportunity to invest in imports but also in proper drying and storage facilities. It further avails an opportunity for bio-innovation in farm level approaches that reduce afflatoxin, such as breeding for hard seed coat.

Local expertise in biotech available for partnership

Investment in biotechnology and agribusiness requires a robust support system capable of ensuring returns. Such a system is characterised by a competent regulatory framework, adequate human capacity, established research and training, and an enabling policy environment. Kenya is the only country in the region with a functional biosafety law (Biosafety Act No. 2, 2009), policies and guidelines. This has enabled investors in biotechnology to apply for approvals for product development at various stages. Applications and approvals for confined field trials (CFTs) in the last five years (Table 4) demonstrated the robustness of the regulatory system.

The existence of certified biosafety laboratories, such as the Plant Transformation Laboratory at Kenyatta University as well as trained and qualified local scientists provides the necessary support system required for investment in GM-related agribusiness. The expertise at the local universities is strengthened by an established training programme for next generation scientists and collaborators. These are strategic catalysts for investment in local development of GM crops or field trials for GM crops developed elsewhere.

Chapter 5: **Recommendations**

This study sought to determine how the ban on GM foods affects food security, research and training, and to identify opportunities for investment in biotechnology and agribusiness in Kenya. It presents a comprehensive dataset obtained from both primary and secondary sources. From the study, the following recommendations are provided to guide health, agricultural and trade policy, as well as investment decisions.

1. The current ban on GM foods should be lifted – the ban on GM foods affects food prices, limits local development and deployment of GM crops, and threatens the already fragile food security in Kenya. Further, the ban now hinders research and training, limiting efforts aimed at human resource development for Kenya and the region.

2. Import duty on grains should be favourable, and millers be allowed to freely source for quality raw material – the current duty levied on maize imports is prohibitory, set at nearly 50%. The high import duty affects the price of raw materials, hence increasing consumer prices of finished products. Further, the government has currently restricted maize imports from other countries; hence millers have to use locally available low quality maize, leading to food safety and product standards challenges.

3. Kenya is a viable destination for investment in biotechnology – Kenya is by far a better investment hub, despite the policy challenges around GMO. The country's suitability for investment in biotechnology and agribusiness emanates from the frequent food deficits it experiences, humongous abiotic and biotic (pests, diseases, drought, floods, etc.) challenges facing agriculture, high proportion of population engaged in farming, position as a harbor, as well as the robust regulatory, infrastructural and policy system.

4. The development of GM products for Kenya should focus on quality improvement and promotion of adoption – data from this study showed that quality is the first priority for millers and manufacturers (Figure 10). Quality improvement can target crops such as maize, as most maize currently available in Kenya has been found to have major safety issues, including high levels of aflatoxin infestation. Further, adoption of GM products would need to be promoted in order to guarantee reliable production, as currently there is low level of adoption for most agricultural technologies in Kenya.

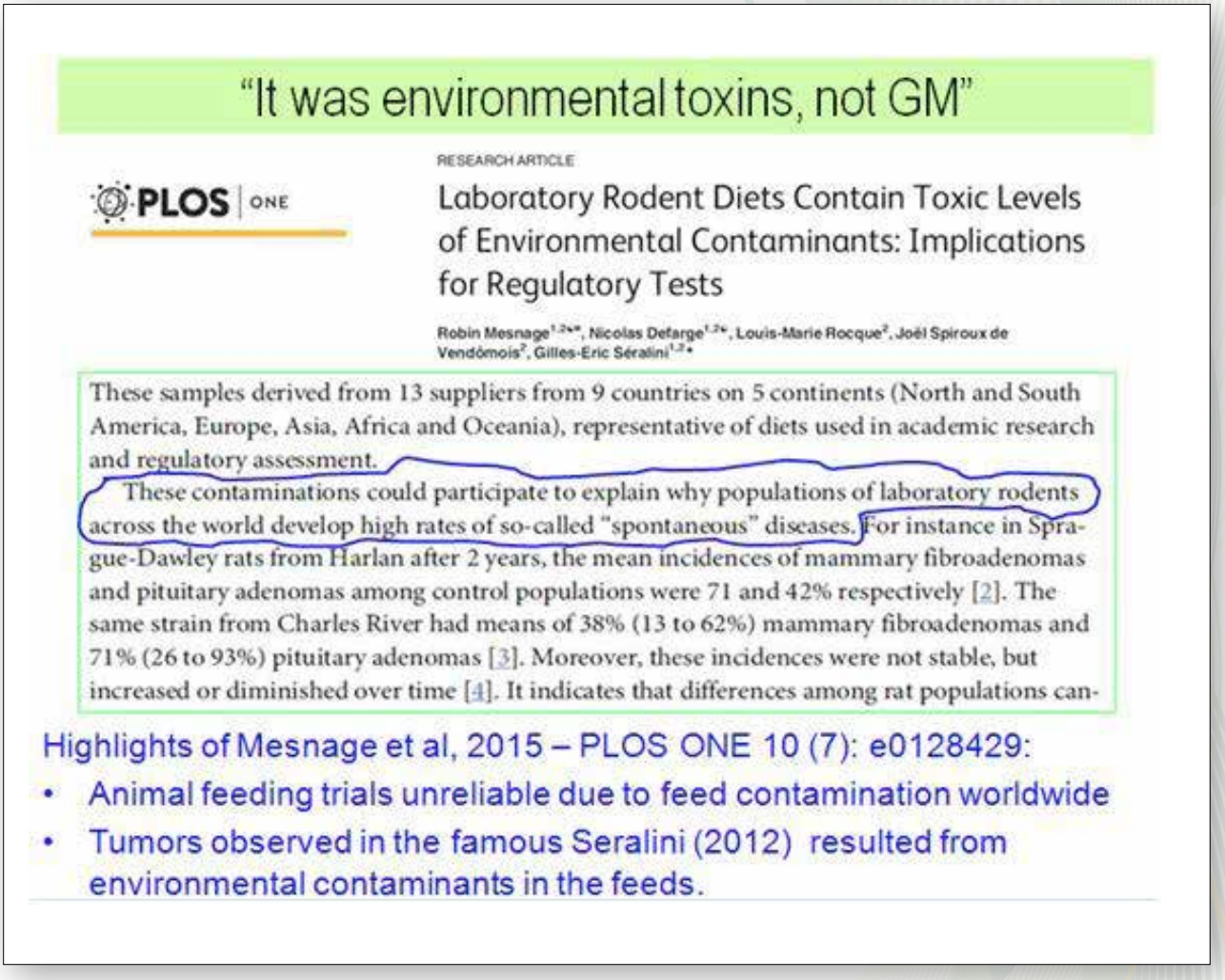
5. GMO-linked biosafety policies need to be harmonized across the East African Community (EAC) – with most countries in the region adopting modern biotechnology after development of biosafety law (Kenya and Tanzania) or biosafety policy frameworks (Rwanda and Uganda), the commercialisation of GM

crops by countries in the region is imminent (especially for *Bt* maize and cotton). Consequently, GMO linked biosafety issues (e.g. GMO labeling, tests and milling) are likely to emerge thereby raising new challenges in the fight to eliminate non-tariff barriers to trade in the region and beyond. Efforts to harmonise policies and improve regulatory environment for trade will be essential to achieving increased access, availability and utilisation of the GMO maize. Regional harmonisation has been technically achieved in non-GMO commodity related standards for many products, including maize and other cereals (EAS, 2005; EAC, 2010).

6. Cereal trade across EAC should not be hindered – blocking cereal trade, especially maize, across the EAC affects regional trade and food security. Maize is traded through both formal and informal channels, with the latter predominating in the more porous borders such as Uganda-South Sudan or where the trade volumes overwhelm the handling capacity of customs officials (e.g. Uganda-Kenya border). Within the East African region, cross-border trade accounts for about 60% of trade in staple grains with Kenya being the major destination for maize. Cross-border trade is driven by many socio-economic factors that lead to price differentials, but in many cases, trade barriers prevent food from reaching areas with deficits thus significantly impacting on regional food security.

Appendices

Appendix 1: Enviromental toxins caused cancer not GMO



"It was environmental toxins, not GM"

PLOS ONE

RESEARCH ARTICLE

Laboratory Rodent Diets Contain Toxic Levels of Environmental Contaminants: Implications for Regulatory Tests

Robin Mesnage[1,2]*, Nicolas Defarge[1,2], Louis-Marie Rocque[2], Joël Spiroux de Vendômois[2], Gilles-Eric Séralini[1,2]*

These samples derived from 13 suppliers from 9 countries on 5 continents (North and South America, Europe, Asia, Africa and Oceania), representative of diets used in academic research and regulatory assessment.

These contaminations could participate to explain why populations of laboratory rodents across the world develop high rates of so-called "spontaneous" diseases. For instance in Sprague-Dawley rats from Harlan after 2 years, the mean incidences of mammary fibroadenomas and pituitary adenomas among control populations were 71 and 42% respectively [2]. The same strain from Charles River had means of 38% (13 to 62%) mammary fibroadenomas and 71% (26 to 93%) pituitary adenomas [3]. Moreover, these incidences were not stable, but increased or diminished over time [4]. It indicates that differences among rat populations can-

Highlights of Mesnage et al, 2015 – PLOS ONE 10 (7): e0128429:

- Animal feeding trials unreliable due to feed contamination worldwide
- Tumors observed in the famous Seralini (2012) resulted from environmental contaminants in the feeds.

Appendix 2: Macharia taskforce, November 2013

CORRIGENDA

IN Gazette Notice No. 13432 of 2013, Cause No. 90 of 2013, *amend* the deceased's date of death printed as "19th August, 1972" to *read* "19th August, 2012".

IN Gazette Notice No. 13432 of 2013, Cause No. 82 of 2013, *amend* the second petitioner's name printed as "Cecilia Ngonyo Mutumi" to *read* "Cecilia Ngonyo Metumi".

GAZETTE NOTICE NO. 13604

THE INCOME TAX ACT

(*Cap*. 470)

APPOINTMENT

IN EXERCISE of the powers conferred by section 82 of the Income Tax Act, the Cabinet Secretary for the National Treasury appoints—

John Macharia Mwangi—(Chairman),
Nathan Karugu Mbugua,
Rosemary Kirika,
John Muiruri,
Gerald Andego Magani,

to be members of the Thika Local Committee, for a period of two years, with effect from the 1st November, 2013.

Dated the 3rd October, 2013.

HENRY ROTICH,
Cabinet Secretary for the National Treasury.

GAZETTE NOTICE NO. 13605

THE WATER ACT

(*No*. 8 *of* 2002)

THE COAST WATER SERVICES BOARD

APPOINTMENT

IN EXERCISE of the powers conferred by section 51 of the Water Act, 2002, the Cabinet Secretary for Environment, Water and Natural Resources appoints—

Konora Mabudi Jilo,
Jane Mwende Kimuyu Kibati,

to be members of the Coast Water Services Board, for a period of three (3) years, with effect from the 19th Septenber, 2013.

Dated the 19th September, 2013.

JUDI W. WAKHUNGU,
Cabinet Secretary for Environment, Water and Natural Resources.

GAZETTE NOTICE NO. 13606

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

(*No*. 8 *of* 1999)

THE NATIONAL ENVIRONMENT TRIBUNAL

APPOINTMENT

IN EXERCISE of the powers conferred by section 125 (1) (a–d) of the Environmetal Management and Co-ordination Act, the Cabinet Secretary for Environment, Water and Natural Resources appoints:

Under section 125 (1) (*b*)—

Jane Akinyi Dwasi (Dr.);

Under section 125 (1) (*d*)—

Maureen Wanjiru Mathenge,
Francis Dommy Pitt Situma,

to be members of the National Environmetal Tribunal for a period of three (3) years.

Dated the 19th September, 2013.

JUDI W. WAKHUNGU,
Cabinet Secretary for Environment, Water and Natural Resources.

GAZETTE NOTICE NO. 13607

TASKFORCE TO REVIEW MATTERS RELATING TO GENETICALLY MODIFIED FOODS AND FOOD SAFETY

APPOINTMENT

IT IS NOTIFIED for the general information of the public that the Cabinet Secretary for Health has appointed a taskforce consisting of the following—

Kihumbu Thairu (Prof.)—(*Chairperson*);

Members:

Joy Wanjiru Kiano (Dr.),
Ann Wangai (Dr.),
Nancy Budambula (Dr.),
Shaukat Abdulrazak (Prof.),
Samuel Gundu (Prof.),
Marion Mutugi (Prof.),
Salome Mpoke (Dr.),
Johnson Irungu (Dr.),
Eva Oduor,
Willy Tonui (Dr.),
Kepha Ombacho (Dr.)—(*Secretary*),

Terms of Reference:

1. The terms of reference of the taskforce are to—

   (a) review literature on scientific data from clinical trials on both the short and long term effect of genetically modified foods on human and animal health;

   (b) assess infrastructural capacities in Kenya to monitor genetically modified products in the country ;

   (c) make recommendations on genetically modified foods and food security in the country;

   (d) make recommendations on safety of genetically modified foods to human health;

   (e) make recommendations on the actions to be undertaken by any person including the government, on matters relating to genetically modified organisms and food safety;

   (f) assess and make appropriate recommendations on the general administration and management of genetically modified food imports into Kenya and in particular—

      (i) adequacy of qualified human resource capacity to monitor research, use and importation of genetically modified products in the country;

      (ii) approval procedures for import of genetically modified food by the relevant regulatory agencies;

      (iii) examination of the legal framework and systems for biotechnology on genetically modified foods in the country and in the region; and

      (iv) co-ordination of the regulatory agencies;

   (g) analyze published and controversial research papers on safety assessment of genetically modified foods;

   (h) analyze the possible reasons and underlying factors for ban of genetically modified importation, cultivation or trade by some countries;

   (i) develop a policy direction and advice the government on whether to maintain or lift the existing ban on genetically modified foods; and

   (j) look into any other issues pertinent to the safety of genetically modified foodstuffs which are not specifically identified in the Terms of Reference,

and to make a report of its findings to the Cabinet Secretary for Health.

2. In the performance of its functions, the taskforce—

   (a) shall hold such number of meetings in such places and at such times as the taskforce shall consider necessary for the proper discharge of its functions;

   (b) co-opt any resource persons as and when necessary, on short term basis, to assist in the achievement of the Terms of Reference;

(c) make reports or updates, every two weeks, to the Cabinet Secretary for Health outlining any matters that may require urgent action;

(d) shall receive views from members of the public and receive oral and written submissions from any person with relevant information;

(e) may use official reports of any previous investigations relevant to its mandate;

(f) may carry out or cause to be carried out such studies or researches as may inform the taskforce on its mandate.

3. The taskforce shall complete its work and submit its final report to the Cabinet Secretary not later than three months from the date of its first appointment and the Cabinet Secretary for Health may when necessary extend the period.

4. The secretariat of the taskforce shall be based at the Ministry of Health. Submission from the public can be addressed to the Secretary, Taskforce to Review matters relating to genetically modified foods and food safety P.O. Box 30016, Nairobi.

JAMES W. MACHARIA,
Cabinet Secretary for Health.

GAZETTE NOTICE NO. 13608

THE FIREARMS ACT

(*Cap.* 114)

APPOINTMENT

IN EXERCISE of the powers conferred by section 3 of the Firearms Act, the Inspector-General of Police appoints—

C.I. Simon Nyabocwa Kebori,
C.I. William Chepkwony,
C.I. (W) Joyce Ngina Mutisya,

to be Licensing Officers for the purpose of the Act.

Dated the 4th July, 2013.

DAVID M. KIMAIYO,
Inspector-General, National Police Service.

GAZETTE NOTICE NO. 13609

THE CONSTITUTION OF KENYA

THE COUNTY GOVERNMENTS ACT

(*No.* 17 *of* 2012)

NAIROBI CITY COUNTY

APPOINTMENT OF TASK FORCE FOR THE AUDIT AND EXAMINATION OF THE DELIVERY OF LEGAL SERVICES TO THE NAIROBI CITY COUNTY GOVERNMENT

IT IS NOTIFIED for public information that I, Evans Odhiambo Kidero, the Governor of the Nairobi City County, have appointed a Task Force with the following Terms of Reference—

(a) To review the organizational structure and hierarchical level of the county legal unit within the county government and recommend—

(i) an organizational structure that will generally enable and facilitate effective overall delivery of services in the county;

(ii) the organisational relationship between that unit and the office of the Governor and other organs and departments of the county government that make use of legal services;

(b) To audit all ongoing legal cases and advise the Governor on the way forward with respect to each case;

(c) To advise the Governor with respect to the legal fees demanded by the advocates from the County Government on the respective cases;

(d) To determine the reasons/causes for the unusual high number of cases against the defunct Nairobi City Council and recommend any change in the management of the affairs of the County Government so as to minimize litigation and /or legal disputes involving the county government and, in this regard, also develop a legal risk evaluation tool;

(e) To peruse any past reportson the delivery of legal services to the defunct Nairobi City Council by other public and other agencies and recommend implementation strategies of their recommendations,if any;

(f) Recommend considerations to be taken into account in the procurement of legal services so as to ensure equity to service providers, implementation of the constitutional and other government policy pronouncements on procurement and to the optimum value from service providers;

(g) To consider any other matter related and incidental to the foregoing and make such recommendations as may be appropriate;

(h) To report to the Governor its findings and recomendations.

The members of the Task Force shall be as follows—

Jinaro Kibet, Chairperson, Advocate;

Gad Awuonda, Legal Advisor, Office of the Governor of Nairobi City County;

Charles Mutinda, Nominated by the Attorney-General;

Appolo Mboya, Secretary, Law Society of Kenya;

Mercy Kamau (Ms.), County Executive Committee member for Public Service Management;

Robi Vincent Sarara, Nominated by the Commission on Administrative Justice;

Jacob Ngwele, Clerk, the Nairobi County Assembly;

Anthony Ongondi, Nominated by the Ethics and Anti-Corruption Commission;

Frederick Riaga, Nominated by the Institute of Certified Public Accountants;

Karisa Iha, Special Advisor to the Task Force-the Director, Legal Services, Nairobi City County

Festo Fadamula (Dr.), Secretary, Political Advisor, Office of the Governor of Nairobi City County and who will be assited by Paul Aol.

Powers and Mode of Operation of the Task Force:

In the execution of its mandate, the Task Force may—

(a) in the absence of the Chaiperson, the members shall chose one of their own to preside;

(b) from time to time co-opt such persons as may possess such expertise necessary for the execution of the mandate of the Task Force;

(c) interview any person it deems necessary;

(d) consult such sources of information as may be approriate;

(e) invite memorandum from relevant institutions and the public generally;

(f) engage the services of such experts, including forensic experts and investigators to assist it in its work;

(g) subject to the foregoing, the Task Force shall regulate its own procedure.

Duration of Assignment:

The Task Force shall, subject to any extension that the Governor may authorise, execute its mandate and submit its report to the Governor, not later than four months from the date of its commissioning.

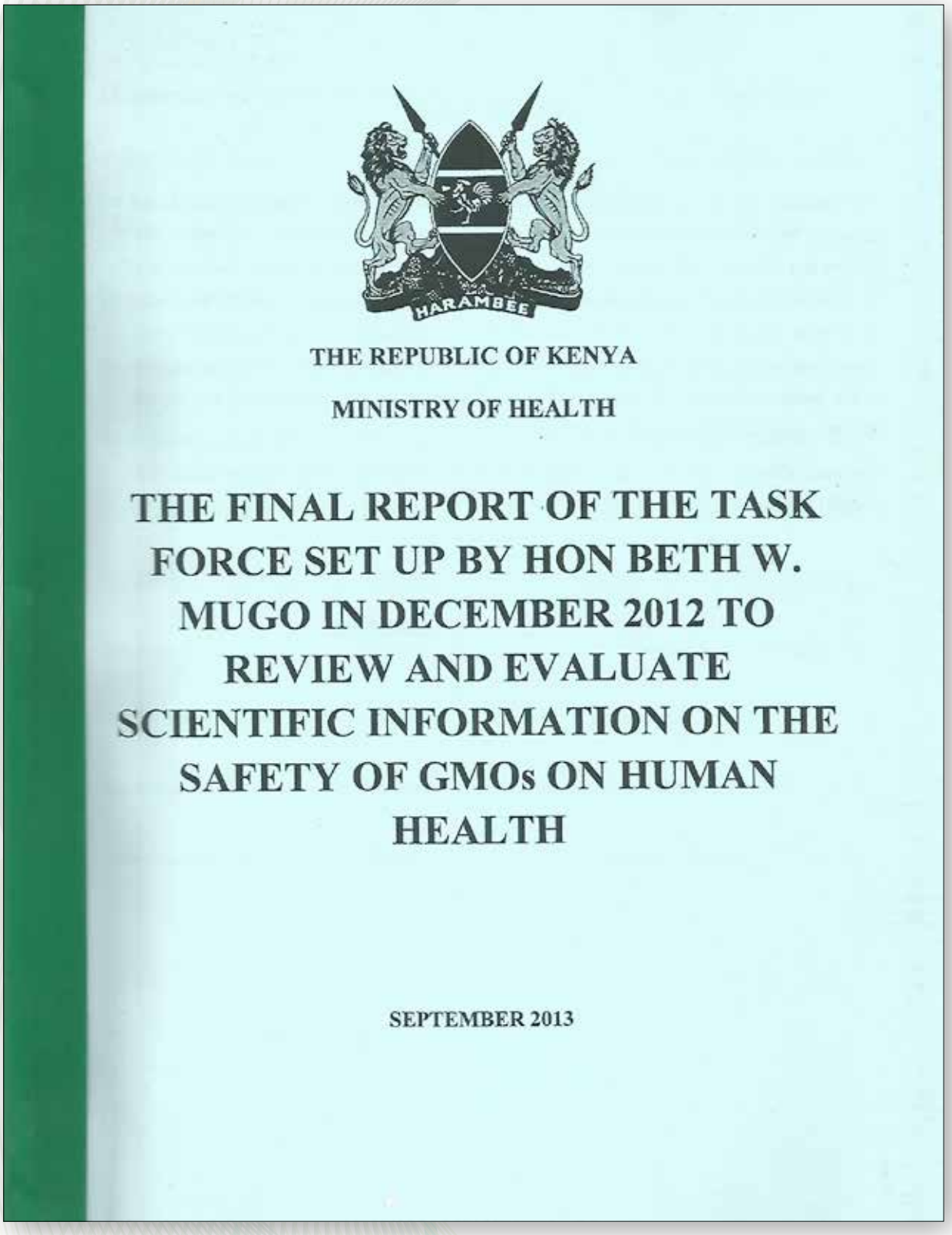
Subject to the foregoing paragraph, the Task Force may, if it deems it expedient to do so, submit to the Governor interim reports proposing measures for immediate implementation before its final report.

The Secretarial Support and Facilitation:

The Secretarial support to the Task Force shall be provided by the office of the County Secretary and that office shall provide the necessary facilitation of the process to ensure effective and timely delivery by the Task Force on its mandate.

The members of the Task force shall be paid such sitting allowances as may be authorised by the Governor and these shall be defrayed out of the Funds of the county government.

Appendix 3: Taskforce report to Mugo 2013



THE REPUBLIC OF KENYA

MINISTRY OF HEALTH

THE FINAL REPORT OF THE TASK FORCE SET UP BY HON BETH W. MUGO IN DECEMBER 2012 TO REVIEW AND EVALUATE SCIENTIFIC INFORMATION ON THE SAFETY OF GMOs ON HUMAN HEALTH

SEPTEMBER 2013

Members of the Task Force Appointed in December 2012 by Hon Beth Mugo

Prof. Kihumbu Thairu	Chairman	Founding member KEMRI, member KEM Board of Management
Prof. Ruth Nduati	Member	Chairperson KEMRI Board of Management
Prof. Solomon Mpoke	Member	Director KEMRI
Prof. Samuel Gudu	Member	Principal, Rongo University College
Prof. Shaukat Abdulrazak	Member	CEO, National Council for Science a Technology
Prof. Marion Wanjiku Mutugi	Member	Biomedical Research Scientist, Trainer a Manager, JKUAT
Dr. Nancy L. Budambula	Member	Senior Lecturer, Department of Botany, JKUAT
Dr. Anne Wangai	Member	Chief Research Scientist, Crop Protection Virology, KARI
Dr. Joy Wanjiru Kiano	Member	GMO scientist, private sector
Dr. Gerald Mkoji	Member	Chief Research Officer, KEMRI
Mrs. Caroline Kithinji	Recorder	Ethics Review Committee, KEMRI

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10.5 Recommendations by the GM Task Force Regarding the Ban

It is the position of the Task Force Appointed by Hon Beth W. Mugo in January 2012, that cabinet exercised the **precautionary principle** in banning the importation of GM foods in the country. Their decision was in tandem with the approach that policy makers can make discretionary decisions in situations where there is the possibility of harm when extensive scientific knowledge on the matter is lacking or when scientific investigation has found a plausible risk. This principle further states that this is a social responsibility to protect the public from exposure to potential harm until scientific findings emerge that provide sound evidence that no harm will result.

From our review of the scientific information and mechanisms in place, we have come to the conclusion that the safety of GM foods has not been conclusively demonstrated to allow for the lifting of the ban. The Task Force therefore recommends that the following actions be taken, in order of priority before the lift of the ban is considered:

1. **Development and adoption of the requisite guidelines for testing of GMOs for safety in regard to human health;**
2. **Developing the capacity for the determination of safety of GMO events (i.e products) on a case to case basis with respect to the GMO event;**
3. **Development and strengthening of regulatory framework for production, monitoring and marketing of GMOs in the country;**
4. **Enhancement of infrastructural and human capacity of the regulators such as the NBA to carry out the requisite tests in house;**
5. **Developing adequate infrastructure for carrying out and where necessary replicating long term clinical trials by Kenyan scientists funded solely by the government of Kenya and not by external donors or producers.**

Signed ----------

Date November 15th 2013

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Appendix 4:

MINISTRY OF PUBLIC HEALTH AND SANITATION

Telegrams:"MINIHEALTH", Nairobi
Telephone Nairobi 0202717077
Email: psph@health.go.ke
When replying please quote
MPHS/DC/2/10/04

AFYA HOUSE
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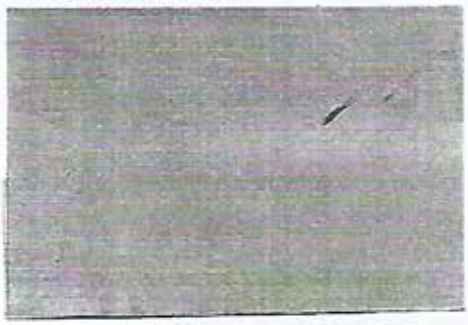
Date: 19th December, 2012



RE: TASK FORCE TO REVIEW AND EVALUATE SCIENTIFIC INFORMATION ON SAFETY OF GMO FOODS ON HUMAN HEALTH

I am pleased to inform you that you have been appointed as a member of the above Task Force to review and evaluate scientific information on effect(s) of GMO foods on Human health. The exercise of the Task Force is expected to take ninety (90) working days starting 14th January, 2013.

The Taskforce will be chaired by KEMRI.

The Terms of Reference of this Task Force are to:

1. review of literature on scientific data from clinical trials on effect(s) (both short- and long-term) of GMO foods on human and animal health;

2. assessment of infrastructural capacities in Kenya to monitor GMO products in the country;

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3. make recommendations on GMO foods and food security in the country;

4. make recommendations on safety of GMO foods to human health;

5. assess and make appropriate recommendations on the general administration and management of GMO food imports into Kenya, and in particular:

   a) adequacy of qualified human resource capacity to monitor research, use and importation of GMO products in the country;

   b) approval procedures for import of GMO food by the relevant regulatory agencies;

   c) examination of the legal framework and systems for biotechnology on GMO foods in the country and in the region;

   d) coordination of the regulatory agencies;

6. revisit published and controversial research papers on safety assessment of GMO foods;

7. analyze the possible reasons and underlying factors for ban of GMO importation, cultivation and/or trade by some countries;

8. develop a policy direction and advice the government on whether to maintain or lift the ban; and

9. look into any other issues pertinent to the safety of GMO foodstuffs which are not specifically identified in the above Terms of Reference.

10. The taskforce is further mandated to:

   a) co-opt any resource persons as and when necessary on short-term basis to assist in fulfilment of the terms of reference;

b) make reports/updates fortnightly to the Minister for Public Health and Sanitation, outlining any matters that may require urgent action; and

c) make recommendations on the actions to be undertaken by any person(s) including the Government on matters relating to GMOs and food safety.

The full and final report of the taskforce should be submitted to the Government through the appointing authority within ninety working days.

Yours Sincerely

Hon. Beth W. Mugo, EGH, MP
MINISTER FOR PUBLIC HEALTH AND SANITATION

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Appendix 5:

SECRETARIAT
College of Agriculture & Veterinary Sciences,
UoN, Kapenguria Rd, Off Waiyaki Way

Kenya University Biotech Consortium
Championing Agricultural & Health advancement through biotechnology

Tel: 254 738888817
Email:
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KENYA UNIVERSITY BIOTECHNOLOGY CONSORTIUM

Project: Opportunities for investment in biotechnology and agribusiness

QUESTIONNAIRE

Date _____/_____/_____

Your contribution to this study is highly appreciated. The information collected in this survey will be treated as confidential. Specific information collected from each single respondent will not be presented in our final report; rather, responses will be grouped under general categories, to avoid any direct relationship between the conclusions presented in the final report and a specific institution or person.

1. **Contact Information**

For principal officer responding this questionnaire

1.1 Name and designation:

1.2 Institutional affiliation:

1.3 Email address:

1.4 Contact telephone number:

1.5 Sectoral information (*Tick [✓] as appropriate*)

Grain milling	
Cereal grower	
Food and feed manufacturing	
Manufacturing of edible products	
Academic	
Research	
Regulator	
Government agency	

2. **Manufacturing and milling Sector**

2.1 From which region do you currently source your raw materials?
(*Tick [✓] as appropriate*)

Within Kenya ☐

East Africa ☐

Southern Africa ☐

United States of America ☐

Europe ☐

Other (*please specify*) ☐

2.2 Do your raw materials include/contain any of the following (*Tick [✓] as appropriate*)

Maize or corn ☐

Soybean ☐

Cotton ☐

Rice ☐

Sugar beet ☐

Canola ☐

Wheat ☐

2.3 Would you be willing to use raw materials improved through genetic modification? (*Tick [✓] as appropriate*)

If it is cheaper than non-GM ☐

If reliably available within the country ☐

If it has improved quality ☐

If it is developed locally ☐

If developed by multinational companies ☐

2.4 What is the target market for your products? (*Tick [✓] as appropriate*)

Within Kenya ☐

East Africa ☐

Outside the East African Community (EAC) ☐

2.5 Are you aware of any current restriction on importation of genetically modified (GM) products into Kenya? (*Tick [✓] as appropriate*)

Yes ☐ No ☐

2.6 What is your comment on the ban on importation of GM products?

2.7 To what extent has the ban affected the SOURCES of your raw materials?
(*Tick [✓] as appropriate*)

Not at all ☐

Minimally ☐

Moderately ☐

Severely ☐

2.8 From where did you source your raw materials before then ban?
(*Tick [✓] as appropriate*)

2.9 To what extent has the ban affected the PRICES of your RAW MATERIALS?
(*Tick [✓] as appropriate*)

Not at all ☐

Minimally ☐

Moderately ☐

Severely ☐

2.10 To what extent has the ban affected your production volume?
(*Tick [✓] as appropriate*)

Not at all ☐

Minimally ☐

Moderately ☐

Severely ☐

2.11 Please provide production volume for periods 2010 – 2016

2.12 What is your total workforce? (*Tick [✓] as appropriate*)

Below 100 ☐

100 – 1000 ☐

Over 1000 ☐

2.13 Has the ban necessitated reorganization of your human resources?
(*Tick [✓] as appropriate*)

Not at all ☐

Minimally ☐

Moderately ☐

Severely ☐

2.14 To what extent has the ban affected the retail PRICES of your PRODUCTS?
(*Tick [✓] as appropriate*)

Not at all ☐

Minimally ☐

Moderately ☐

Severely ☐

2.15 Given a platform, is your sector ready to express these concerns?
(*Tick [✓] as appropriate*)

Yes ☐ No ☐

2.16 If NO, please explain your lack of interest

3. **Academic and research institutions**

3.1 Do you offer training in biotechnology? (*Tick [✓] as appropriate*)

Yes ☐ No ☐

3.2 If applicable, what is your cluster aggregate for admission into BSc. biotechnology courses?

3.3 Do you use the following facilities/instruments for research and training in biotechnology?
(*Tick [✓] as appropriate*)

Plant transformation facility	Yes	☐	No	☐
DNA analysis lab	Yes	☐	No	☐
Bioinformatics	Yes	☐	No	☐
Facility for animal models	Yes	☐	No	☐
Toxicology lab	Yes	☐	No	☐
Institutional Biosafety Committee	Yes	☐	No	☐
Ethical Review Committee	Yes	☐	No	☐
Qualified and competent staff	Yes	☐	No	☐

3.4 What is the cluster aggregate for admission into each of the following degree courses, or their nearest equivalent?

BSc. Food Science/nutrition ☐

BSc. Biology ☐

BSc. Agriculture ☐

BSc. Fisheries ☐

3.5 Provide data on TOTAL NUMBER of students admitted to your university in the last six years (2010 – 2016) (*From University and KUCCPS*)

	Govt. sponsored	Self sponsored
2010/2011		
2011/2012		
2012/2013		
2013/2014		
2014/2015		
2015/2016		

3.6 Provide data on students enrolled into BIOTECH courses in the last six years (2010 – 2016)

	Govt. sponsored	Self sponsored
2010/2011		
2011/2012		
2012/2013		
2013/2014		
2014/2015		
2015/2016		

3.7 How many students transferred (a) from biotech to other courses, (b) from other courses to biotech, in the following years?

	Transfer from biotech course	Transfer to biotech course
2010/2011		
2011/2012		
2012/2013		
2013/2014		
2014/2015		
2015/2016		

3.8 What is the total research funding held in your institution in the following years?

	Overall Funding	Biotech Funding
2010		
2012		
2014		
2016		

3.9 What is the NEW research funding received at your institution in the following years?

	Overall Funding	Biotech Funding
2010		
2012		
2014		
2016		

3.10 Have you faced a situation where you have to terminate a degree or research programme related to biotechnology in the following years?

2010-2011 ☐

2012-2013 ☐

2014-2015 ☐

2016 ☐

3.11 Are you aware that importation of GM foods was banned by the government a few years ago? (*Tick [✓] as appropriate*)

Yes ☐ No ☐

3.12 If YES, has the ban affected your research and training in any way?

☐

3.13 Given a platform, is your sector ready to express these concerns?
(*Tick [✓] as appropriate*)

Yes ☐ No ☐

3.14 If NO, please explain your lack of interest

☐

4. **Regulatory and other government agencies**

4.1 Provide the number of import permits for GM products in the years 2010-2016

	Applications	Approvals
2010		
2011		
2012		
2013		
2014		
2015		
2016*		

4.2 Provide the number of projects for GM research in the years 2010-2016

	Applications	Approvals
2010		
2011		
2012		
2013		
2014		
2015		
2016*		

4.3 Provide the number of field trials (CFT and NPT) for GM crops in the years 2010-2016

	Applications	Approvals
2010		
2011		
2012		
2013		
2014		
2015		
2016*		

4.4 Do you use the following in your regulatory role?
(*Tick [✓] as appropriate*)

Reference labs	Yes		No	
Other regulatory agencies	Yes		No	
Institutional Biosafety Committees	Yes		No	
Expert Reviewers	Yes		No	
Market surveillance	Yes		No	
Qualified and competent staff	Yes		No	
Compliance monitoring	Yes		No	
Awareness promotion/public education	Yes		No	

4.5 Provide the import volume (metric tonnes) for grains in the years 2010-2016

	Non GM grains	GM grains
2010		
2011		
2012		
2013		
2014		
2015		
2016*		

4.6 How much cargo do you expect to be diverted to other ports due to existing ban on importation of GM foods?

4.7 Please provide other comments that relate to GM technology and products in Kenya

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