



## **SURVEY OF PUBLIC AWARENESS ON BIOSAFETY ISSUES IN TANZANIA**

**Vice President's Office**

**2012**

## **Executive summary**

Modern biotechnology is an emerging novel technology with potentials in improving human and animal health, agriculture, industrial and agricultural production as well as the environment. However, risks and opportunities associated with the development and use of modern biotechnology particularly over human and animal health, species biodiversity and the environment are not well understood, hence concerns among Tanzanians. In an attempt to protect the right to food security and social-welfare of her citizens, Tanzania became a member to most of international environment protection treaties and ratified the associated protocols including the Convention on Biological Diversity (CBD), International Treaty on Plant Genetic Resources for Food and Agriculture, and the Cartagena Protocol on Biosafety (CPB). Moreover, in lieu of formulating appropriate policies and instituting useful regulations that would guide the rational use of modern biotechnology, the need to evaluate awareness of Tanzanians about the GMOs and product thereof was found imperative, hence the current study. The study established that GMOs are poorly understood amongst Tanzanians except for a small section of elites at tertiary level of education. Awareness campaigns through workshops and meetings played an appreciable role to the knowledge on GMOs although a small segment has been reached. Most Tanzanians sees GMO and modern biotechnology as disadvantageous and consider Health and Agricultural sectors to be the most affected. It is assumed that tourism sector might also be affected in the long run. Knowledge on the existence of biosafety regulation regimes is also limited among Tanzanians. It is recommended that, concerted effort that will involve various actors from different sectors is required in an attempt to deliver the right message to the needy population on modern biotechnology at the appropriate time. Training focus should take interest on farmers, women and elderly people in the respective communities.

## LIST OF ACRONYMS AND ABBREVIATIONS

CBD	Convention on Biological Diversity
CPB	Cartagena Protocol on Biosafety
DALDO	District Agriculture and Livestock Development Officer
GEO	Genetically Engineered Organisms
GMO	Genetically Modified Organisms
GM	Genetic Modification
NBF	National Biosafety Framework
NEMC	National Environment Management Commit
TBS	Tanzania Bureau of Standards
TFDA	Tanzania Food and Drug Authority
TPRI	Tropical Pesticide Research Institute
TOSCI	Tanzania Official Seeds Certification Institute
TV	Television
UNEP	United Nations Environment Programme
UN	United Nations
VPO	Vice President Office

# 1: INTRODUCTION

## 1.1. Background

**Biotechnology** refers to any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use (Anon, 2012). Biotechnology draws on the pure biological sciences (genetics, microbiology, animal cell culture, molecular biology, biochemistry, embryology, cell biology) and in many instances is also dependent on knowledge and methods from outside the sphere of biology such as chemical engineering, bioprocess engineering, information technology and biorobotics (UN, 2008). The combined use of different technologies in ways that maintains genetical integrity of the respective organisms is considered purely biotechnology. However, whenever biotechnological application involves modification of the genetical composition of individuals, the term

**Modern Biotechnology** is applied. According to UNEP, modern biotechnology is a term adopted by international convention to refer to biotechnological techniques for the manipulation of genetic material and the fusion of cells beyond normal breeding barriers: (Berger and Arendal, 2009). The most obvious example is genetic engineering to create genetically modified/engineered organisms (GMOs/GEOs) through “transgenic technology” involving the insertion or deletion of genes.

Modern biotechnology is an emerging novel technology with potentials in improving human and animal health, agriculture, industrial and agricultural production as well as environmental protection. This emerging technology was anticipated to play a significant role in the 21<sup>st</sup> century in advancing socio-economic development as stipulated in the National Science and Technology Policy (1996) and the National Biotechnology Policy (2010). However, the development and applications of modern biotechnology have been associated with both opportunities and concerns over the risks of GMOs to human and animal health, biodiversity and the environment. Concerns raised against modern biotechnology may be grouped into environmental; human health; biodiversity; and socio-economic and ethical concerns.

- a) *Environmental concerns* include increase in weediness; toxicity to non-target organism; super pests and super diseases; negative impacts on biodiversity; and effect on the purity of other crops.
- b) *Human and animal health (food and feeds)* concerns cover the potential for gene transfer from GM plant to gut microflora and mammalian cells; safety of antibiotic resistance marker gene used for the selection of GM plants; potential of transgenes contaminating the food chain and potential allergenicity and toxicity in GM foods.
- c) *Socio-economic and ethical concerns* arise due to companies controlling their processes, genes and chemicals. Socio ethical concerns revolve around ethical or dietary implications of vegetarians or certain religious groups and choice of consumers.

In lieu of these concerns and uncertainty, modern biotechnology is viewed as a complex emerging issue that is outstanding although with limited public awareness and knowledge. As a result, public interest and concern over GMOs issues have been growing over the past years and are now on the national agenda.

Research on Modern biotechnology dates back in early 1980s but was not commercialized until late 1990s. A large number of Genetically Modified Crops (GMCs) and Foods were developed to address hunger and malnutrition problems around the world. Some of the typical example of GM product includes maize and cotton cultivars genetically engineered with the *Bacillus thuringiensis* gene (popularly known as Bt maize and cotton) to impart resistance against destructive insect pests (FAO, 2008), crops engineered for herbicide tolerance including Round-up Ready Canola and Soybean (FAO, 2008; Rowe, 2004), and “Golden rice” that has increased Vitamin A content (Bonny, 2003; Hoban 2002). Most of these commercial releases were based in developed countries mostly the USA, Canada, European countries and South Africa. Tanzania is yet to commercialize Genetically Modified Organisms (GMOs) apart from few laboratory experiments and field trials.

This necessitated formulation of necessary policy, legal and institutional framework for ensuring safe use and application of modern biotechnology. Thus Tanzania became a member of the Convention on Biological Diversity (CBD) and ratified the Cartagena Protocol on Biosafety (CPB) in March, 2003. The country also ratified the International Treaty on Plant Genetic Resources for Food and Agriculture in April, 2004 (ESAANet, 2007).

Tanzania being a Party to the Convention on Biological Diversity (CBD) and its Cartagena Protocol on Biosafety (CPB) is obliged to promote and facilitate public awareness, education and participation concerning the safe transfer, handling and use of GMOs in relation to the conservation of biological diversity, taking into account the risks to human and animal health (Article 23 of the CPB). Likewise, the Environmental Management Act, 2004 as well as Biosafety Regulations, 2009 provides for promotion and facilitation of public awareness, education and participation concerning the safe transfer, handling and use of GMOs and products thereof. Other existing relevant instruments that insist for public awareness and participation include the National Biosafety Framework (NBF) (2007) and the National Biotechnology Policy (2010).

There are few surveys on public awareness and perception of modern biotechnology in the country that have been conducted over the past few years (Mneney, 2003; and Lewis *et al*, 2009). These surveys have revealed extremely low level of public awareness on GMOs issues. In this regard, numerous efforts have been undertaken by the Government and other stakeholders in improving public awareness through introduction of modern biotechnology in tertiary educational curricula, workshops, dissemination of awareness materials and media. In view of the identified gaps and efforts made, it was necessary to assess the current level of public awareness and understanding so as to facilitate in devising strategies and measures for improved public participation and decision making.

## **1.2 Justification of the Assignment**

Modern biotechnology is an emerging innovative technology that is considered as key to next green revolution. It is therefore necessary to capture the proven benefits arising from health, agriculture, industry and environmental applications of modern biotechnology while protecting and sustaining the safety of community and the environment.

General global trend suggests divided perception and acceptance of modern biotechnology in view of associated potential risks. This mixed reception of this technology created the need to promote public understanding and awareness for its beneficial adoption, safe use and application. This survey was therefore commissioned to assess the present level of awareness and perception of modern biotechnology among various target groups of stakeholders in the country. It is anticipated that the results of this survey will facilitate in devising appropriate strategies for effective promotion of public awareness and perception on modern biotechnology in the country.

## **1.3 Objectives of the assignment**

### **1.3.1 Overall Objective**

The overall objective of the study was to create information base that would guide strategic policy interventions on public awareness on Genetically Modified Organisms (GMOs).

### **1.3.2 Specific Objectives**

The specific objectives were to:

- i) Determine the current status of public awareness on Genetically Modified Organisms (GMOs) and products thereof;
- ii) Assess public perception of Genetically Modified Organisms (GMOs) and products thereof;

- iii) Determine awareness level on national regulatory framework of GMOs and products thereof; and
- iv) Propose strategic measures for improving public awareness.

## **2. METHODOLOGY**

### **2.1 Study Location**

The study was carried out in three out of seven designated agro-ecological zones in the country. The zones were selected randomly. However, the time frame for which the study had to be completed, accessibility of the location, and budgetary constraints dictated the choices of the study areas. Selected study areas were Central Zone (Dodoma - *arid land/ drought prone*), Eastern zone (Morogoro - *high rainfall and fertile soil with many high learning institutions*) and Northern zone (Same - *semi arid with lots of farming communities*).

### **2.2 Data collection**

The study was conducted through survey and data collected by using a structured questionnaire (Annex 2), that was carried out from February to March 2012. The questionnaire consisted of three parts. The first part was on profile of the respondent (such as age, education level and occupation), the second part was on awareness and perception on GMOs whereas the third part was on proposed measures and strategies for improving public awareness and regulation of GMOs in the country.

The questionnaire was pre-tested on ten respondents in some township and rural areas of Morogoro, prior to its effective use. Some issues that required adjustment were corrected such that asked questions would lead to obtaining the intended information. Thereafter, the Team Leader trained the enumerators prior to the commencement of the survey. During training, the survey team went through the questionnaire to clarify areas of ambiguity and emphasize key variables of interest.



Survey data was collected through oral administration of the questionnaire by trained enumerators. A total of 7 major categories of respondents were formed and these are Academia; Regulatory Authorities; Service provider; Farmers; Non-government Organizations (NGOs); and Media (Table 1). The survey targeted a minimum of 100 respondents per zone and a total of 302 respondents were interviewed (Table 2). The survey approach used was purposive selection of the main target group followed by randomization. The selection process was made in such a way that adequate representation of men and women, rural and urban population, as well as public, private and self-employed individuals were covered.

**Table 1: Categories of the Targeted stakeholders**

Category	Description
i) Academia	University lecturers, researchers and students
ii) Regulatory Authorities	Government Ministries and Departments, Agencies and Institutions including Local Government Authorities responsible for regulating biosafety & related issues.
iii) Service provider	Input supply companies/authorities, service provision agencies and extension service Officers.
iv) Farmers	Individual/ companies involved in agricultural activities majoring on either crops or livestock.
v) Non-government Organizations (NGOs)	Local associations (NGOs) advocating in to social welfare and environmental management issues.
vi) Media	Journalists (instructors and employee of public and private media companies).

**Table 2: Profile and distribution of the respondents**

	Frequency	Percentage
<b>Respondent's group</b>		
Academia	58	19.21
Regulatory authorities	57	18.87
Service provider	33	10.93
NGOs	20	6.62
Farmers	120	39.74
Media	14	4.64
<b>Sex</b>		
Female	168	55.63
Male	134	44.37
<b>Age distribution</b>		
18-35	169	55.96
36-50	96	31.79
> 50	37	12.25
<b>Location of the respondents (zone)</b>		
Eastern zone	100	33.11
Central zone	100	33.11
Northern zone	102	33.78

### 2.3 Data analysis

Statistical Package for Social Sciences (SPSS) version 20.0 was used for data analysis. Descriptive statistics were made.

### **3. RESULTS AND DISCUSSION**

#### **3.1 Respondents' awareness of GMOs**

##### **3.1.1 General observations**

Respondents were asked whether they had heard about GMOs and if so, provide the year during which they heard about it and mechanism through which they were informed. The obtained results indicated that 32.7% of the respondents had heard about GMOs while a greater proportion of the respondents (67.3%) had not heard about GMOs (Fig. 1). Generally, this suggests very low level of awareness among the respondents. Moreover, of the respondents who have heard about GMOs, 77.6% indicated to have been aware over the last ten years in 2000s (2000-2009). Only a small proportion of respondents of about 2% indicated to have heard of GMOs in the 1980's (Fig. 2). These results portrays the fact that modern biotechnology is recent and an emerging technology whose publicity increased after commercialization of GM crops particularly in the USA 1996 and later on in the rest on European countries followed by the lone advocate of GMO in Africa, South Africa in 1997 (Aerni, 2002). It is worth noting that the respondents who indicated to have heard about GMOs before their global commercialization (before mid-1990s) were from academic and research institutions suggesting that they might have come across GMOs issues during their studies overseas.

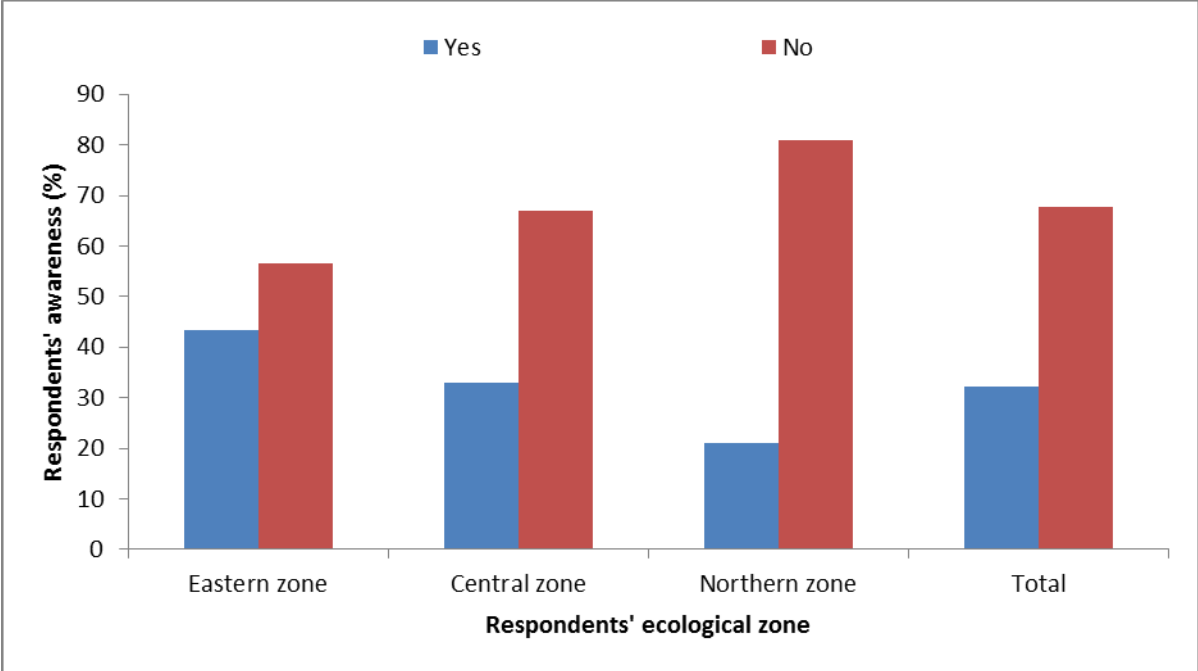


Figure 1. Awareness of respondents on GMO in the surveyed zones

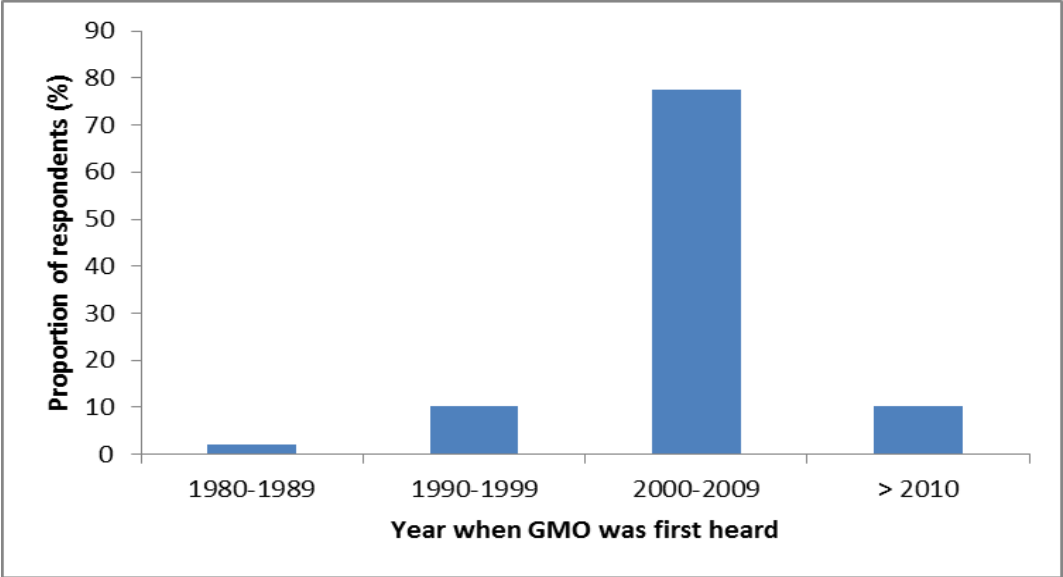
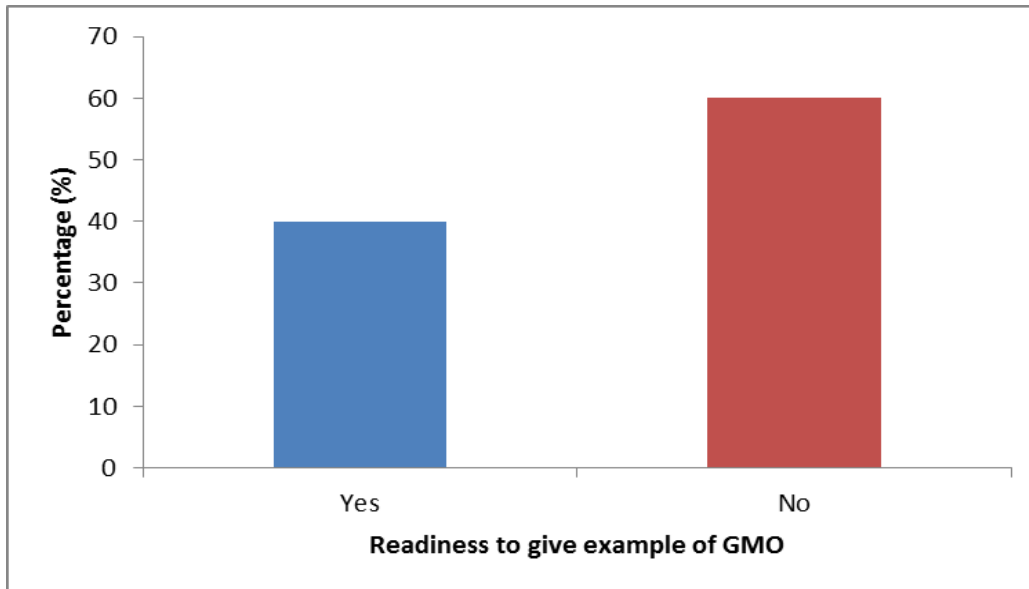


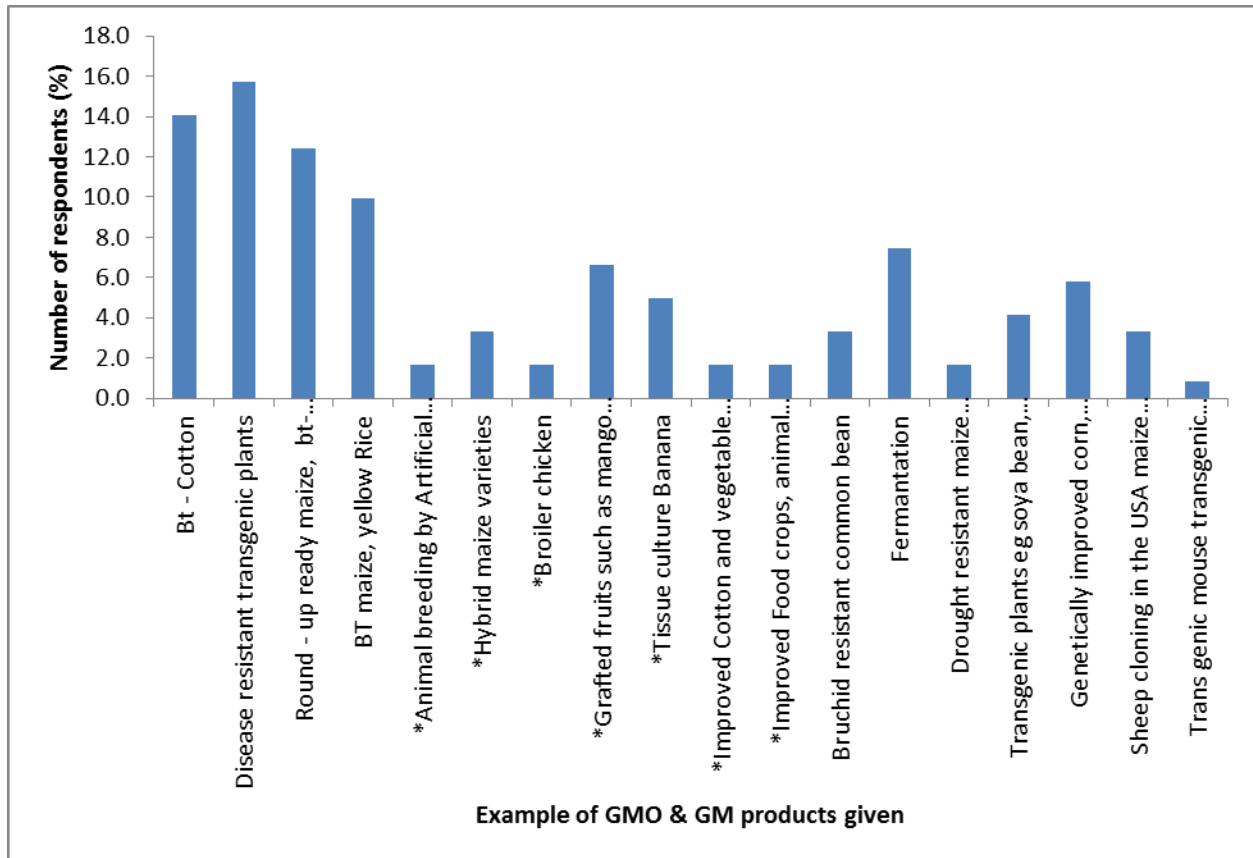
Figure 2. Distribution of respondents with respect to time when first heard of GMO

### 3.1.2 Relevant examples of GMO

In an attempt to ascertain the respondents' knowledge of GMOs, they were asked to give typical examples of either GMOs or product thereof. Out of the respondents who have heard about GMOs, 40% claimed to be able to give examples while majority (60%) declared not being able to (Fig. 3). Unfortunately, 21.6% of those who gave examples provided wrong examples such as broiler chicken, tissue culture banana, improved maize varieties, animal breeding by artificial insemination and improved mango varieties from Sokoine University of Agriculture (SUA) (Fig. 4).



**Figure 3.** Respondents' readiness to give examples of GMO and GM products



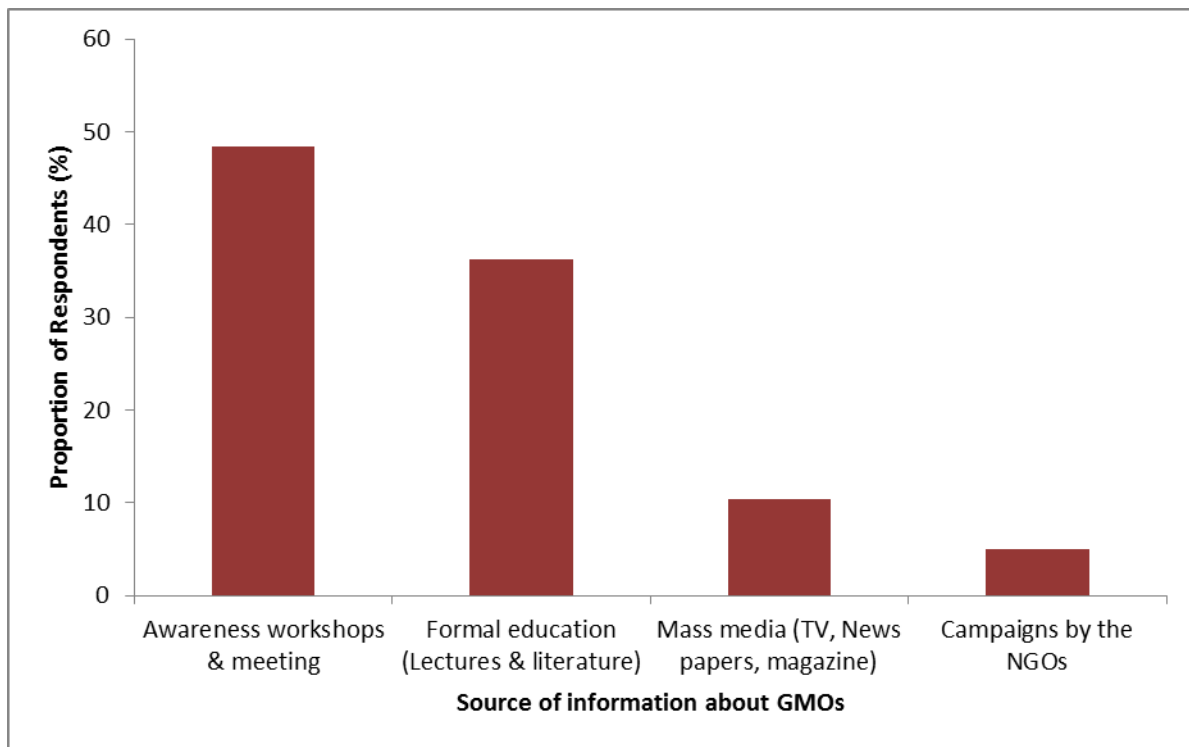
**Figure 4.** GMO and GM products examples given by the respondents

These results further reveals the limited level of public understanding of GMOs even among those have heard of it. Additionally this would be an awakening call to the Universities like SUA and many other institutions that uses improved technologies like tissue culture, grafting and artificial insemination to provide relevant information to the public regarding their products. This would serve to minimize confusion between conventionally improved products and GMOs.

### 3.1.3 Source of information about GMOs

The results further reveal that workshops and meetings (48.4%) was the major source of information from which respondents were informed and gained knowledge about GMOs followed by news media (print and electronic) (36.2%) and academic and research institutions (10.4%) while NGOs were ranked the least (5%) source of

information regarding GMOs (Fig. 5). The findings suggest workshops and meetings as very important source of information. This was consistent with the existing indicative figure about education on public awareness on GMO whereby many workshops and meetings were organized countrywide between 2005 and 2010 by various stakeholders including the Vice President Office, COSTECH and NGOs like Envirocare and MVIWATA. For instance, the Vice President's Office organized about 30 workshops and meetings over the past 5 years involving more than 25,000 stakeholders (VPO, Personal Communication). Although NGOs play a significant role in advocacy and public awareness, the current study revealed that NGOs had limited contribution on public awareness about GMOs, contrary to expectations. This may be due to existence of very few NGOs involved in advocacy of GMOs issues in the country suggesting the need for increase vibrancy among the existing ones.

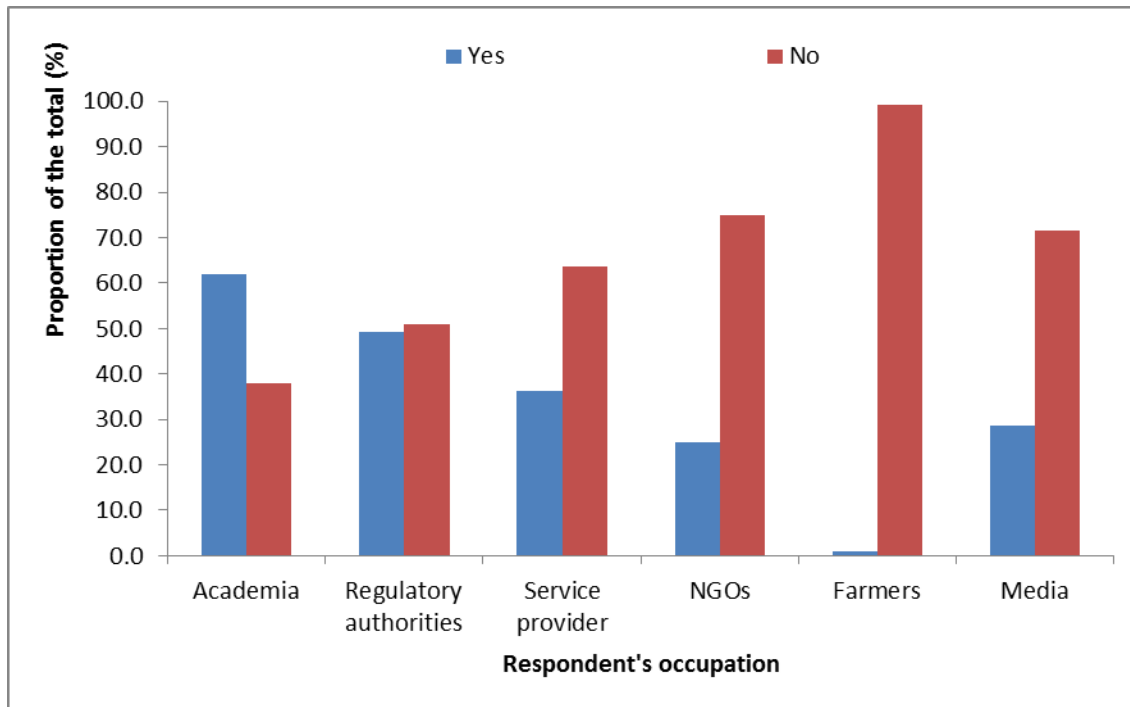


**Figure 5.** Sources of information about GMO and GM products

### **3.2 Comparison across stakeholder groups**

In comparing level of awareness on GMOs across stakeholder groups, it was found that academia had the highest level of awareness (62.1%) followed by Government Regulatory Authorities (49.1%), Input/Service Providers (36.4%), Media (28.6%), NGOs (25%) whereas almost all farmers lack awareness on GMOs (0.85%) (Fig. 6). These results can be partly attributed to inability of some of the stakeholder groups particularly farmers to have limited access to relevant information about GMO. Contrary to expectations, the level of awareness among respondents from the mass media was relatively low. This is based on the fact that media have always been treated as the most important segment of participants in most of awareness workshops organized by the VPO office (VPO, Personal communication). The probable cause for such low level of awareness is that GMOs issues might not be subject of interest to readers, listeners and viewers or not selling for commercial purposes hence rarely tops the media headlines. As such, media personnel have limited interest on GMO and therefore, poorly informed about it. Very often, the media would be the greatest and dependable sources of information to the public. Such low levels of knowledge about GMO issues suggest a need for training to specific groups.

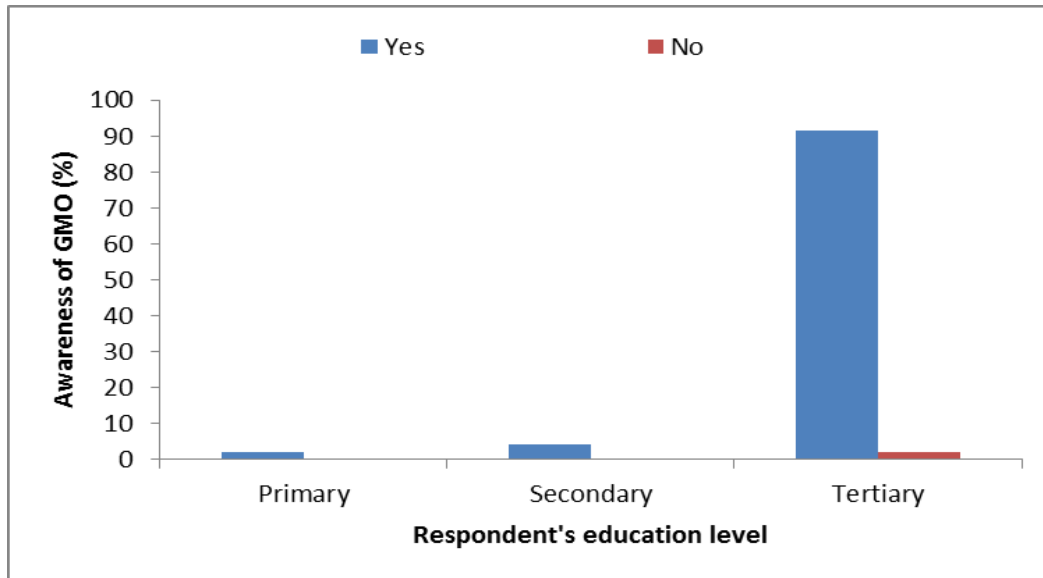




**Figure 6.** Awareness on GMO and GM products across stakeholders groups

### 3.2.1 Influence of education level

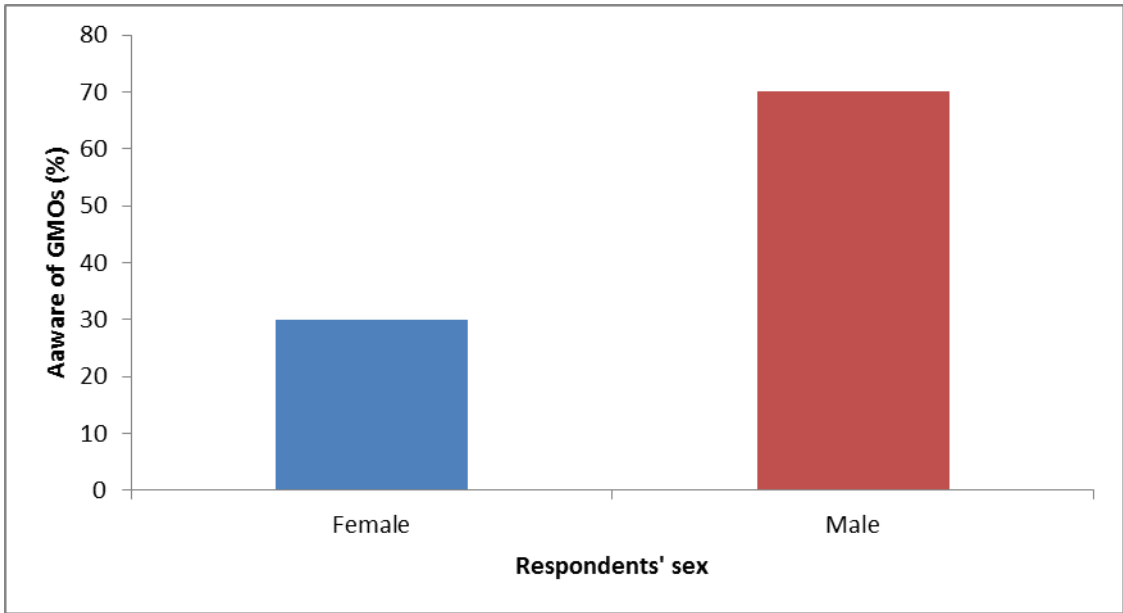
Majority of respondents with tertiary education level (91.7%) were found to be aware of GMOs issues as compared to those with secondary (4.2%) and primary education level (2.1%) (Fig. 7). These results can be partly attributed to direct exposure of respondents with tertiary education level on modern biotechnology issues through formal education which may have contributed to their high level of awareness. Indeed, the result reaffirms the perception that modern biotechnology is a novel but complex subject and therefore not expected to be easily understood by persons with relatively lower level of education. In addition, respondents with tertiary education level were realized to have added avenues for accessing information about modern biotechnology including structured academic curricula, participation in workshops and meetings, access to websites, journals and other scientific print and electronic documentation.



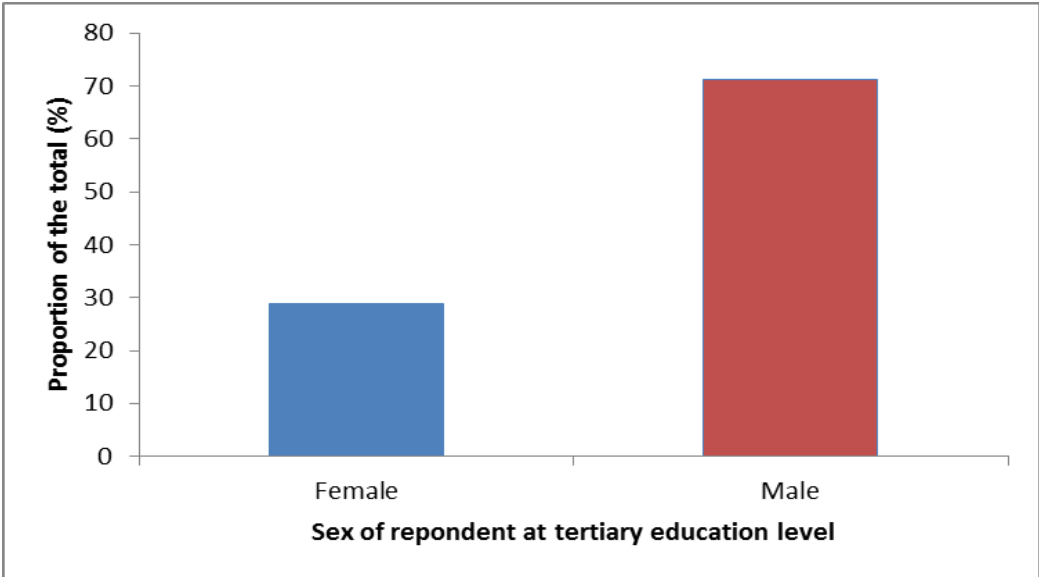
**Figure 7.** Awareness on GMO and GM products across respondents' education levels

### 3.2.2 Comparison of awareness across gender

Majority of the male respondents (70%) portrayed higher level of awareness than female respondents (30%) (Fig. 8a). Since majority of the female respondents were farmers (84.2%), their low education level might have contributed to limited awareness of modern biotechnology. Moreover, in comparing awareness levels between males and females at tertiary education level, male respondents were more informed (71.1%) compared to female counterpart (28.9%) (Fig. 8b). These results may be attributed to relatively low enrolment of female students in science subjects at both secondary and tertiary education levels.



**Figure 8a.** Awareness on GMO and GM products across gender of respondents

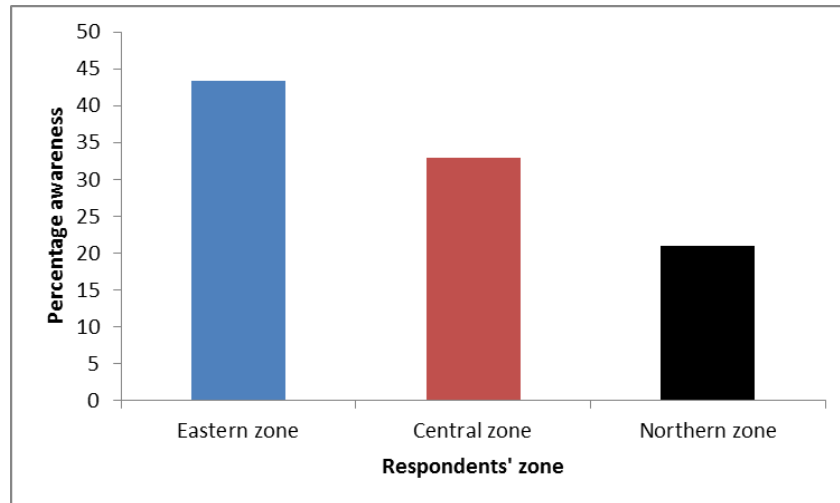


**Figure 8b.** Awareness on GMO and GM products across gender at tertiary education level

### 3.2.3 Comparison across agro-ecological zone

It was assumed in this survey that public awareness and perception on GMOs may be influenced by agro-ecological zone. Comparison of respondents' awareness among the three agro-ecological zones indicated that majority of respondents from the Eastern zone (Morogoro) (43.4%) were aware of GMOs followed by the Central Zone (Dodoma) (33.1%) and Northern Zone (Same) was the least informed (21.2%) (Fig. 9). The influence of incorporating modern biotechnology into the academic curricula at the Universities offering science-based courses such as Sokoine University of Agriculture could have contributed to such high level of awareness on GMOs and product thereof. Moreover, the region is a home to many other Universities including Mzumbe University, Muslim University of Morogoro, Jordan University and institutions such as the Livestock training Institute (LITI) as well as the Morogoro Teachers College. All these are assumed to provide avenues not only for the fusion of advanced knowledge amongst the elites but also the provision for access to information about modern world, inclusive of GMO issues. As previously observed, GMO issues and product thereof were more familiar to persons at tertiary than at lower levels of education. The University influence on the awareness may not be overemphasized.

Like the Eastern zone, respondents in the Central zone were appreciably informed about GMOs although to a relatively lesser extent compared to the former. The influence of University of Dodoma and a couple of educative programs conducted by the WEMA project (currently being implemented in the area) to the public could have contributed to such level of awareness. Moreover, the VPO and NGO's such as Envirocare confirmed to have conducted a series of public awareness training on GMOs in Dodoma during the last three years (VPO, personal communication).

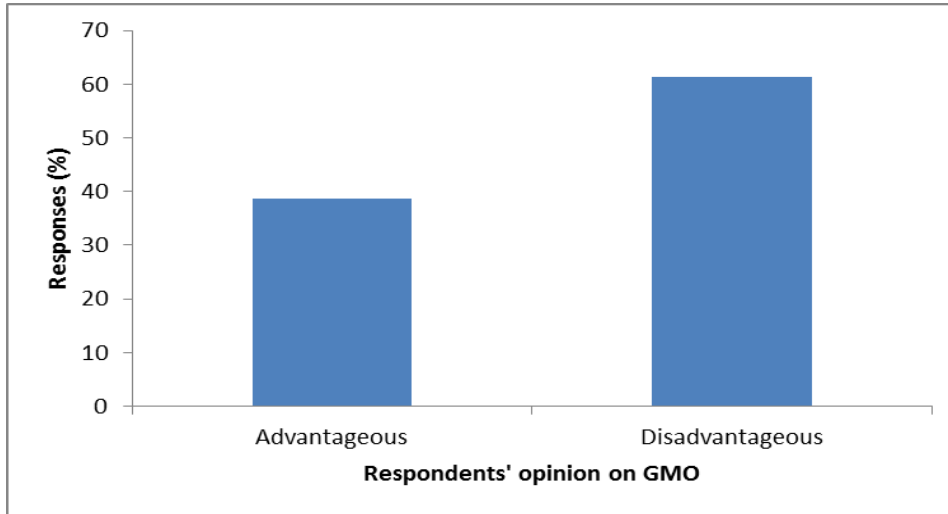


**Figure 9.** Awareness on GMO and GM products in the surveyed zones

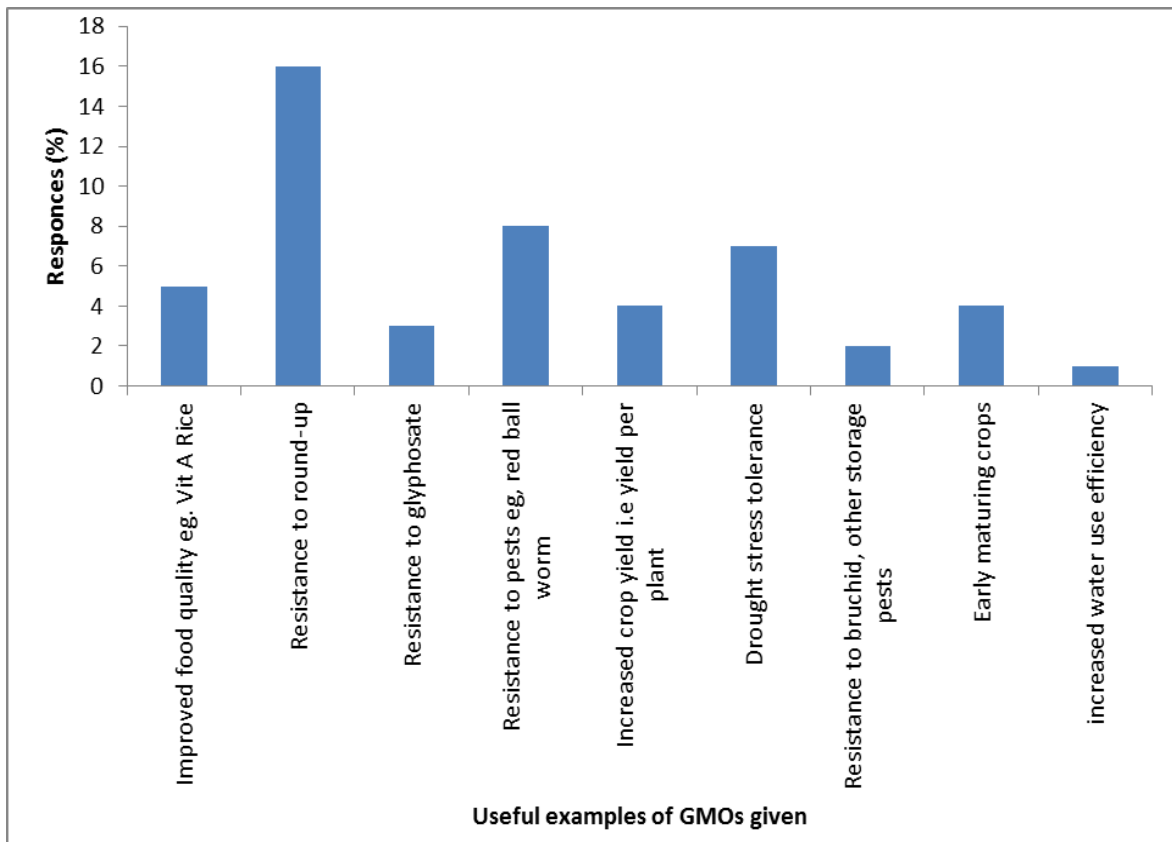
### 3.3.0 Perception

Public perception on use of GMOs was examined by interviewing the respondents on whether GMOs are advantageous and important, concerns of GMOs and important sectors that could benefit best from modern biotechnology. The results indicated that 38.7% of the respondents thought that GMOs are advantageous and important while 61.3% of the respondents thought otherwise (Fig. 10a). These observations are similar to many other African countries such as Kenya (Shauri *et al.*, 2008); Ghana (Buah, 2011; Quaye *et al.*, 2009); Nigeria, (Ayanwale *et al.*, 2004), and South Africa (Aerni, 2002). Thus, GMOs and product thereof presents a typical foreign technology with doubtful implications and outcome amongst most African communities. Scenario similar to what has been observed in many African countries was also reported in Europe (Bonny, 2003; Eurobarometer, 2002). Indeed, modern biotechnology is perceived a road to disaster by many across the globe. Out of those in support of GMOs, 38.2% were able to give accompanying reasons of their views some of which included improved quality and quantity of agricultural products, herbicide tolerance, resistance to pest and diseases and improve food security (Fig. 10b). In addition, 67.8% of the respondents were of the view that the potential risks associated with GMOs outweigh the benefits. Unfortunately, only 12% of the 67.8% were able to give supporting reasons for their views which included loss of indigenous species, adverse health effects,

genetic drift to non-target species, and development of pest biotypes that might be resistant to existing management techniques.



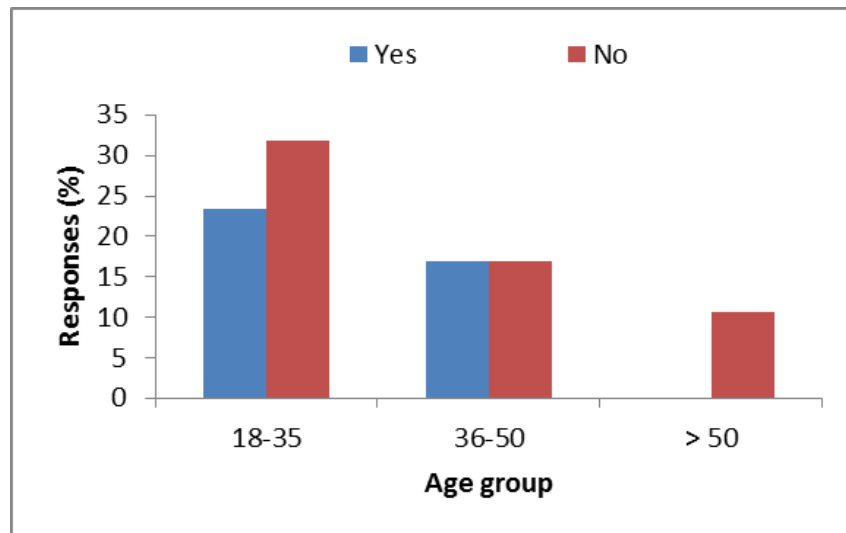
**Figure 10a.** Respondents perception on GMO and GM product



**Figure 10b.** Useful examples of GMO and GM product given by respondents

### 3.3.1 Age influence on GMO preferences

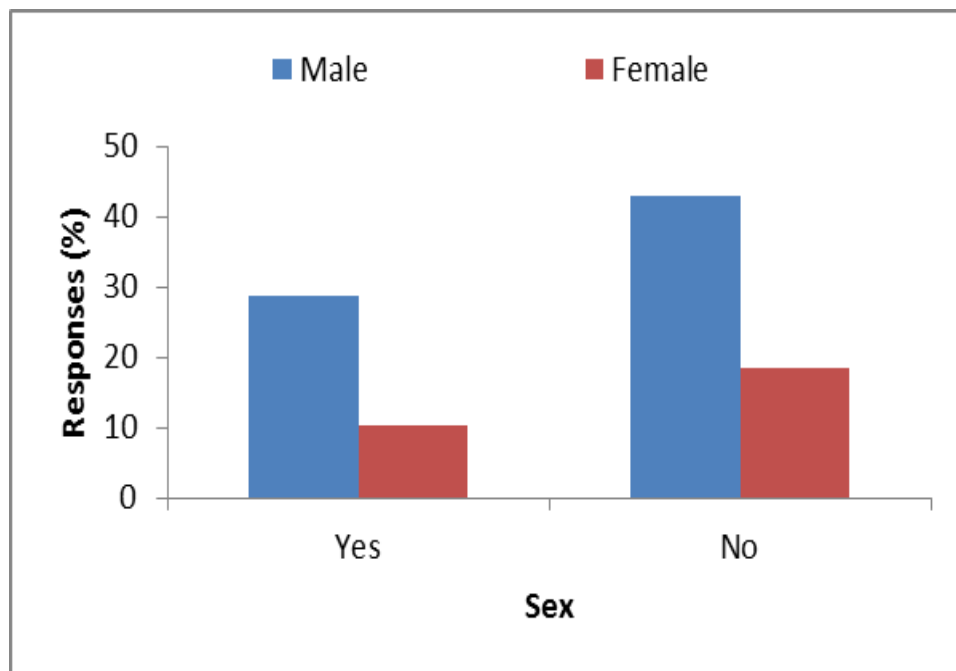
The respondents' age was found to influence their opinion on the GMOs (Fig. 11). The young generation (18-35 years) was more positive to GMOs compared to the older groups. More than 23% of respondents in this group visualized GMOs as advantageous while about 32% presented a negative opinion on GMOs. Respondents at advanced age 36-50 years presented a balanced opinion over GMOs. Equal number of 17% expressed a divided opinion in which GMOs were visualized as either advantageous or disadvantageous. A major contrast was noted with the oldest respondents (>50 years) who strictly did not support GMOs. This group presented 10% of all respondents. These finding tallies well with the age of the technology advocacy. Since modern biotechnology is a very recent one (Wikipedia, 2009), it is well understood by the relatively younger generation compared to the aged ones. It further suggests that human being would be repulsive of the knowledge they do not know compared to what they know. It's very probable that most persons have negative opinion over GMO simply because they are inadequately educated about the technology and product thereof. All in all, the indicative number of the young generation and tallying opinion of the mid-aged group suggests great potential of GMO acceptance in future.



**Figure 11.** Perception on GMO and GM product with respect to respondents' age

### 3.3.2 Gender preferences of GMOs

When grouped based on their sex, male respondents were more supportive of GMO (28.6%) than the female counterparts (10.2%). Interestingly, there were similarly many male respondents (42.9%) who were against GMOs and less female (18.4%) who disapproved the usefulness of GMOs and product thereof (Fig. 12 ). Thus, although it might appear like males were in support of GMOs, the difference between sexes were critically more of varying proportion in number of respondents interviewed that the sex-biased opinion. As previously portrayed there were many males who were knowledgeable of GMO particularly at tertiary education levels compared to the female respondents hence a seemingly male-biased opinion. These results suggest that a relatively larger proportion of respondents were not in support of the GMOs and product thereof. Limited knowledge about GMOs and the fear of risks associated with the technology might have led to such a negative perception from most respondents.

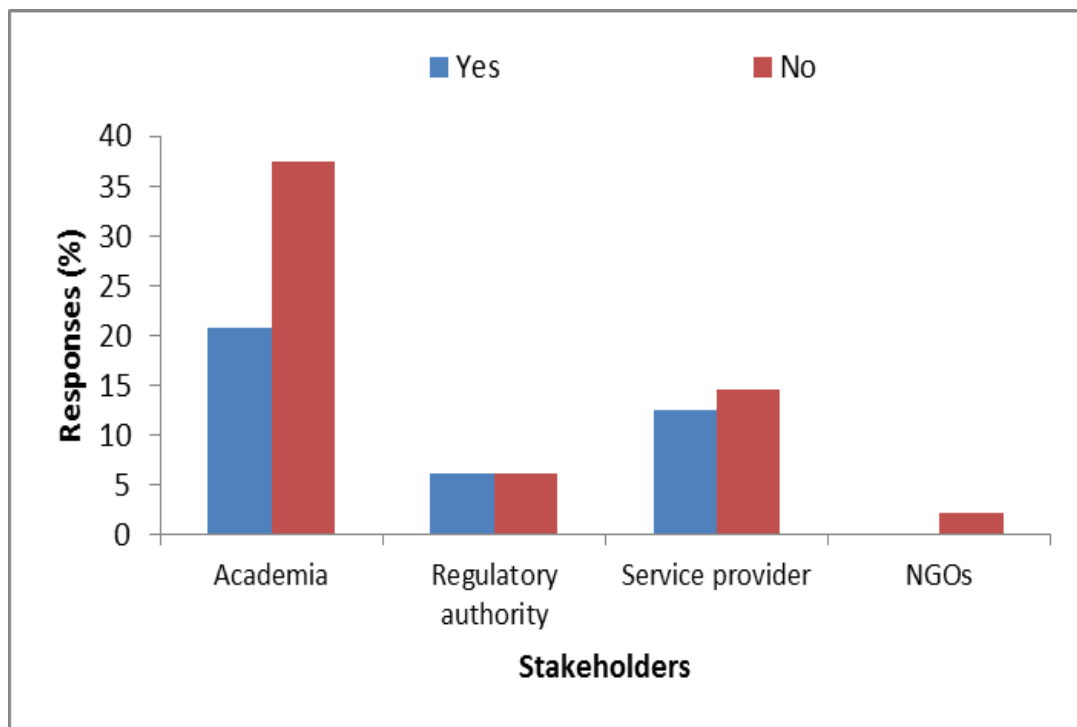


**Figure 12.** Gender-based perception on whether GMO and GM product are advantageous



### 3.3.3 Occupational-based preference of GMO

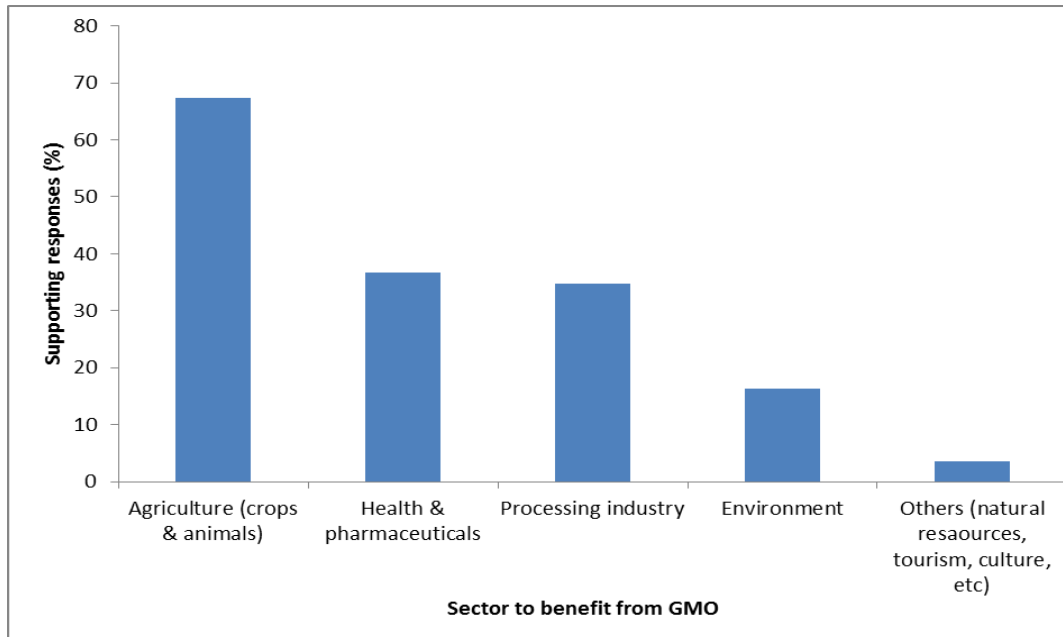
Occupation-based analysis of the stakeholders' views on GMOs and product thereof revealed that the academia group was much in support of the technology and its products (21%) compared to the regulators and farmers (Fig. 13). This finding was in accordance with expectations because apart from being part and parcel of curricula, there were several researches on GMO being conducted at Sokoine University of Agriculture. Interestingly, regulators were equally divided with half of them supporting the technology while the other half was totally against it. Detailed discussion with some of regulators like District Agricultural and Livestock Officers (DALDOs) revealed that most of them feared the risks that might be associated with GMO although they were supportive of technology if safety would be totally ensured. An appreciable number of service providers (13%) were similarly supportive of GMO and product thereof but similarly good proportion of them (15%) regarded the technology disadvantageous. None of the farmers responded to this questions on whether GMO were advantageous or disadvantageous hence the missing data for this important group of respondents.



**Figure 13.** Stakeholders perception of GMO and GM products

### **3.4 Sectors that would benefit from GMO technology**

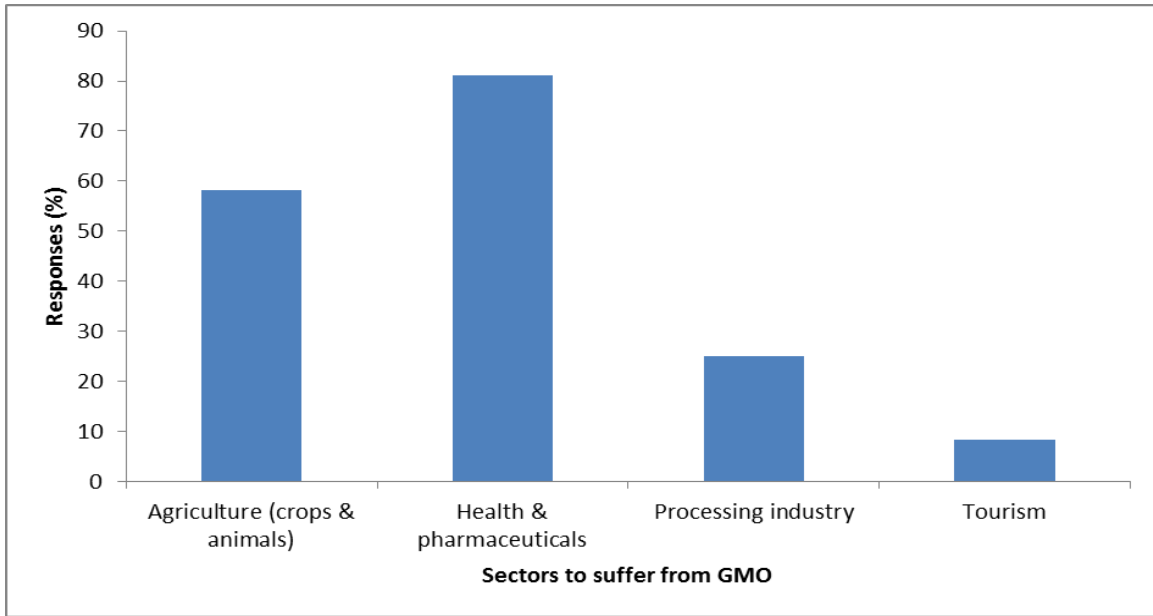
In a multiple answer question that required respondents to mention more than one sector they thought would benefit from modern biotechnology through GMOs and product thereof, 35.2% of the respondents were able to identify the priority sectors (Fig. 14). These include agriculture (67.3%), health (36.7%), industry (34.7%), and environment (16.3%). These results suggest agricultural sector to have the potential to benefit more from modern biotechnology compared to other sectors. Existing practical examples of GMOs (refer section 3.3.0) which have already gained influence in Tanzania might have played a role into respondents' realization of the potential benefit of GMO to the agricultural sector. Based on the results, modern biotechnology would be easily accepted in agricultural sector compared to the rest. Health and processing industries were similarly perceived to benefit from modern biotechnology although to a lesser extent compared to agriculture. Despite these responses it is unquestionable fact that biotechnology has wider application in the health and processing industry (Wikipedia, 2009). Possible reasons for respondents biases in agriculture includes respondents' interest in agriculture, limited knowledge of the health and pharmaceuticals, underdeveloped processing sectors in Tanzania with limited use of GMO products and lack of practical examples in other disciplines apart from agriculture.



**Figure 14.** Sectors that would benefit from GMO and GM products

### 3.5 Sector that would be negatively affected by GMO technology

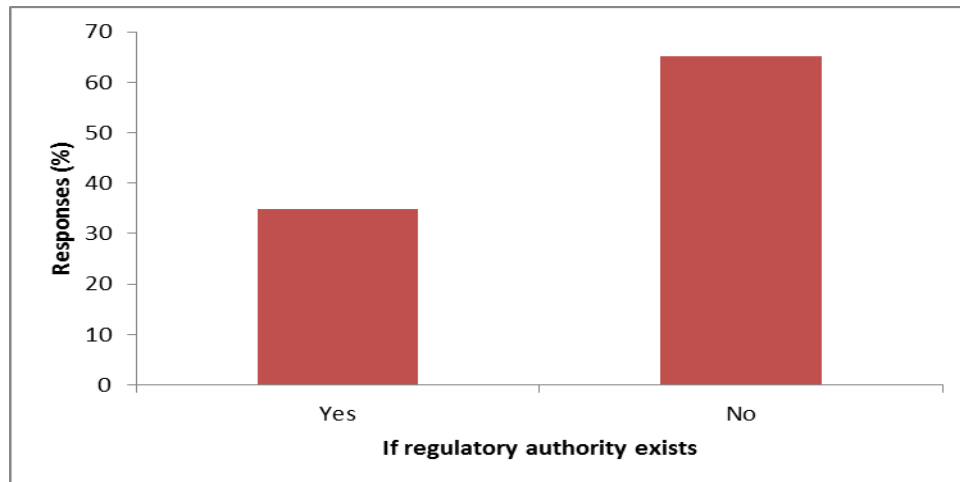
On the other hand, the sectors identified to potentially suffer negatively from modern biotechnology particularly through GMOs were health (81.2%), agriculture (58.3%), processing industry (25%) and tourism (8.3%). Based on the results, health sector could mostly be negatively affected (Fig. 15). Although such observations lacked justifiable evidence of the perceived negative impacts, respondents associated any risk associated with GMOs with an ultimate end into several maladies on human health that would finally end up in need for medication from health sector. Therefore, the perceived effect on the health sector is mainly based on the expected medical attention that would be required if risks associated with GMO becomes a reality. Processing industry was considered to be potentially affected by GMO due to the assumption that consumers of processed food would end up deserting the produce if were eventually known to be GMO-based due to the stigma attached to them. Tourism sector was also sought to potentially suffer due to displacement and ultimate loss of traditional plants and animals that would erode the integrity and useful qualities of target sites that constitutes essential elements of tourism attraction.



**Figure 15.** Sectors that would be negatively affected by GMO and GM products

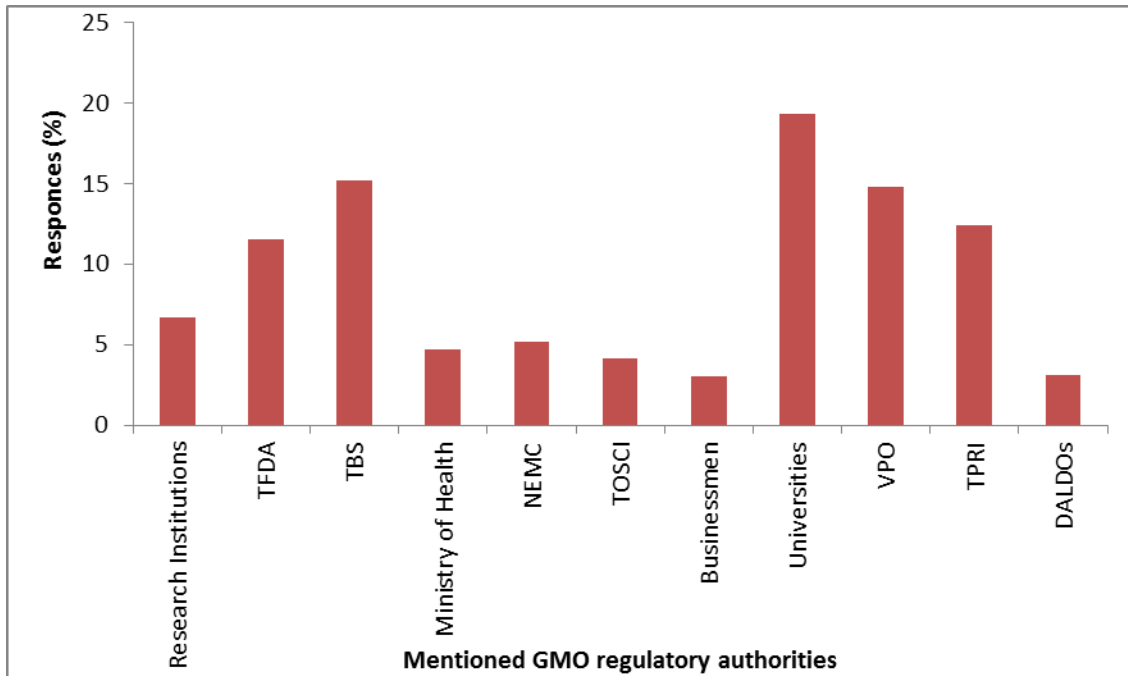
### 3.6 Awareness on the existence of national biosafety regulatory framework

Awareness on the existence of national biosafety regulatory framework was also assessed. Respondents were asked whether they were aware of existence of biosafety regulatory regime and if known, to give examples of such regulatory authorities. About 35% of the respondents were aware of the existence of regulatory regime while 65% were not aware (Fig.16). These results suggest limited public understanding of biosafety regulatory regime existing in the country. Generally there were a great sign of irresponsibility among respondents. Very few of them felt concerned on whether GMO are regulated in Tanzania or not. Some were quick to point out that regulation of what goes on in the country is a Government responsibility and felt no need to be bothered.



**Figure 16.** Knowledge on the existence of Biosafety regulatory authority

The knowledge of Biosafety regulatory regimes proved to be a difficult subject among respondents. Out of those who indicated to be aware of biosafety regulatory regime, only 30% were able to give relevant examples which included TFDA, NEMC, TBS, Ministry of health, TOSCI, TPRI and VPO. Some institutions wrongly perceived to execute biosafety regulatory role included research and academic institutions and business community (Fig. 17). Shockingly, some respondents (officials) from TOSCI and Ministry of Health were not informed of GMOs and did not know who regulates the technology and associated products. These results shocked the researcher particularly the fact that although most respondents had expressed concerns over GMOs, they were not aware of existence of any regulation regime in Tanzania. Such sense of irresponsibility, lack of patriotism and lack of sense of belonging could be a time bomb waiting to blast and deny the country a great treasure it deserves. Thus awareness campaigns should go hand in hand with stimulation of patriotism and nationalism among Tanzanians.



**Figure 17.** Biosafety regulatory authorities identified by the respondents

#### 4. CONCLUSION

The study revealed limited understanding of GMO and product thereof among members of public in Tanzania. Respondents in the Eastern zone were relatively more informed than the Central and Northern zones. Higher learning institutions are believed to have played a major role into such awareness. Male respondents were more knowledgeable of the GMOs than Female counterparts. Apart from structured formal academic curricula, awareness campaign through workshops and sensitization meetings have largely contributed to awareness on GMOs although is yet to be done. However, messages delivered through many of awareness campaigns seems to have remained personal property of those who attend workshops, largely unshared among other community members, even those within shared office premises. The vast part of interviewed respondents regard the publicity and awareness on GMOs a responsibility for the government and few NGOs with vested interest in the technology. The media (print audiovisual and other form of electronics) which majority of the population use, have not been utilized effectively.

## 5. RECOMMENDATIONS

Based on the study findings the following recommendations are made:

1. There is need for extensive and more concerted efforts to educate the vast population of Tanzanian cannot be overemphasized. Various stakeholders including scientists, researchers, NGOs and the private sector should join the Government initiatives to communicate proactively with the public, especially women and elderly people about GMOs and products thereof.
2. Incorporation of GMO issues into academic curricula should consider the lower levels of education delivery system including secondary and primary schools
3. All institutions offering technical educations including agricultural colleges, schools of journalism, Teachers colleges and many others should include GMOs issues (practice, policies and regulation) to expound access to such an important knowledge of modern science.
4. Educative campaign through mass media (TV and New papers) should be strengthened.
5. Message for the educative campaign should include synthesis of appropriate, accurate and comprehensive information about GMOs for added understanding of the technology and policies or regulations governing its use.

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**ANNEX 1**

**QUESTIONNAIRE: ASSESSMENT OF THE AWARENESS ON GMO AND BIOSAFETY REGULATIONS IN TANZANIA**

**SECTION A:** Fill in the blanks

1. Name of interviewer ..... Date ..... Form No. ....
2. Name of respondent.....
3. Age & sex of respondent.....(Years).....(M or F)
4. Institute/Village/school.....
5. Education level of respondent.....
6. Occupation of respondent (1) major.....  
(2) minor.....
7. Location/District(s)..... Region: .....

**SECTION B:** *circle the right answer or fill in the blanks where applicable*

1. Have you ever heard of the word GMO?  
(1) Yes (2) No

*If No, go to Section C. If Yes, go to 2.*

2. Briefly tell what do you understand by GMO? (*guide the respondent to freely tell/speak his/her mind*)

.....  
.....  
.....  
.....  
.....

3. Would you give any example of GMO? (1) Yes (2) No

4. If the answer (in 3 above) is Yes, mention any example of GMO that you know?.....

.....  
.....

5. When did you first hear/read about GMO or GM products? Month\_\_\_\_\_ Year\_\_\_\_\_

6. Where did you hear/read or learn about GMO?

- (1) At school/university/learning center
- (2) From a friend
- (3) From a colleague
- (4) From parent/guardian
- (5) From a written article/journal/book/newspaper
- (6) From internet/website
- (7) From NGO (environmental activist)

- (8) From agricultural officers
- (9) From researchers
- (10) Others (specify).....

7. In which industry are GMOs & GM products very common?

- (1) Medicine
- (2) Agriculture (i) crops (ii) animals
- (3) Pesticide industry
- (4) Processing industry (processor)
- (5) Tourism industry
- (6) Environment
- (7) Others (specify).....

8. If more than one industry is mentioned (in 6 above) rank them according to their importance beginning with the most affected industry

- (1).....
- (2).....
- (3).....
- (4).....

9. Where do you think was the origin/source of the GMOs?.....

10. Who developed or influenced the development of GMO?

- (1) Researchers
- (2) Teachers
- (3) University lecturers/professors
- (4) Farmers
- (5) Medical scientist
- (6) Businessmen
- (7) Others (specify).....

11. What might have facilitated the spread of GMO & GM products into this area/ country?

- (1) International Trade
- (2) Importation of aid items
- (3) Foreign visitor/tourist
- (4) Researchers
- (5) Natural disasters (earthquakes, winds, super natural power)
- (6) Local seed exchange by farmers
- (7) Gift from relatives
- (8) Unknown
- (9) Others (specify).....

12. What has been the spreading rate of GMO & GM products in Tanzania since its first occurrence?

- (1) Fast                      (2) Slow              (3) Not spreading      (4) Unknown

13. Do you think GMO and GM products are advantageous & important for Tanzania?

- (1) Yes                      (2) No

14. If the answer (in 13 above) is yes, give reasons why?.....

.....  
.....

15. In which sector(s) do you think GMOs and GM products are important?

- (1) Medicine  
(2) Agriculture (i) crops (ii) animals  
(3) Pesticide industry  
(4) Processing industry (processor)  
(5) Tourism industry  
(6) Environment  
(7) Others (specify).....

16. Do you think GMO and GM products are disadvantageous & dangerous for Tanzania?

- (1) Yes                      (2) No

17. If the answer (in 16 above) is Yes, give reasons why?.....

.....  
.....

18. In which sectors are the GMO and GM products dangerous?

- (1) Health (Human and animals)  
(2) Agriculture (i) crops (ii) animals (iii) others.....  
(3) Environment  
(4) Processing industry (processor)  
(5) Tourism industry  
(6) Infrastructure  
(7) Others (specify).....

19. In what ways are the GMO and GM products dangerous?.....

.....  
.....

20. Are you aware of existence of any regulation or procedure governing the uses of GMO and the GM products?

(1) Yes (2) No

21(a). If the answer (in 20 above) is Yes which regulation is that?.....

.....  
.....

21(b). How did you know/learn/get informed about the existence of such regulation?

.....  
.....

21(c). If the answer (in 20 above) is No, go to section C

22. Do you know of anyone / institution/ organization or department which is charged with responsibility of enforcing such GMO regulations?

(1) Yes (2) No

23. If Yes (in 22 above) mention them

1.....2.....  
3.....4.....

24. If No (in 22 above) go to section C.

25. Do you think Tanzania needs to regulate the uses of GMO and GM products?

(1) Yes (2) No

26a. If Yes (in 25 above) give reasons why?

.....  
.....

26b. If No (in 25 above) give reasons why?

.....  
.....

### SECTION C:

27. What do you think GMOs are? .....

.....

28. Have you ever heard of someone mentioning or talking about GMO?

(1) Yes (2) No

29. a). If Yes (in 28 above) where was that?

- 1) Meeting
- 2) informal gathering
- 3) seminar/workshop

- 4) forgotten
- 5) Others (specify).....

29 b) If No (in 28 above) what should be done to promote awareness about GMO and GM products?.....  
.....

.....  
.....

30. What regulations should be put in place to govern the appropriate uses of GMO and GM product? (mention or suggest).....

.....  
.....  
.....

31. Who do you think should be charged with such responsibilities and why?

1..... Reasons 1.....  
2.....  
3.....

2..... Reasons 1.....  
2.....  
3.....

3..... Reasons 1.....  
2.....  
3.....

32. *Any other general comments pertaining to GMO and GM products?*

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**THANK YOU!**