

A Stakeholder Approach to Investigating Public Perception and Attitudes towards Agricultural Biotechnology in Ghana

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Absract

A stakeholder survey was conducted in Ghana to assess the level of public perceptions and acceptance of agricultural biotechnologies. A total of 100 respondents drawn from academia, Non-governmental organizations, business community, government and other stakeholders were interviewed on their views on self-protection attitudes, health and economic benefits, skepticism and optimism about agricultural biotechnologies as well as the level of confidence in existing government regulatory systems to protect society against any negative effects of biotechnological issues. Although half of the sample interviewed did not accept biotechnologies in general and GM foods in particular, there was rather high approval of some specific health and economic benefits. About 80 percent of the sample interviewed lack confidence in existing government regulatory systems probably due to inadequate capacity. Upgrading of the existing regulatory system with adequate capacity to regulate the ethical and moral issues associated with biotechnologies and GM foods was recommended

Introduction

Public perception of agricultural biotechnology has been thoroughly investigated in industrialized countries (Shanahan, J., D. Scheufele and E. Lee, 2001; Gaskell et al, 2000). However, not much is known about public attitudes in developing countries. The worldwide application of biotechnology in the production of food, fiber and pharmaceutical is a major development of the late 20th century. This emerging technology is often viewed as the next revolution which has the potential to fundamentally alter the way the society organizes its production and distribution of food.

Globally, billions of dollars have already been invested in biotechnology research and new product development. Science and Technology is poised to bring consumers a wide range of genetically modified (GM) products. In fact, many GM products have already entered the food distribution chains. These products have the potential to not only meet the basic needs, but also bring a wide range of economic, environmental and health benefits.

Despite the numerous benefits associated with biotechnology, its public acceptance has been with mixed feelings (Einsiedel, 1997; Aerni, 1999; Kalaitzandonakes, 2000; Sagar *et al.*, 2000; Shanahan *et al.*, 2001; Hallman *et al.*, 2001). In the public debates on biotechnology, four main issues have been raised including socio-economic, intrinsic value of nature, environmental protection and regulatory system.

Regarding socio-economic, biotechnology advocates emphasize the potential benefits to society via reduction of hunger and malnutrition, prevention and cure of diseases, and promotion of health and general well being of society. This group maintains that the benefits of modern genetic technologies will rather improve food security and help alleviate poverty (Watanabe, 1985; Isserman, 2001; Hamstra 1998 and Hossain *et al.*, 2002). On the other hand some argue that modern genetic technologies may allow developed countries produce commodities that are currently imported from developing countries. Such developments, it is claimed, will have significant negative effects on poverty situation in the Third world and lead to global instability (Junne, 1991; Galhardi, 1995). Another source of concern is that if biotechnology developments are not tailored to local conditions, most farmers will eventually become permanently dependent on multinational corporations for their "means of production" which may bring adverse socio-economic outcomes (Ruivenkamp, 2005; Feenberg, 2005).

With respect to intrinsic value of nature, the use of biotechnology has been criticized as a needless interference with nature that may lead to unknown and potentially disastrous consequences. Biotechnology is often criticized on the ground that its use in plants and animals, especially gene transfer across species, take us to "realms of God" and against "Law of Nature". Arguing further, genes are seen as naturally occurring entities that can be discovered (not invented), granting patent ownership to genetic findings and processes is morally and ethically untenable. Consumer acceptance of biotechnology has been found to be significantly related not only to their perceptions of risks and benefits associated with GM products, but also to their moral and ethical views (Moon and Balasubramanian, 2004 and Baker and Burnham 2001). *In the*

environmental protection and regulatory debates, some resist the use of genetic technologies in agricultural production alleging (perceived) risks to humans and environment, while others question the level of trust in government bodies to regulate its use.

In Ghana, very few studies have systematically explored the underlying factors influencing the acceptance of food biotechnology among consumers. This article therefore proposes to bridge the knowledge gap on public perception of agricultural biotechnology in developing countries.

Objectives

This study explored the underlying factors influencing public perception and consumer attitudes towards food biotechnology with the following specific objectives:

1. To determine the level of acceptance and attitudes towards GM foods in Ghana
2. To investigate the perceived health and economic benefits
3. To examine public skepticism/fear and optimism about biotechnology
4. To establish the level of public/consumer confidence in government regulatory systems
5. To recommend ways to improve public acceptance of biotechnology

Methodology

The formation of an individual's perception of the risks and benefits of a new technology is a very complex process determined by the selected sources of information, values, interests, and personal experience. In the case of agricultural biotechnology, most people cannot count on personal experience but must rely entirely on the information they receive. These sources of information can be rumors, experiences of people that work in the field, statements issued by the industry, government, public interest groups or the academia, and, most important, media reports. Based on the socially communicated values, the social status, and the professional affiliation, a person regards the different sources of information to be trustworthy. The selection of sources of information is also strongly influenced by one's personal worldview or interests. This implies that given answers on potential risks on biotechnological

products should be interpreted as answers which also reflect the personal adherence to specific worldviews, judgments on the information sources, etc. The investigation of public perception in a particular country can therefore be conducted by means of a representative survey where the respondents are chosen at random, or it can focus on those political actors who form public opinion and claim to represent certain public and private interests. The later may not necessarily focus on an assumed representative judgment but rather indicate some influential factors in the debate on public perception of biotechnologies.

The Stakeholder Approach

This study employed the stakeholder approach to investigate public perception and consumer attitudes about agricultural biotechnology in Ghana. This approach allows conducting a survey on public risk perception in a country with low awareness of agricultural biotechnology. It also allows going beyond simple questions designed for consumers who are hardly familiar with agricultural biotechnology and its environmental, health and socioeconomic risks and benefits. The different stakeholders or consumer segments covered include academia, Non-governmental organizations, business community, government and others.

Sources of Data and Analysis

A structured questionnaire was designed for data collection on public attitudes towards various issues pertaining to the use of biotechnology in agriculture. These included subjects such as approval of genetic modifications of plants and animals to develop products that will bring specific health and economic benefits, moral and ethical concerns about plant and animal genetics, perceptions of health and environmental risks associated with biotechnology, and willingness to accept GM food products. Information was also collected on consumers' socio-economic and value characteristics. In addition, the survey elicited respondents' confidence in the government's ability and willingness to protect public interest. To obtain an objective measure of scientific knowledge of respondents, some basic questions on science relating to biotechnology were asked. The responses to these questions were evaluated and the number of correct responses used as the measure of their understanding of science.

A total of 100 people were interviewed. The target sample frame was the Ghanaian adult civilian population (18 years or older) in the different stakeholders or consumer segments covered. Statistical Package for the Social Sciences (SPSS) and Microsoft Excel were used to analyze the data collected for discussion.

Survey findings

Socio-economic profile of Respondents and Knowledge of Biotechnology

Table 1 presents the *socio-economic profile* of respondents and their knowledge about biotechnology and GM technology. There was a high response from academia (Lecturers and Students), which could be attributed to the fact that the people in this category have easy access to information on biotechnology and GM technology. The same could be said for government, which had people from areas such as Food and Research Institute (FRI), Ghana Standards Boards, Food and Drugs Board, and Nuguchi Memorial Institute for Medical Research (NMIR) who deal with biotechnology on daily basis. The response to the question on the knowledge of Biotechnology and GM foods was 100 percent and 95.3 percent respectively. This was very impressive, suggesting that respondents were in good position to give good judgment/views on the research topic and did not depend on hearsay.

Table 1 Socio-Economic Profiles And Knowledge of Biotechnology Of Respondents

Characteristics	% Response	Characteristics	% Response
Occupation		Knowledge on GM foods	
Academia	45.3	Yes	95.3
NGO	8.1	No	3.5
Business	14.0	No response	1.2
Government	23.3	Acceptance of GM food in Ghana	
Others	9.3	Yes	44.2
Gender		No	50.0
Males	67.4	No response	5.8
Females	32.6	Against GM foods on religious grounds	
Knowledge of Biotech		Yes	16.3
Yes	100.0	No	83.7
No	0	Government support for Biotech Research	
		Yes	84.9
		No	11.6
		No response	3.6

Level of acceptance and attitudes towards GM foods in Ghana

Examining responses on acceptance of GM in Ghana, half of the sample interviewed was not in favor of GM. They believed that the acceptance of GM would make farmers loose focus on the traditional way of cultivating putting the whole nation at the mercy of profit driven foreign companies who produce GM foods "This would be disastrous for the economy". Again, research institutes are not well equipped to deal with the issues concerning GM foods. Some respondents cited an example of a recent case that occurred in the Unites States where a GM producing company sent a farmer to court for keeping some of the crops he bought from the company on an earlier date and planting the rest later on a latter date instead of going to buy new crops for planting as agreed in the contract. As explained in the methodology, personal experiences and access to the right information on biotechnology could influence responses to questions posed in this study.

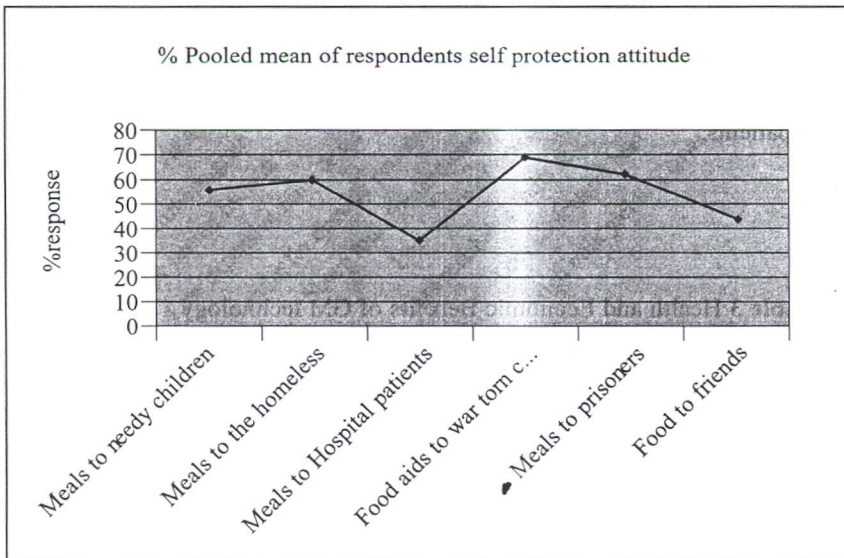
Close to 6 percent of the sample interviewed who were indecisive simply did not have adequate knowledge on the benefits and negative impacts associated with GM technology Majority (84.9%) however believed that any decision on GM should be supported with a thorough research base in the home country. About 16 percent of the sample interviewed was against GM foods on religious grounds and cultural influences. Table 2 presents results on protection attitudes of various consumers towards biotechnology. It was revealed that a greater percentage of the respondents in the other categories -those who are not in academia, government or business-are unwilling to accept GM as part of meals to hospital patients. The response ranges from as low as 27.8 percent by academia through to 50 percent by other stakeholders.

Table 2 Self-protection attitudes by the various consumer categories

Self protection attitudes	% Yes Response by Category				
	Academia	NGO	Government	Business	Others
Meals to needy children	50.0	57.1	68.4	50.0	50.0
Meals to homeless in shelters	58.3	42.9	73.4	50.0	75.0
Meals to hospital patients	27.8	42.9	33.3	41.7	50.0
Food to war torn countries	66.7	71.4	78.9	58.3	62.5
Meals to prisoners	52.8	71.4	78.9	50.0	75.0
Food to friends	41.7	28.6	47.4	33.3	75.0

They also did not approve GM as part of food to friends except for the rather high affirmative response (75 percent) from other stakeholders. The perception pattern is illustrated in figure 1. This takes into account the percentage mean of the responses from the various consumers of GM foods (all five stakeholders).

Figure 1 Percentage pooled mean of stakeholders self protection attitudes



Perceived Health and Economic Benefits

Table 3 presents results on various consumer categories' views on health and economic benefits of GM foods/technology. Generally there was high approval of health and economic benefits of GM technology ranging from 50-100 percent by all the stakeholders except for some few instances where the approval was just below the average percentage. Other stakeholders attained the highest approval (75-100 percent) for all the instances stated where GM technology could be used; this was followed by Academia, which had the next highest approval ranging from 52.8 - 80.6 percent. The pattern of approval of other stakeholders and Academia is similar to that of NGO, Business and Government except for GM technology in creating better tasting fruits and vegetables where there was a low approval of 47.4 percent by the Government. Also GM technology for creating less expensive fruits and veg-

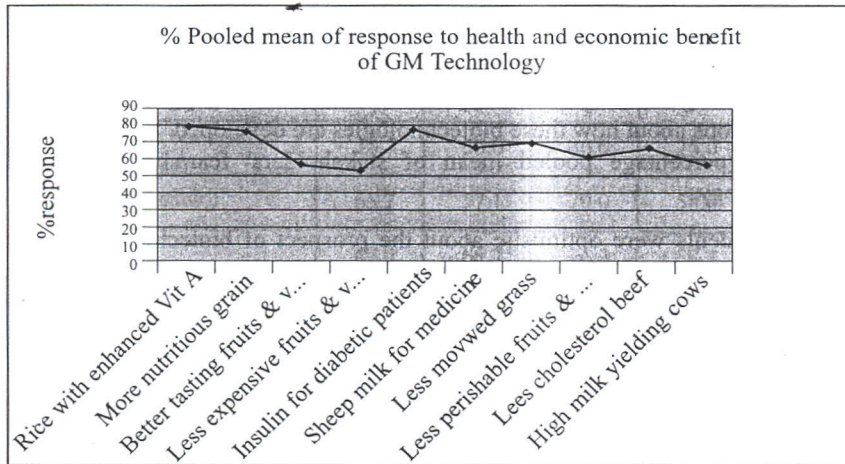
etables received a relatively low approval of 42.9 percent and 47.4 percent by NGO and Government respectively.

One would expect that the approval of GM technology for creating insulin should be low but in this case it's rather the opposite with the following percentages; Academia (74.3 percent), NGO (85.7 percent), Government (84.2 percent), Business (75.0 percent), Other stakeholders (87.5 percent). The line graph in figure 2 illustrates the percentage pooled mean of approval of GM technology by the stakeholders. This graph shows that GM technology has a high percentage approval from all the stakeholders with regards to health benefits, especially in creating rice with enhanced vitamin A and insulin for diabetic patients.

Table 3 Health and Economic Benefits of GM technology

Health & Economic Benefit	% Yes Response by Category				
	Academia	NGO	Government	Business	Other stakeholders
Rice with Enhanced Vit A	80.6	85.7	84.2	66.7	87.5
More Nutritous Grain	77.8	71.4	77.8	50.0	100.0
Better taste in Fruits & Vegetables	52.8	85.7	47.4	50.0	87.5
Less Expensive fruits and Vegetables	52.8	42.9	47.4	58.3	75.0
Insulin for Diabetic Patients	74.3	85.7	84.2	75.0	87.5
Sheep Milk for Medicines	66.1	85.7	68.4	50.0	75.0
Less mowed Grass	72.2	42.9	73.7	66.7	75.0
Less perishable fruits & Vegetables	62.9	85.7	47.4	58.3	75.0
Less Cholesterol beef	61.1	71.4	43.7	66.7	62.5
High Milk yielding Cows	52.8	42.9	52.6	58.3	87.5

Figure 2 Percentage pooled mean response from stakeholders concerning health and economic benefits of GM technology.



Skeptism/Fear and Optimism about Biotechnology

Results on respondents' views on Skeptism/fear about biotechnology are presented in table 4. All consumer categories were not willing to accept GM technology if it's against nature despite the advantages. The percentage Yes response to this question ranged from 25 percent by business through to 50 percent by NGO and other stakeholders. Most of them agreed that some GM technology threatened nature and thus there was a need for regulations given GM potential dangers.

Respondents however did not strongly agree to the fact that nature should be left as it is. Government had a weak agreement of 26.3 percent and some officials interviewed were of the view that it's highly impossible to leave nature as it is since we depend on it for human survival thus if there are regulations to check GM we could go ahead and exploit nature but in a controlled manner. On the other hand, NGO had a high agreement percentage of 66.7 percent of leaving nature as it is. This is because it consisted of members from Friends of the Earth, an NGO concerned with the conservation of nature.

Buying from non-GM food shops only, received a negative response; Academia (45.5 percent), NGO (28.6 percent), Government (21.1 percent), Business (16.7 percent) and others (14.3 percent). A greater percentage across consumer categories did not agree that serious GM accidents are bound to hap-

pen (57.1 - 91.2 percent). Most of them were also unwilling to petition against GM and did not really mind if served GM foods unknowingly in restaurants (50 - 71 percent). When asked whether they believe that GM products created by scientist are public driven there was neither a strong agreement nor disagreement i.e. a little below and above the average percentage response across consumer categories. Again the impressions created here suggest that people have questions about how these biotechnologies are developed. Figure 3 illustrates the percentage pooled mean of stakeholders' fear/skepticism about biotechnology.

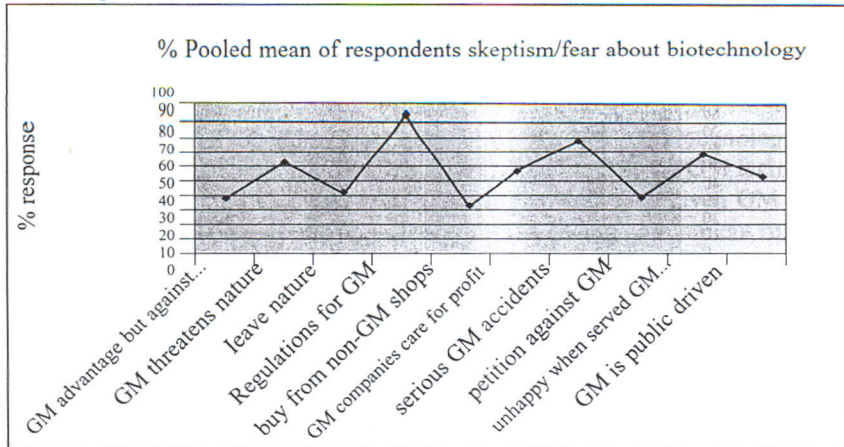
Respondents were optimistic about the prospect of biotechnology if the associated risk is well managed; for example new and improved food and fiber that can bring a wide range of health and economic benefits to society. Table 5 depicts optimism about biotechnology by the various consumer categories. GM crops were believed to have brighter business future; Academia (73.3 percent), NGO (50.0 percent, Government (63.2 percent), Business (41.7 percent) and Other stakeholders (75.0 percent). All the consumer categories except Business did not agree that scientist know better and it can be seen clearly from the following percentages; Academia (40.5 percent), NGO (0.0 percent), Government (25.0 percent), Business (58.3 percent), Other stakeholders (37.5.0 percent). Other stakeholders strongly answered No to GM risks being exaggerated. The rest were a little above the average percentage with business taking the lead with 58.3 percent.

A very high positive response to the participation in GM public debate can be seen from table 5 ranging from 66.7 - 100 percent. Also most respondents seem to watch TV and read about GM biotechnology, which is a good sign that they might have reliable sources of information about GM technology although the opinions of these T.V watchers may not be very representative for the whole Ghanaian population. Figure 4 illustrates the percentage pooled mean of stakeholders' optimism about biotechnology.

Table 4 Skepticism about Biotechnology

Skepticism and fear about biotech	% Yes Response by Category				
	Academia	NGO	Government	Business	Other stakeholders
GM advantage but against nature	35.3	50.0	40.0	25.0	50.0
GM threatens nature	65.7	57.1	70.0	58.0	37.5
Leave nature	47.9	66.7	26.3	58.3	-
Regulations for GM	97.2	85.7	90.0	83.3	100.0
Buy from non-GM foods shops	45.5	28.6	21.1	16.7	14.3
GM companies care for profit	55.9	85.7	52.6	66.7	14.3
Serious GM accidents	91.2	71.4	68.4	72.7	57.1
Petition against GM	37.1	57.1	31.6	41.7	25.0
Unhappy when served GM food	68.6	71.4	60.0	75.0	50.0
GM is public driven	41.7	57.1	61.4	66.7	42.9

Figure 3 Percentage pooled mean response from stakeholders concerning their skepticism/fear about biotechnology



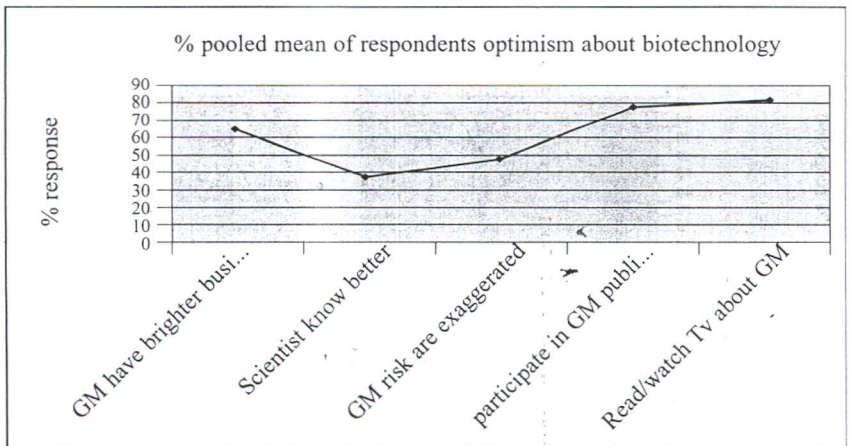
Confidence in Government Regulatory System

With regard to the level of confidence in government regulatory system in the area of biotechnology, all consumer categories had very low confidence in government organizations such as the Food and Drugs board and the Ghana Standards Board. Moreover, there was a little confidence in research institutions such as Food and Research Institute (FRI) and Noguchi Memorial Institute for Medical Research (NMIR). Most of respondents were of the view that the government institutions are not well equipped to handle GM technology. Hence the high positive response to the need to establish a special body to regulate ethical and moral issues associated with biotechnology research. The pattern of response is well illustrated in the line graph in Figure 5

Table 5 Optimism about Biotechnology

Optimism About Biotechnology	% Yes Response by Category				
	Academia	NGO	Government	Business	Other stakeholders
GM crops have brighter business future	73.3	50.0	63.2	41.7	75.0
Scientist know better	40.5	0.0	25.0	58.3	37.5
GM risk are exaggerated	43.2	50.0	55.0	58.3	12.5
Participate in GM public debates	75.0	83.3	85.0	83.3	62.5
Read/watch TV about GM technology	78.4	66.7	78.9	83.3	100.0

Figure 4 Percentage pooled mean response from stakeholders concerning their optimism about biotechnology



GENERAL DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

General Discussions and Conclusions

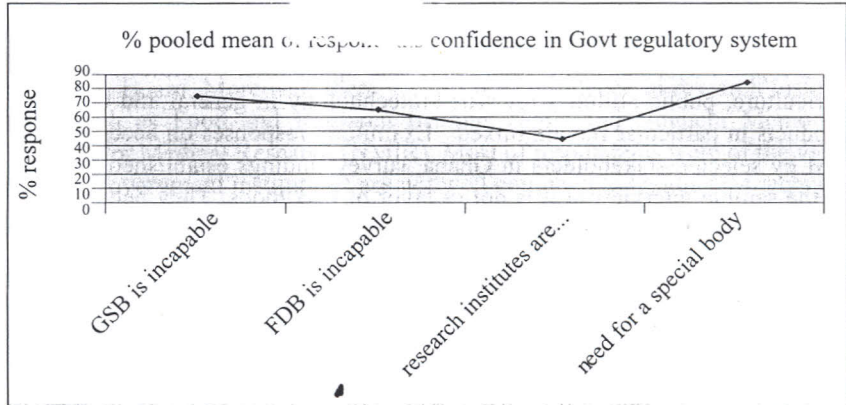
Despite major scientific progress in the application of biotechnology in agriculture, public attitudes towards biotechnology in general and GM food products in particular remain mixed. Examining responses on acceptance of GM by selected stakeholders in Ghana, survey findings established that half of the sample interviewed was not in favor of GM foods. They believed that the acceptance of GM foods would make farmers loose focus on the traditional way of cultivating putting the whole nation at the mercy of profit driven foreign companies who produce GM foods.

There was high level of self protectionist attitudes on the part of the respondents. While majority were cautious of being served with GM foods they remained indifferent if served to needy children, the homeless, food aid to war torn countries and prisoners who do not have a choice. Respondents had the notion that needy children, the homeless, war torn countries and prisoners have no choice thus if GM foods can feed them why not, yet with friends and hospital patients other factors must be considered (e.g. side effects of GM foods).

Surprisingly, there was overwhelming approval of specific health and economic benefits of GM technology especially, in creating rice with enhanced vitamin A and insulin for diabetic patients. This rather high approval of GM technology for creating insulin and vitamin A for patients conflicts with the negative attitude of respondents to GM foods as part of meals to hospital patients. Such conflicting results suggest the need for more awareness creation and intensive education on biotechnological issues in Ghana.

Respondents were concerned about the perceived health, safety and environmental risks often associated with the use of biotechnologies. A significant percentage of the respondents were not willing to accept GM technology if it's against nature despite the advantages. They agreed that some GM technology threatened nature and thus there was a need for regulations given GM potential dangers. However, public confidence in the existing government regulatory systems was very low and therefore a request was made for a complete replacement or adequate capacity building of the existing ones to regulate the ethical and moral issues associated with biotechnology research. Respondents were however optimistic about the prospects of biotechnology if the associated risks are well managed.

Figure 5 Percentage pooled mean response from stakeholders concerning their confidence in government regulatory system



Recommendations

Two key recommendations are worth considering. First, there is the need for more tailor-made research inputs in order to make concrete informed decisions on the Ghanaian situation. Secondly, a **regulating body** which is adequately equipped should be placed over large genetic companies for proper control and to avoid monopoly or exploitation of the potential market. Alternatively, **measures** should be taken to upgrade the existing regulatory systems so as to boost public confidence in them.

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