Philip Stubbs

Professor Thomas-Pollei

Writ 3152W: Writing on Issues of Science and Technology

4 May 2012

A Public Debate about Food Security and Technology:

The Transfer and Access of Biotechnology Products for Poor, Malnourished People in Sub-Saharan Africa

People from developing countries, especially in Sub-Saharan Africa, in the 21st century face significant environmental and technological challenges due to rapid increases in the populations of these countries, the increase in world food prices that people cannot afford, the unequal access and distribution of food, and the lack of resources, infrastructure, and technological advancements currently in place within the borders of these countries for their farmers and citizens to utilize. Specifically, food security is a major concern that societies are planning and dealing with right now, especially in developing and third world countries. The problem of food security is not defined as the lack of or scarcity of food in the world, but rather, the core of the food security debate in the 21st century is the issue of access to food and technological resources for agriculture. It is not just about the production of food, but the important questions in this debate regarding food security that need to be analyzed and addressed are: who will have access to the biotechnology products like genetically modified organisms, and what are the benefits, challenges, and risks of globalization and increased availability of such technology?

With rapid increases in the world population, finding ways to provide adequate, nutritious food to poor, malnourished people in Africa has become a critical, public debate. To face this growing concern, many technologically-advanced countries like the United States and Canada, for example, have considered, developed, and utilized various technologies, specifically biotechnology and the increasing use of genetically modified organisms, to increase global food security and to end world hunger in order to meet present food needs and to help meet the food needs of future generations in the third world.

This issue has been a serious concern in developing countries with regards to science and technology, especially in Sub-Saharan Africa where the potential of biotechnology is nonexistent

or underdeveloped. “New technologies provide opportunities for increasing productivity while reducing pressures on resources” (*Our Common Future* 144). Developing countries in Sub-Saharan Africa have been examining the benefits of adopting biotechnology, and they have been comparing the benefits of transgenic crops to the potential risks and consequences they might face. According to Drew Endy in his *Seed* magazine article, “Biotechnology without Borders,” “many powerful new technologies migrate slowly, if it all, to developing world populations” (Endy). This is an important point because much of the scientific knowledge and advancement of biotechnology and food security has been isolated from the developing world. Scientists in developed countries, especially within the United States, have discovered many new ideas about biotechnology and genetic modification, but they have directed those ideas within their own scientific communities (through patents and intellectual property rights) instead of directing science outward to the rest of the world. Patricia Kameri-Mbote, from the International Environmental Law Research Centre, mentions in her article, “Biotechnology and Food Security in Africa,” that “the concentration of agricultural biotechnology R&D in a handful of companies has implications for access to the technology and products thereof” (Kameri-Mbote). Thus, one of the core issues of this debate is the conflict between the globalization of genetically modified organisms and the legal and the commercial-market frameworks of biotechnology patenting and development.

Currently, part of this debate has to do with the fact that there is a significant technology gap between scientifically-advanced and developing countries, and thus, the transfer of agricultural biotechnology cannot move as rapidly or freely to poor, rural countries in Africa where farming is a large percentage of GDP. According to Arjunan Subramanian, Kerry Kirwan, and David Pink in their *Science* magazine article, bridging this “gap between science and society

needs to be a high priority in order to put all currently available science to efficient use in addressing global food security concerns." (173). These countries' agricultural industries are struggling because they are falling behind in the globalization of science and technology development. This technology gap is causing poor people, especially farmers, in Sub-Saharan Africa to have a much more difficult time producing food for themselves, their families, and their countries since they do not have adequate resources, infrastructures, or property rights to the research and development of biotechnology and genetically modified crops.

Thus, the debate over the global science transfer of biotechnology products is a relevant issue in science and technology because it illustrates how the push for the introduction of modern biotechnologies and genetically modified foods into developing countries in the Sub-Saharan Africa region can positively impact these countries by helping local farmers increase and keep up with food production and science as compared to the rest of the world, by providing inexpensive, adequate nutrition to the malnourished diets in developing countries, and by ensuring equal access to food and technological resources in the future. However, at the same time, this debate greatly matters to the public sphere because it shows how biotechnology transfer conflicts with the privatization of biotechnology development and patents in developed countries, the lack of knowledgeable stakeholders in Africa, the public perception of the potential risks and benefits of adopting genetically modified crops for agricultural and feeding purposes, and the overlooked ethical and environmental concerns.

Right now, there is a serious conflict between the rapid growth in the number of people in developing countries in Africa and the lack of technological resources available in those countries to make sure that each person is receiving adequate food for survival. A critical approach to better understanding the science and the basic ideas at stake in this controversial

issue is to examine how countries like the United States with more advanced sciences and technologies try to facilitate change in less scientifically advanced countries in Sub-Saharan Africa to improve food production, stabilize the food supply, and increase nutrition in sustainable ways.

It is crucial to understand that there are both advantages and risks of transferring biotechnology products from scientifically-developed nations to the developing world. Specifically, Lorraine Mitchell, from the United States Department of Agriculture, argues in her article, "Biotechnology and Food Security," that "as with any improvement in technology, farmers in developing countries must find new advances profitable. Consumers in developing countries will benefit if biotech crops are less expensive or more nutritious than traditional crops" (Mitchell). Thus, this transfer of biotechnology to developing countries is advantageous if and only if this technology is economically feasible for local farmers, if the new genetically modified crops are produced and consumed at cheaper, more affordable prices for the citizens of third world nations, and if these crops are generally more healthy for consumers than the original crops.

However, it is significant to realize in this debate that there are some serious concerns that biotechnology transfer and adoption can have as well, especially in Sub-Saharan Africa where many of these countries do not have a healthy economy to produce and consume food, the proper legal and government infrastructures to develop and research biotech crops, and the most efficient technological resources for agricultural purposes. The introduction of technology and genetically modified crops would require the government, the citizens, and the local farmers in Sub-Saharan Africa to alter their institutional structures and food production systems because "developing countries have fewer institutions to cushion the risk of adopting new technology"

(Mitchell). Thus far, most of the institutions, technological resources, and infrastructures particularly set up for biotechnology research and development is concentrated within the private sector of the developed world.

The transfer of biotechnology and other technological products to developing countries to help fight world hunger is taking place at a much slower pace than anticipated because this transfer conflicts with the increasing consolidation of biotechnology research in private corporations inside artificial environments in advanced countries. In fact, Mitchell argues one reason why the developing world is experiencing such slow progress in the science of genetically modified organisms and in food production is "because of concerns related to farmers' ability to purchase the inputs and the lack of protection of intellectual property in developing countries" (Mitchell). The developed nations, like the United States and Canada, have already been able to experience the benefits of biotechnology products because private organizations in these countries hold most of the patents for developing modified seeds around the world. As a result, the costs of biotechnology have been higher in developing countries for farmers to produce genetically modified foods, for citizens to consume these foods, and for the government to set up the appropriate infrastructures to develop and distribute the foods.

At the same time, with the current public research taking place in developing countries, Sub-Saharan Africa has already started to develop positive relations or partnerships with private companies and governments in the developed world in order to increase the access and equity of biotechnology food products to its citizens. Mitchell mentions that "how widespread these partnerships are and how many of them will concentrate on varieties relevant to developing nations will affect the usefulness of the biotechnology revolution for developing countries" (Mitchell). Thus, on one side of the debate, the lack of access to agriculture resources, the high

costs of biotechnology, and the insufficient government infrastructures for research and development are challenges and barriers that Sub-Saharan Africa face in successfully utilizing genetically modified food crops to increase production and access to food resources. However, on the other side of the debate, the success of biotechnology adoption in developing countries like Kenya or South Africa depends on the cooperation of biotech companies in the United States with the governments, the citizens, and the local farmers of the developing countries in need to make sure food is affordable, nutritious, and readily available.

Thus, the increasing concentration of science research and the privatization of technology in developed nations pose a problem in the transfer of biotechnology. More important, there are major disagreements from the major stakeholders in Sub-Saharan Africa on this debate about the impact biotechnology will have on the global food market and the overall economy of developing countries. This disagreement is a challenging, complex issue because on one side of the debate, there are some people who believe that biotechnology will do more economic, environmental, and human health-related damage to poor citizens and farmers in developing countries. At the same time, there are those who positively perceive biotechnology to be the ultimate and only answer to the issues of food production and access. Patricia Kameri-Mbote points out that the stakeholders in "African countries have not taken deliberate efforts to understand biotechnology, tap its potential, and use it to address some of their basic agricultural problems" (Kameri-Mbote). In other words, the stakeholders including the governments, citizens, and farmers in African countries do not have the appropriate knowledge or understanding of biotechnology and genetically modified crops, and thus, it has become difficult to migrate and transfer biotechnology products like GMO's to the Sub-Saharan Africa region. Part of the reason why the people in Sub-Saharan Africa have struggled to keep up with the science and technology

of food production is because they lack a public sphere or a community to discuss this issue. Kameri-Mbote argues that since there is a lack of knowledgeable stakeholders in Africa, the controversy in this issue is that there is an "ambivalence to or indecision on biotechnology" (Kameri-Mbote). To further clarify, the public in developing countries have doubts, uncertainties, and differing public perceptions about the adoption of genetically modified food products and their potential impact. It is true that there has been increasing research and development of biotechnology in Sub-Saharan Africa in the past two decades or so in both the public and private sectors; however, it is significant to make note that the problem is that it is the large, private corporations around the world that have merged together to control a majority of the property rights for biotechnology development. Hence, these organizations have and will heavily influence the development, the open access, and the decisions regarding biotechnology resources in Africa.

So, there is a problem facing developing nations in Sub-Saharan Africa today with the absence of knowledgeable and skilled stakeholders in Africa despite research and development slowly starting to take place within these countries' borders. To understand the complex issues surrounding this debate, it is critical to look at the controversial issue from the perspective of the most important stakeholder in the debate, the African population. Supporters of introducing biotechnology into Sub-Saharan Africa have argued that transgenic crops will benefit the developing countries and their citizens, who are struggling with issues like severe environmental problems, food production and access, and poverty. In fact, Florence Wambugu claims in her *Nature* magazine article, "Why Africa needs agricultural biotech," that "small-scale farmers in Africa have benefited by using hybrid seeds from local and multinational companies, and transgenic seeds in effect are simply added-value improvement to these hybrids" (Wambugu 15).

Thus, one argument for this relevant issue in science points to the idea that there is a critical push for the introduction of biotech crops into countries in Sub-Saharan Africa to decrease poverty and famine levels and to protect the environment, especially since transgenic crops have been successfully introduced and implemented into the diets and natural environments of developed countries around the world and into a few countries in the Sub-Saharan Africa region like South Africa.

With the introduction of genetically modified crops, biotechnology could possibly guarantee poor farmers in Africa economic benefits and prosperity by increasing productivity and crop yield. However, at the same time, Wambugu asserts that "the critics of biotechnology claim that Africa has no chance to benefit from biotechnology, and that Africa will only be a dumping ground or will be exploited by multinationals" (Wambugu 15). So, the possibility of exploitation, manipulation, and abuse by large, global biotech companies in developed countries shows that the public cannot understand this issue about biotechnology transfer and why it matters without taking into consideration the significant ethical, biosafety, and environmental aspects of this debate first.

Biotechnology products and the genetic modification of crops have their benefits, but because it is such a new, uncertain, and unexplored technology, it does not come without its risks. Thus, to understand this complex issue, the public must look at it from an ethical and environmental standpoint. First, as with any issue in science and technology, it is crucial to analyze biotechnology's environmental impact on the Sub-Saharan Africa region, landscape, and diversity. From an environmental perspective, some of the questions at stake in this issue that need to be addressed in the public sphere by the major stakeholders in Africa include: How does biotechnology transfer affect biodiversity? Will genetically modified crops create and release

toxic chemicals into the atmosphere, and hence, be detrimental to human and other living organisms' health? How can biotechnology be developed in a sustainable way "without compromising the ability of future generations to meet their own needs?" (*Our Common Future* 8). These environmental questions cannot be ignored when addressing issues of food security and transgenic crops in Sub-Saharan Africa, but as with many other new technologies, they often are neglected from country to country because of differing public perceptions and the very slow growth of scientific and technological advancements in the third world.

Consequently, not only do major stakeholders like the general public, international governments, and biotech corporations need to understand how equal access and transfer of biotechnology products transform food productivity in developing countries, but they have an obligation to understand how this new technology might transform the African landscape that they are influencing and helping to develop. Florence Wambugu really expresses the environmental side of this debate and why it is a significant public concern for consumers and producers of transgenic crops. Wambugu emphasizes that "consumers need to be informed of the pros and cons of various agricultural biotechnology packages, the dangers of using unsuitable foreign germplasm, and how to avoid the loss of local germplasm and to maintain local diversity" (Wambugu 16). As a result, this public debate of the transfer of biotechnology requires global public participation because the "bio" in biotechnology implies the manipulation of living, breathing plants and animals in the environment. Therefore, the genetic manipulation of crops and the environment is just one of many crucial aspects of this debate that the people of Africa and the developed countries have to consider when increasing the access of biotechnology products to rural, poor farmers.

However, on the other side of the debate, there are people like Norman Borlaug, Nobel Prize Laureate for Peace in 1970, who see biotechnology as a means to end world hunger and increase food productivity in developing countries because it has its environmental advantages. Whereas people against the transfer of biotechnology argue that genetically modified crops are unsafe for nature and human consumption, Borlaug claims in his article, "Ending World Hunger," that "genetically modified organisms and genetically modified foods are imprecise terms that refer to the use of transgenic crops. The fact is that genetic modification started long before humankind started altering crops by artificial selection" (Borlaug 489). Thus, the partiality, the differing viewpoints, and the uncertainty about the long term environmental effects of biotechnology will play a central role in evaluating the consequences and benefits of biotechnology transfer and access. However, as stated by Sheila Jasanoff in her article, "Technologies of humility," the stakeholders of this controversial issue need to develop "disciplined methods to accommodate the partiality of scientific knowledge and to act under irredeemable uncertainty" (Jasanoff 33). This issue of food security and biotechnology is so complex, but it requires knowledgeable, active stakeholders to act even under the most uncertain environmental conditions in order to move towards a pragmatic way forward. In their article, "The role of biotechnology in ensuring food security and sustainable agriculture," researchers Abah, Ishaq, and Wada acknowledge the limits and uncertainty of biotechnology and the manipulation of genetic organisms when they say that "the existence of unknown risks cannot be ruled out with absolute certainty, neither for transgenic crops nor for any other technology" (8898-8899). Since the science of biotechnology is relatively new and unexplored by scientists, the public, and developing countries, there is much uncertainty and unavailable information about the biosafety and the environmental impact of this technology in Sub-Saharan Africa.

The unavailable information about the impact of biotechnology has caused differing cultural and country perceptions about genetically modified organisms and crops. In fact, Arjunan Subramanian, Kerry Kirwan, and David Pink in their *Science* magazine article state that this public "perception failure poses an imminent danger to the advancement of science. Consumer resistance to genetically modified products affects trade relations and reduces private research and development on plant biotechnology" (173). It is significant to acknowledge that international cooperation and private research are essential for a new science like biotechnology; however, the main stakeholders of this debate, especially the people of Sub-Saharan Africa, must be informed of the environmental challenges. They must act on this problem, even with the uncertainty and partiality that modern science and technology research are strongly built on today.

Just like how uncertainty and partiality are inevitable in the advancement of sciences, ethics is inseparable from the adoption and the access to technologies. Thus, to comprehend this complex debate, it is vital to consider the ethics involved with the transfer of biotechnology. This issue is a relevant, complex controversy that needs to be widely understood by the public from an ethical standpoint because as stated by Ismail Serageldin in his *Science* magazine article, "Biotechnology and Food Security in the 21st Century," "scientific research on such issues must be guided by ethical and safety principles, as well as respect for the private sector's need to earn a decent return." (Serageldin 388). There are definitely important ethical questions at stake in this debate, especially since biotech patents are primarily controlled by private institutions in technologically-advanced nations, and the developing countries lack public participation and the financial resources to invest in biotechnology research. Thus, according to Serageldin, the issue of biotechnology transfer requires a shift "in the research paradigm" that allows open and equal

access to research and development in science and technology among developing and developed nations (Serageldin 387-388). However, in addition, this paradigm shift is going to require the public to closely examine the ethics of the large, global biotech corporations' motives and interests because there is no doubt that the introduction of genetically modified seeds is going to make the developing countries in Sub-Saharan Africa more reliant on these corporations. Serageldin argues that "there must be recognition of the need for increased public involvement with biotechnology for complementing private sector research, to ensure transparency and accountability and to promote a broad range of public goods research just as markets expand for results of private goods research" (Serageldin 389). Consequently, it is important for the public to understand that private researchers and corporations main goal is to make profit, but at the same time, the general public and these private businesses have ethical and moral responsibilities to attend to this issue of feeding the people in Sub-Saharan Africa without exploiting the safety and health of current populations, future generations, the environment, and without taking advantage of people's beliefs and cultures in place within the African continent.

From an ethics standpoint on this debate, since technologies have already been developed to feed millions of people in Africa and to increase food production, there is an ethical obligation to use those technologies to provide each individual with the most fundamental need for survival, food. If private entities cannot work for the public good and the interests of local farmers in Africa, then a major question arises in this debate about who should be responsible to provide and regulate measures for biotechnology access. Many biotech institutions will argue that bioethics are only a problem in technologically-advanced countries since third world countries do not have the infrastructures or institutions to afford new technologies. However, Dr. Vandana Shiva, from the Research Institute for Science, Technology, and Ecology in New Delhi, India

disagrees with the biotech industry's viewpoint that bioethics and biosafety are not significant matters in developing countries, and she disagrees that the debate about biotechnology is nonexistent in third world nations plagued by hunger and famine. Dr. Shiva states in her article, "Bioethics: A Third World Issue," that "bioethics and value decisions are necessary in the Third World because biotechnology, like any technology, is not neutral in its impacts. It carries disproportionate benefits for some people and disproportionate costs for others. To ask who gains and who loses, and what are the benefits and what are the costs, is to ask ethical questions" (Shiva). Bioethics plays a huge role in this debate because if private businesses are developing and researching biotechnology products for their own good and interests, there is a possibility that these corporations might potentially exploit or abuse (through patents and commercialization of seeds) not only plants and animals but also the living human beings who live in these poorer nations.

The scientific controversy about the introduction of biotechnology into Sub-Saharan Africa matters to the public because genetically modified organisms will create advantages and consequences, winners and losers, and other tradeoffs or opportunity costs that people must know. Public knowledge of the ethical, environmental, legal, commercial, and technological questions and choices tied to the issues of food security and biotechnology cannot be excluded from the impact genetically modified foods will have on economically poor, less technologically-advanced countries. Thus, it is essential to harness the benefits of biotechnology in the underdeveloped countries of Sub-Saharan Africa, but the uncertainty of this novel technology, the unknown safety and environmental concerns, private corporations' self-serving goals, and the public's values and ethics of the manipulation of genetics and living organisms have all contributed to the slow adoption and transfer of this technology to Sub-Saharan Africa.

Works Cited

Abah, J., M.N. Ishaq, and A.C. Wada. "The role of biotechnology in ensuring food security and sustainable agriculture." *African Journal of Biotechnology* 9.52 21 December 2010: 8896-8900. Print.

Borlaug, Norman. "Ending World Hunger. The Promise of Biotechnology and the Threat of Antiscience Zealotry." *Plant Physiology* 124.2 (Oct. 2000): 487-490. Print.

Endy, Drew. "Biotechnology Without Borders." *SeedMagazine.com.* Seed Media Group, 3 March 2011. Web. 3 February 2012.

Jasanoff, Sheila. "Technologies of humility." *Nature.* Nature Publishing Group, 1 November 2007. Web. 21 March 2012.

Kameri-Mbote, Patricia. "Biotechnology and Food Security in Africa: Some Policy and Institutional Considerations." *International Environmental Law Research Centre.* International Environmental Law Research Centre, 2002. Web. 30 March 2012.

Mitchell, Lorraine. "Biotechnology and Food Security." *United States Department of Agriculture.* United States Department of Agriculture, 2012. Web. 30 March 2012.

Our Common Future: The World Commission on Environment and Development. New York: Oxford University Press, 1987. Print.

Serageldin, Ismail. "Biotechnology and Food Security in the 21st Century." *Science* 285.387 (July 1999): 387-389. Print.

Shiva, Vandana. "Bioethics: A Third World Issue." *NativeWeb.* NativeWeb, n.d. Web. 1 April 2012.

Subramanian, Arjunan, Kerry Kirwan, and David Pink. "Food Security: Population Controls." *Science.* The American Association for the Advancement of Science (AAAS), 9 April 2010. Web. 30 March 2012.

Wambugu, Florence. "Why Africa needs agricultural biotech." *Nature.com.* Macmillan Magazines Ltd., 1 July 1999. Web. 30 March 2012.