Engineering Akerlof Lemons: Information Asymmetry, Externalities, and Market Intervention in the Genetically Modified Food Market

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"I applaud Africa's rejection of genetically modified food . . . GM [genetically modified] food should be outlawed throughout the world. Until it is we should all boycott it . . . even if we are starving."

- Peter (U.S.A.) – Comment from a BBC Internet discussion considering whether southern Africa should accept genetically modified food aid.[1]

"Don't worry about what I feed my family. You just give me some money and I will take care of it. You don't have to assume that I don't know what to feed my family. The problem is that I happen to be poor, and if you can't do anything about that then get out of here. Don't waste my time."

- Farmer, Bangladesh, early 1980's[2]

INTRODUCTION

Famine threatened an estimated 14.4 million people in southern Africa between September 2002 and March 2003.[3]

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1. *Should Southern Africa Accept GM Food Aid?*, BBC NEWS, July 30, 2002, *at* http://news.bbc.co.uk/1/hi/world/africa/ (on file with author).

2. Florence McCarthy, *The Target Group: Women in Rural Bangladesh, in* ROOM FOR MANOEUVRE: AN EXPLORATION OF PUBLIC POLICY PLANNING IN AGRICULTURAL AND RURAL DEVELOPMENT 49-58 (E.J. Clay & B.B. Schaffer eds., 1984).

3. On September 16, 2002, the Southern African Development Community's Food, Agriculture, and Natural Resources Vulnerability Committee (SADC FANR) estimated that the maximum number of people in need between September 1, 2002, and March 31, 2003, would be 14.4 million. U.S. AGENCY FOR INT'L DEV., SOUTHERN

Food aid from the United States could help ameliorate this crisis.[4] A few countries, however, have declined the food offered or have accepted it under limited conditions because it cannot be certified as free of genetic modification.[5]

This recent controversy in southern Africa, regarding genetically modified food (GMOs),[6] is symptomatic of the broader trade impasse over GMOs between the United States and the European Union (EU).[7] GMOs are no longer only a trade issue for the World Trade Organization (WTO) and the General Agreement on Tariffs and Trade (GATT), but GMOs have also become an issue of humanitarian aid and international human rights under the International Covenant on Economic, Social, and Cultural Rights,[8] the International Covenant of Civil and Political Rights,[9] and the Universal Declaration on Human Rights.[10]

The GMO market is failing for several reasons, including: (1) information asymmetry and the economic phenomena known

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AFRICA - COMPLEX FOOD SECURITY CRISIS SITUATION REPORT #1 (FY) 2003 (Oct. 4, 2002), *available at* http://www.usaid.gov/ofda/southernafrica_sr1_fy03.html [hereinafter U.S. AID].

4. The United States pledged to give fifty percent of the World Food Programme's commitment. The European Union committed to twenty percent. Andrew S. Natsios, The Food Crisis in Southern Africa: The Challenge to Sustainability, Briefing at the Foreign Press Center (Aug. 20, 2002), *available at* http://fpc.state.gov/12853.htm.

5. *Zimbabwe Reconsiders GM Grain*, BBC NEWS, Aug. 2, 2002, *at* http://news.bbc.co.uk/2/hi/africa/2167860.stm. Zimbabwe originally announced it would refuse the grain but then reversed its decision. *Id.* Zambia's President announced that GMOs would be examined for safety before distribution. *Id.* Mozambique, which acts as a pass-through in transit for food to Malawi and Zimbabwe, asked the World Food Programme to cover the grain in plastic sheeting to avoid spillage, which might contaminate their crops. *Id.* Malawi said it had no choice but to accept the food. *Id.*; *see also Zimbabwe Turns Away US Food Aid*, BBC NEWS, May 31, 2002, *at* http://news.bbc.co.uk/2/hi/africa/2019052.stm (announcing the declination of food aid).

6. Although the author has used the more typical abbreviation GMO that means genetically modified organism, the context of this article is limited to plant food and does not address the subject of genetic modification of animals or humans.

7. *See supra* note 5.

8. *See International Covenant on Economic, Social and Cultural Rights*, G.A. Res. 2200A (XXI), 21 U.N. GAOR, Supp. No. 16, at 49, U.N. Doc. A/6316, *entered into force* Jan. 3, 1976 [hereinafter ICESCR].

9. *International Covenant on Civil and Political Rights*, G.A. Res. 2200A (XXI), 21 U.N. GAOR, Supp. No. 16, at 52, U.N. Doc. A/6316 (1966), 999 U.N.T.S. 171, *entered into force* Mar. 23, 1976 [hereinafter ICCPR].

10. *Universal Declaration of Human Rights*, G.A. Res. 217, U.N. GAOR, 3d Sess., 183d plen. mtg., at 71, U.N. Doc. A/810 (1948) [hereinafter UDHR].

as the "lemon problem;"[11] (2) the presence of environmental and biological externalities which may not be reflected in the price of the product;[12] and (3) the western bias of intellectual property rights, which seriously disadvantages the long history of agricultural production in developing economies.[13] These shortcomings and the resulting trade impasse between the United States and the EU highlight the problem of equity and efficiency in the GMO market.[14]

This Note will discuss the economic failure in the GMO market and argue that the creation of a human rights test to judge GMO market regulation is an appropriate tool to gauge necessary market interventions. Part I defines GMOs and identifies GMO benefits and concerns. Part II examines the conflict between the United States and the EU and how it has affected the provision of food aid in less developed countries. Part III discusses three types of market failure in the GMO market. Part IV describes the internationally recognized right to food. Finally, Part V promotes the right to food by applying a human rights test to necessary economic intervention.

I. THE CONFLICT SURROUNDING GENETICALLY MODIFIED FOOD

A. DEFINING GENETICALLY MODIFIED FOOD

The debate regarding GMOs developed when biotechnology created ways for scientists to fuse genes on a cellular level.[15] Even though the regulatory or legal definitions of GMOs are inconsistent internationally, this Note adopts the definition that genetically modified food is food that has been created through a biotechnological process[16] "to isolate genes from an organism,

11. *See* discussion *infra* Part III.A.

12. *See* discussion *infra* Part III.B.

13. *See* discussion *infra* Part III.C.

14. *See* discussion *infra* Part III.C.

15. *See* Jeffrey K. Francer, *Frankenstein Foods or Flavor Savers?: Regulating Agricultural Biotechnology in the United States and European Union*, 7 VA. J. SOC. POL'Y & L. 257, 261-62 (2000); ROBERT L. PAARLBERG, GOVERNING THE GM CROP REVOLUTION: POLICY CHOICES FOR DEVELOPING COUNTRIES 1 (Food, Agriculture, and the Environment, Discussion Paper No. 33, Dec. 2000). Genetic engineering technology developed in 1973, but the modern commercial GM crop revolution did not begin until 1995. PAARLBERG, *supra*, at 1.

16. In this Note, the terms genetic engineering, genetic modification, and biotechnology are used interchangeably.

manipulate them in the laboratory and *inject* them into another organism."[17]

Differences between the EU and U.S. definitions of genetically modified food are the genesis of the controversy between the two bodies regarding the regulation and labeling of GMO food. The U.S. regulatory scheme does not contemplate a difference between "new" genetically modified food, modified through biotechnology, and food produced from hybridization[18] or other traditional methods of genetic modification,[19] and uses the term "genetically modified" food to encompass both processes.[20] The EU, however, considers non-traditional methods of modification, such as those which occur in a laboratory, as suspect. It reserves the term "genetically modified" for food and food ingredients which are modified in the laboratory, contain genetically modified material, or are produced from "parent" GMOs.[21] In the EU, foods produced from genetically "injected" or genetically modified seed are subject to heightened scrutiny.[22] The EU Regulation on Novel Foods and Food Ingredients states that foods must be labeled when they are no longer "equivalent" to their conventional counterparts.[23] The EU views the laboratory method of gene "injection" as inherently suspect, so any food

17. Marsha A. Echols, *Food Safety Regulation in the European Union and the United States: Different Cultures, Different Laws*, 4 COLUM. J. EUR. L. 525, 535 n.48 (1998) (citing ORG. ON ECON. AND CMTY. DEV., BIOTECHNOLOGY, AGRICULTURE AND FOOD 211 (1992)).

18. Biotechnology includes traditional animal and plant breeding techniques, such as hybridization and the selection of plants and animals with specific characteristics to create, for example, crops which produce higher yields of grain. Francer, *supra* note 15, at 261-62; CONVENTION ON BIOLOGICAL DIVERSITY, *Frequently Asked Questions about the Cartagena Protocol on Biosafety*, *at* http://www.biodiv.org/bio safety/faqs.asp (last visited Jan. 27, 2003).

19. Biotechnology, in the form of traditional fermentation techniques, has been used for decades to make bread, cheese, and beer. *See* Francer, *supra* note 15, at 261-62.

20. George E.C. York, *Global Foods, Local Tastes and Biotechnology: The New Legal Architecture of International Agriculture Trade*, 7 COLUM. J. EUR. L. 423, 426 (2001). For example, the U.S. regulatory scheme does not contemplate any difference between an apple produced from seeds that have been "injected" with a gene in a laboratory to make the apple taste sour, and an apple produced through hybridization in an orchard through cross-pollination, seed selection, or other non-laboratory methods to make it taste sour. Both have been genetically modified from the natural state: one with historic methods and the other with new laboratory methods. *Id.*

21. Council Regulation 258/97 on Novel Foods and Food Ingredients, art. 1, 1997 O.J. (L 43) 5 [hereinafter Novel Foods Regulation].

22. *See id.*

23. *Id.* at art. 8. For example, this might occur when a food has a different composition, use or nutritional value as compared to the conventional food. *Id.*

that has undergone this process is no longer "equivalent" and, therefore is subject to the novel foods regulation regime.[24]

B. BENEFITS OF GENETICALLY MODIFIED FOOD

The potential benefits of genetically modified foods are numerous.[25] Many varieties of GM seed currently on the market have been promulgated because they decrease agricultural inputs[26] or increase yields.[27] Some of the nutritional benefits that scientists promise include foods that are richer in vitamins,[28] minerals, or protein, or lower in fat,[29] making it easier to choose

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24. *See id.* at art. 1. Any food, "with a new or intentionally modified primary molecular structure" is subject to the regulation. *Id.*

25. Over 500 scientists wrote the following in a letter supporting biotechnology:

> In developing countries, biotechnology advances will provide the means to overcome vitamin deficiencies, to supply vaccines for killer diseases, like cholera and malaria, to increase production and protect fragile natural resources, and to grow crops under normally unfavorable conditions . . . . When there is no credible evidence of a risk to human health from use of biotechnology, why would anyone want to deny the world these benefits?

U.S. DEP'T OF STATE, FACT SHEET: FREQUENTLY ASKED QUESTIONS ABOUT BIOTECHNOLOGY (Jan. 22, 2001), *available at* http://www.state.gov/e/eb/rls/fs/1142.htm.

26. York, *supra* note 20, at 430-31. Bt, or bacillus thuringeinsis, cotton provides one example of the environmental benefits of biotechnology, which are already being enjoyed in the United States. *Id.* While Bt cotton grown in California requires only one application of chemical insecticide per season instead of the former thirteen, Arizona farmers have reduced their use of insecticides by seventy-five percent. *Id*; *see also* Charles W. Smitherman III, *World Trade Organization Adjudication of the European Union—United States Dispute Over the Moratorium on the Introduction of New Genetically Modified Foods to the European Common Market: A Hypothetical Opinion of the Dispute Panel*, 30 GA. J. INT'L & COMP. L. 475, 480-81 (2002).

27. *See* York, *supra* note 20, at 429.

> For example Bt corn, which incorporates the genes of a soil microbe which is toxic to corn-damaging insects but safe for humans, animals, and other plants, has increased its yield by more than 66 million bushels in 1999 and has also led to modest decreases in insecticide use. Moreover, while studies have shown that certain types of GM wheat are expected to lead to an increase in yield potential of ten to fifteen percent, the World Bank has reported that biotechnology promises to increase food productivity in the developing world by twenty-five percent.

Id.

28. For example, "a new rice variety [golden rice] developed in Switzerland under a Rockefeller Foundation grant provides vitamin A. Each year nearly [one] million child deaths and [fourteen] million children with blindness and other eye problems have been linked to vitamin A deficiency." U.S. DEP'T OF STATE, *supra* note 25.

29. A potato with higher starch content would soak up less oil when it was fried, thereby reducing the fat content in french fries and potato chips. *See* CRAIG DONNELLAN, GENETICALLY MODIFIED FOOD 4 (2000).

a healthy diet.[30] GMOs also enhance marketability through improved preservation of fruits and vegetables.[31] Furthermore, farmers enjoy the benefit of crops that are able to resist bacterial and viral disease, insect attacks,[32] drought, and frost.[33] Biotechnology also provides for quicker diagnosis of diseases in plants and animals.[34] Finally, herbicide-tolerant crops require less herbicide,[35] and nitrogen-fixing, self-fertilizing cereal crops[36] require less chemical fertilizer. Together these benefits should lead to improved quality and quantity of foods and increased availability to people throughout the world.[37]

Commercial seed companies use the tool of biotechnology, instead of more traditional hybridization methods for three main reasons. First, genetic engineering increases the accuracy of targeting a specific, desirable trait in a plant, whereas hybrid results are less accurate and some less desirable traits might need to be tolerated in order to pursue the targeted trait.[38] Second, genetic engineering increases the speed of the promulgation of a certain desired trait.[39] Third, genetic engineering

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30. *Id.* at 3-5.

31. The Flavr Savr® tomato was the first genetically modified food released in the United States. Genetic modification removed the gene that produces the enzyme that causes tomatoes to soften. York, *supra* note 20, at 429. This meant that tomatoes could be shipped while firm, decreasing product loss due to softness, as well as increasing shelf life. DONNELLAN, *supra* note 29, at 4; York, *supra* note 20, at 426, 429.

32. *See* York, *supra* note 20, at 431. Bt cotton was engineered to be resistant to insects. However, the pink bullworm, a significant threat to cotton plants, has not developed resistance to the Bt gene. *Id.*

33. *See infra* note 40 and accompanying text.

34. Biotechnology test kits have been developed which can help farmers test crops to determine when pests or diseases are plaguing their crops, so they can take appropriate measures. *See* DONNELLAN, *supra* note 29, at 4-5.

35. *See id.* at 3-4.

36. Scientists are trying to engineer the natural nitrogen-fixing trait of beans into cereal crops, which lack nitrogen fixing-capabilities, with the hope that the cereal crops will become "self-fertilizing" and that less non-organic, high nitrate fertilizer will have to be applied. *See id.* at 4-5.

37. *See* York, *supra* note 20, at 429. "The World Bank has reported that biotechnology promises to increase food productivity in the developing world by twenty-five percent." *Id.* However, the actual impact of GMO crops on pesticide use, yields, and net returns will vary with the crop and technology examined. *See* Jorge Fernandez-Cornejo & William D. McBride, *Genetically Engineered Crops for Pest Management in U.S. Agriculture: Farm-Level Effects,* 786 AGRIC. ECON. REP. 187 (2000), *available at* http://www.ers.usda.gov/publications/aer786.

38. *See* ISMAIL SERAGELDIN & G.J. PERSLEY, CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH, PROMETHEAN SCIENCE: AGRICULTURAL BIOTECHNOLOGY THE ENVIRONMENT, AND THE POOR 19 (2000).

39. Hybridization is a process where seeds are selected and crossbred to arrive

makes possible genetic coding that could not occur in the natural environment.[40] These three reasons translate into increased profit because the seed and product generated can carry a premium price.[41] This premium and the increased profit it represents are why multinational corporations are at the forefront of this research and development.[42]

C. CONCERNS ABOUT GENETICALLY MODIFIED FOOD

Genetic modification of food products is a technology that has leapt from the lab to the commercial market. Consequently, consumers and policymakers have environmental, health, ethical, and legal concerns about the consumption of GMOs and the planting of GM seed.[43]

1. Environmental Concerns

Conservationists are concerned about the use of human and animal genetic material in plants for environmental reasons, including the creation of invasive non-native species and the destruction of plant and animal species. One concern is that copied genes incorporated into a plant could "escape" and transfer to another species with undesirable consequences.[44] For example, ecologists argue that genetically modified crops could cross-pollinate with weeds and create "super-weeds."[45]

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at the desired balance of favorable traits. JOHAN POTTIER, ANTHROPOLOGY OF FOOD: THE SOCIAL DYNAMICS OF FOOD SECURITY 124-26 (1999). Genetic engineering essentially does this in a Petri dish more accurately and faster than nature. *Id.*

40. *See* U.S. DEP'T OF STATE, *supra* note 25. One example of cross breeding which would not occur in nature is the creation of frost resistant tomatoes by "injecting" DNA from cold water fish into the genetic makeup of the plant. James Acton, *Genetically Modified Food*, DEBATABASE (June 30, 2000), *at* http://www.debatabase.org/debatabase/details-pr.asp?topicID=12.

41. *See* SERAGELDIN & PERSLEY, *supra* note 38, at 19-21.

42. *See* DONNELLAN, *supra* note 29, at 5-6.

43. *Id.* at 5-7.

44. *See* York, *supra* note 20, at 433.

45. *Id.* at 433-34; James King, *Could Transgenic Supercorps One Day Breed Superweeds?*, 274 SCIENCE 180, 180-81 (1996); Press Release, Food and Agricultural Organization, Biotechnology Can Help Feed an Increasing World Population - Positive and Negative Aspects Need to Be Balanced (Jan. 21, 1999), *at* www.fao.org/waicent/ois/press/presseng/1999/pren9902.htm. Several studies have shown that gene flow from GMOs to wild varieties does occur. King, *supra*, at 180. Agricultural officials say that the dangers of creating a super weed are, "at the moment hypothetical," and point out that: (1) most GMO crops do not have weedy native relatives with which they could hybridize; (2) most sought after traits do not give weedy relatives a comparative advantage; and (3) herbicide companies have an economic inter-

Another concern is that GMOs decrease the gene pool.[46] Decreases in the gene pool are anticipated because GMOs may promote monocroping, which is the practice of relying on a limited number of commercial seeds and thereby eroding local varieties of crops.[47] As plant species are lost, the community ethos and knowledge that sustained them are also lost, making revitalization of species unlikely.[48] Together these problems indicate that a decreasingly small gene pool puts the world at risk of plant and animal species extinction.[49]

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est in assuring that resistance to a herbicide does not build up in weeds. *Id.* at 180-81. Skeptics hypothesize that although gene transfer may only be likely in one percent of products, with the number of plants being introduced, a moderate to large scale ecological or economic catastrophe in the next ten years is likely. *Id.* at 180.

46. One solution to this is the creation of germ plasma banks, which are repositories in which germ plasma is protected for future use. *See* FOOD & AGRIC. ORG., AGENDA 21, CH. 14 (G) PROMOTING SUSTAINABLE AGRICULTURE AND RURAL DEVELOPMENT: CONSERVATION AND SUSTAINABLE UTILIZATION OF PLANT GENETIC RESOURCES AND FOR FOOD AND SUSTAINABLE AGRICULTURE paras. 14.54-14.55, *at* http://www.fao.org/WAICENT/FaoInfo/Agricult/AGP/AGPS/pgrfa/pdf/ag21e.pdf (last visited Mar. 14, 2003); FOOD & AGRIC. ORG., THE INTERNATIONAL CODE OF CONDUCT FOR PLANT GERMPLASM COLLECTING AND TRANSFER art. 1, *at* http://www.fao.org/WAICENT/FaoInfo/Agricult/AGP/AGPS/pgr/icc/icce.htm (last visited Mar. 14, 2003). Germ plasma simply refers to the genetic material, which makes up the traits of any given plant or animal. *Id.* at art. 2. These banks have received mixed reviews as to their effectiveness. *Id.*

47. During the Green Revolution, decreases in the gene pool were attributed to a development strategy that encouraged monocropping, though it did not include GMO technology. *See* Gilbert Etienne, *Overcoming Rural Poverty: The Lessons of Asia, in* THE GEOPOLITICS OF HUNGER, 2000-2001: HUNGER AND POWER, 259, 259-61 (Action Against Hunger ed., 2001) (describing the Green Revolution and its outcomes). For example, in Zimbabwe after the Green Revolution, two hybrid varieties account for ninety percent of all maize planted. POTTIER, *supra* note 39, at 126. "In an interview in Buhera District, Zimbabwe (September 1993), elders stressed that traditional crops, especially fingermillet (*rapoko*), were declining because local farmers now looked down upon them. 'For these modern farmers, *rapoko* seed is like shoe polish', one elder said." *Id.* (citation omitted).

48. POTTIER, *supra* note 39, at 126.

49. First, planting multi-plant varieties protects populations from plagues that might destroy one variety of plant but not affect another. *See* Héctor Sáez, *Property Rights, Technology, and Land Degradation: A Case Study of Santo Domingo Cuba*, CUBA IN TRANSITION 472 (Aug. 7-9, 1997), *available at* http://lanic.utexas.edu/la/cb/cuba/asce/cuba7/saez.pdf (last visited Jan. 26, 2003). Second, plant or genetic trait loss may mean the loss of important medicines or other commercially useful properties that the market has not yet exploited. *See* Mark J. Plotkin, *Bioprospecting: Medicine Quest: Interview with Mark J. Plotkin, Ph.D.*, *at* http://www.actionbioscience.org/biodiversity/plotkin.html (last visited Jan. 26, 2003). Third, selection of certain traits might breed out other traits. Interview with Jorge Bentancourt, Agricultural Program Director, Peace Corps Honduras, in Honduras (June-Aug. 1998) (describing monocropping during the Green Revolution in Honduras, but the same effect would likely occur with GMO-inspired monocropping).

2. Health Concerns

Moreover, public health specialists and consumer groups are concerned about the use of human and animal genetic material in plants for public health reasons.[50] However, medical and scientific evidence has shown no ill health effects from ingesting genetically modified food.[51] While there are additional concerns about collateral effects from what is being injected, there are feasible means to address them. For instance, some fear reactions to allergens or toxins transferred into the food from the genetic process or the genetic plasma taken.[52] Allergic reactions, however, have only been noted in clinical trials and can be remedied through proper labeling.[53] Therefore, this public health concern can be easily overcome.

Other health specialists fear an increasing human resistance to antibodies because of an antibiotic marker that is included in many GMOs.[54] Scientists use an antibody to "mark" the gene trait that they wish to transfer.[55] This antibody is then carried into the new organism as part of its genetic makeup and is eventually consumed.[56] Antibiotics are commonly prescribed as medicine to ward off infection but a resistance can be developed that renders the drugs ineffective if they are used too often.[57] There is public concern that the antibiotic markers in food, consumed over a lifetime, will contribute to a decrease in the effectiveness of antibodies prescribed for medicinal purposes.[58] To combat this concern, sugar-based markers are al-

50. *See infra* notes 52, 58 and accompanying text.

51. *See* U.S. DEP'T OF STATE, *supra* note 25.

52. York, *supra* note 20, at 433. In a laboratory test it was shown that people who are allergic to nuts may have a reaction to a food which has been modified with genes from Brazilian nuts. WILLIAM K. HALLMAN, CONSUMER CONCERNS ABOUT BIOTECHNOLOGY: INTERNATIONAL PERSPECTIVES 7 (2000) (citing J.A. Nordlee et al., *Identification of a Brazil-Nut Allergen in Transgenic Soybeans,* 334 NEW ENG. J. MED. 688-692 (1996)).

53. *Id.*

54. SERAGELDIN & PERSLEY, *supra* note 38, at 19 (discussing a new sugar-based marker that can replace the antibiotic marker currently being used).

55. *Id.*

56. *Id.*

57. Anthony C. LoBaido, *'Frankenfoods' Create Furor on Dark Continent: Despite Safety Concerns, ANC Government Embraces Altered Crops,* WORLDNETDAILY (Oct. 10, 2002), *at* http://www.worldnetdaily.com/news/article.asp?ARTICLE_ID= 29227.

58. *See EC Regulation of Genetic Modification in Agriculture, Proposal for a European Parliament and Council Directive amending Directive 90/220/EEC on the Deliberate Release into the Environment of Genetically Modified Organisms, Questioning before the Select Comm. on Eur. Communities of the U.K. House of Lords*

ready being tested to possibly replace the antibiotic markers.[59] The introduction of sugar-based markers in the place of antibiotic markers would leave public health concerns largely unsupported by scientific evidence.

3. Legal and Economic Concerns

Additionally, GMOs spark legal and economic concerns for multinational corporations, economic-rights groups, and anti-globalization activists. Multinational corporations are concerned with recapturing their research and development cost through intellectual property protection.[60] It is these multinational corporations, not states or development agencies, which largely drive GMO research and development.[61]

On the other hand, economic rights and anti-globalization activists are concerned that increasing reliance on western-controlled technologies will damage developing world farmers. People working in agriculture development worry that large corporate farmers, the consumers of large multinational corporations that produce GMOs, will receive all the benefits and that the interests of farmers in lesser-developed countries (LDCs) will not be protected.[62] This problem has already surfaced as patents are already being issued to western companies for products that farmers in LDCs have been cultivating for centuries, but have not yet patented.[63]

4. Ethical and Religious Concerns

Furthermore, some consumers are concerned about the use of human and animal genetic material in plants for ethical and religious reasons. Religious leaders convened in the United Kingdom in 1993 to discuss the use of this biotechnology in light

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(July 8, 1998) (question 421 from Lord Rathcavan to Timothy Galvin, Assoc. Administrator, Foreign Agric. Serv., U.S. Dep't of Agric.), *available at* http://www.parliament.thestationeryoffice.co.uk/pa/ld199899/ldselect/ldeucom/11/8070805.htm.

59. SERAGELDIN & PERSLEY, *supra* note 38, at 19.

60. FOOD & AGRIC. ORG., THE IMPACT OF INTELLECTUAL PROPERTY RIGHTS (IPRS) ON FOOD AND AGRICULTURE IN DEVELOPING COUNTRIES, *at* http://www.fao.org/biotech/C6doc.htm (last visited Mar. 14, 2003).

61. HALLMAN, *supra* note 52, at 6.

62. POTTIER, *supra* note 39, at 184.

63. *Id.* at 188. Anthropologist Vandana Shiva said this "represents an attempt to steal both from nature and the farmers who have nurtured basmati for centuries, as well as to sell counterfeit food to the consumer." *Id.* at 184-85.

of religious dietary restrictions.[64] Christian and Jewish groups generally found the use acceptable, but Muslims, Sikhs, and Hindus objected to the use of genetic material from prohibited animals being introduced into plants.[65] Vegetarians also objected to animal proteins being introduced into plant material.[66]

II. REGULATORY CONFLICT BETWEEN THE EUROPEAN UNION AND THE UNITED STATES

The market friction between the EU and the United States stems from the different approaches used by each region to define, test, and label new crop varieties.[67] The U.S. definition of GMOs is product rather than process centered. Defining GMOs by product rather than by process means that the regulatory scheme does not contemplate a difference between genetic engineering and traditional methods of hybridization.[68] As a result, in screening GM crop technologies for food safety and biosafety risks, the United States uses methods similar to those employed for conventional crops.[69] This approach is called the "permissive strategy."[70]

Governments in Europe initially followed suit, adopting the "permissive strategy" until they encountered strong social resistance from a coalition of anti-GMO groups.[71] The EU then invoked its right to take protectionist measures to protect the health, safety, and welfare of its people because of a lack of full scientific certainty regarding the environmental safety of genetically modified products.[72] This new approach is commonly referred to as the "precautionary approach."[73]

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64. DONNELLAN, *supra* note 29, at 7.

65. *Id.*

66. *Id.*

67. The GM food conflict is not limited to the United States and the EU. Canada, Australia, and other countries produce significant amounts of genetically modified crops. The conflict with the United States is highlighted because of its role in the donation of food to southern African states and how specifically the U.S./EU conflict impeded such an exchange. *See* discussion *infra* notes 78-85.

68. *See supra* notes 18-22 and accompanying text.

69. PAARLBERG, *supra* note 15, at 2. Argentina and Canada followed this approach. *Id.*

70. *Id.*

71. *Id.* The Coalition consisted of consumer groups, Green Party leaders, organic farmers, environmental organizations, and opponents of international seed companies. *Id.*

72. *See infra* notes 83-101 and accompanying text.

73. PAARLBERG, *supra* note 15, at 2. The EU and consumer and environmental

A. THE PERMISSIVE STRATEGY

The United States has based its regulatory scheme on the permissive strategy.[74] That is, as long as the product is *substantially equivalent* to the traditional product, differences in the processes used to achieve that result are not considered.[75] Therefore, no special labeling or commodity segregation is required if the modified product passes the safety test used on traditional products.[76]

This regulation is not administered under a centralized authority but rather falls within the combined authority of the United States Department of Agriculture (USDA), the Food and Drug Administration (FDA), and the Environmental Protection Agency (EPA). Under this regulatory framework, USDA's Animal and Plant Health Inspection Service (APHIS) ensures that new GMO varieties are as safe to use in agriculture as conventional varieties.[77] The FDA consults with developers of GMOs to ensure that the new crops and foods produced from them are as safe to consume as conventional foods.[78] Finally, the EPA protects public health and the environment from plants with pesticidal properties and GMOs by conducting scientific reviews.[79]

B. THE PRECAUTIONARY APPROACH

The precautionary approach, which was first pronounced in Principle 15 of the Rio Declaration on Environment and Development,[80] is invoked in those circumstances where science might get ahead of appropriate health and environmental regulations. Principle 15 states that "in order to protect the environment, the precautionary approach shall be applied by States . . . [w]here

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groups cannot base the precautionary approach on the balance of scientific evidence.

> They had no scientific evidence that any GM food or crops on the market were any less safe for human consumption or for the environment than the corresponding conventional foods and crops. Yet the novelty of the GM process seemed to suggest that conventional food safety and biosafety screening procedures were no longer adequate for judging possible risks.

Id.

74. York, *supra* note 20, at 426.

75. Statement of Policy: Foods Derived from New Plant Varieties, Food and Drug Administration, 57 Fed. Reg. 22,984, at 22,984 n.3 (1992).

76. PAARLBERG, *supra* note 15, at 2.

77. U.S. DEP'T OF STATE, *supra* note 25.

78. *Id.*

79. *Id.*

80. *Report of the U.N. Conference on Environment and Development*, U.N. GAOR, 47th Sess., Annex I, at 11, U.N. Doc. A/CONF.125/126 (1992).

there are threats of serious or irreversible damage," with the proviso that "lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[81]

The EU precautionary approach defines genetic modification based on the process rather than the product. The EU does not presume that genetic engineering is an inherently safe process; therefore, it distinguishes between modifications made by traditional methods, which it considers safe, and modifications using modern biotechnology techniques.[82] The EU system deems any product processed with modern biotechnology techniques suspect and subjects it to strict labeling requirements.[83] Furthermore, new GM foods or food products are also subject to the EU's current moratorium on GMO food.[84]

Council directives administer the use of GMOs in the EU. Directives 90/119 and 90/200 govern the release of GMOs in the EU and Directive 90/220 demands that researchers conduct an environmental risk assessment before release of a GMO.[85] Extensive field testing is then required before a product can be marketed.[86] Additionally, producers must receive government consent from each member state before marketing can proceed.[87] Currently, however, the EU has invoked its privileges under the precautionary approach to enforce a de facto moratorium on the release and sale of all GMOs not already approved.[88]

The EU abandoned the permissive strategy for the precautionary approach when constituents voiced concerns over the environmental and health safety of GMOs, despite the absence

81. *Id.*

82. *See* York, *supra* note 20, at 443.

83. According to Article 8.1(a) of Regulation 258/97, consumers must be informed of the modifications and methods of modification when a GMO is "no longer equivalent." *Id.* at 452. A GMO is *no longer equivalent* if the modifications are such that they are beyond the "accepted limits of natural variations for such characteristics." *Id.* at 453 (citing the Novel Foods Regulation). More recently, EU Directive 1139/98 demands "mandatory labeling of novel food products containing more than one percent engineered DNA or protein content (and insinuated associated food safety risks based on the 'precautionary principle')." ADVISORY COMM. ON INT'L ECON. POLICY, U.S. DEP'T OF STATE 24 (ACIEP, Briefing Paper for the June 13, 2000 meeting).

84. *See generally* Smitherman, *supra* note 26; *see also infra* Part II.C. (discussing the cost and nature of the moratorium).

85. Council Directive 90/119/EEC, 1990 O.J. (L 117) 1; Council Directive 90/220/EEC, pmbl. & art. 5, 1990 O.J. (L 117) 15.

86. Council Directive 90/220/EEC, *supra* note 85, at arts. 11.1, 15, 16.

87. *Id.* at art. 6.4.

88. York, *supra* note 20, at 428.

of scientific evidence to support such concerns.[89] European consumers have voiced a high level of concern over GMOs and food safety issues.[90] The strong Green Party presence in Europe backed the precautionary approach.[91] In addition, research on consumer attitudes suggests that the 1996 mad cow disease crisis helped to organize the support of consumer groups.[92] Farm Unions also joined the Greens and consumer groups, citing concerns over food safety and quality and, arguably, hoping for protectionist policies against a U.S. advantage in the GMO market.[93] Environmentalists were also apprehensive and joined the Green Party, consumers, and the farm union coalition, to push the EU towards a precautionary approach.[94] In 1997, the coalition demanded a labeling regime for GMOs.[95] A year later, in 1998, the EU blocked the registration of any new varieties of

89. *See supra* note 72 and accompanying text.

90. *See* HALLMAN, *supra* note 52, at 5-6. Some commentators also feel that media reporting differences between the United States and the EU has played a hand in galvanizing peoples' stance on the GM food issue. *Id.* When the scientific world announced the successful cloning of a sheep, U.S. media sources generally lauded the scientific accomplishment while EU sources more often reported the story from a legal, ethical, and moral side. *Id.* at 4.

91. York, *supra* note 20, at 446.

92. *See* HALLMAN, *supra* note 52, at 6 (citing B. Holmes, *The Great Divide: What Do Americans Make of the Furor Engulfing Britain?,* 161 NEW SCI. 1, 6-7 (1999); R. Horton, *Genetically Modified Foods: "Absurd Concern or Welcome Dialogue?,"* 354 LANCET 1314, 1314-15 (1999)). Mad Cow disease led to the destruction of millions of cows infected with a brain-eating parasite, which caused chronic brain wasting disease in some people who ate the meat. *See* CNN.COM, *Mad Cow Disease: Counting the Cost, at* http://www.cnn.com/SPECIALS/2000/madcow/ (last visited Mar. 14, 2003). Over 188,000 cases of mad cow disease have been reported, including one hundred deaths from vCJD, the related chronic wasting disease. Most of these have occurred in the United Kingdom. CREUTZFELDT-JAKOB DISEASE FOUNDATION, INC., CJD INFO, *at* http://cjdfoundation.org/CJDInfo.html (last visited Jan. 19, 2003); *see also* CNN.COM, *Timeline: How the Crisis Unfolded*, Jan. 15, 2001, *at* http://www.cnn.com/2000/WORLD/europe/UK/10/25/bse.timeline/index.html (outlining the genesis and development of the mad cow disease crisis and its subsequent spread to different parts of the European Union and the world). In considering the heightened anxiety over GM foods in the EU, it is interesting to note that mad cow disease was incorrectly attributed to "the addition of hormones in cattle feed" by 49.2% of Europeans. EUROPEAN COMM'N RESEARCH DIRECTORATE-GEN., EUROBAROMETER 55.2: EUROPEANS, SCIENCE AND TECHNOLOGY (Dec. 2001), *available at* http://europa.eu.int/comm/public_opinion/archives/eb/ebs_154_en.pdf. The disease is actually linked to the presence of infected sheep meat in the diets of cattle, not GMOs or hormones. *See* York, *supra* note 20, at 446.

93. PAARLBERG, *supra* note 15, at 2. European agriculture has been subsidized heavily since World War II. *Id.* This protectionism has been a source of conflict with the U.S. on previous occasions. *Id.*

94. *See id.*

95. *Id.*

GM crops.[96]

C. THE EU MORATORIUM ON U.S. GENETICALLY MODIFIED IMPORTS

The impasse between the passive approach and the precautionary approach has created an effective moratorium costing the United States over $600 million in lost trade.[97] Some commentators argue that such a moratorium breaches the EU's obligations as a member of the WTO.[98] Regardless of whether the effective moratorium is a breach, the standoff between the United States and the EU is not only affecting trade between the two regions, but is also impeding the delivery of food aid to countries in Africa.[99]

D. THE TREATIES AT THE SOURCE OF THE CONFLICT

Both the United States and the EU are members of the WTO and are subject to the limitations set forth in GATT.[100] The WTO and GATT were established to promote free and open trade.[101] This purpose, however, is subject to the domestic right to "protect and preserve the environment."[102] The WTO and GATT provide standards meant to protect the environment and regulate biotechnology, including Article XX of GATT, [103] the WTO Sanitary and Phytosanitary Agreement (SPS),[104] and the Cartagena Protocol on Biosafety (CPB).[105]

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96. *Id.*

97. Smitherman, *supra* note 26, at 475.

98. See *id.* for a hypothetical ruling of the WTO on this matter.

99. *See infra* notes 1298-29 and accompanying text.

100. Marrakesh Agreement Establishing The World Trade Organization, Annex 1A, LEGAL INSTRUMENTS-RESULTS OF THE URUGUAY ROUND vol. 1, 33 I.L.M. 1154 (1994) [hereinafter WTO Agreement]; Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations, Apr. 15, 1994, LEGAL INSTRUMENTS - RESULTS OF THE URUGUAY ROUND vol.1 (1994), 33 I.L.M. 1125 (1994) [hereinafter Final Act]; General Agreement on Tariffs and Trade, Oct. 30, 1947, 55 U.N.T.S. 194 [hereinafter GATT].

101. GATT, *supra* note 100, at pmbl.

102. *Id.*

103. *Id.* at art. XX.

104. Agreement on the Application of Sanitary and Phytosanitary Measures, Apr. 15, 1994, WTO Agreement, Annex 1A, LEGAL INSTRUMENTS – RESULTS OF THE URUGUAY ROUND vol. 1, *available at* http://www.wto.org/english/tratop_e/sps_e/spsagr_e.htm [hereinafter SPS].

105. *See* Cartagena Protocol on Biosafety to the Convention on Biological Diversity, Jan. 29, 2000, 39 I.L.M. 1027 (2000) [hereinafter CPB].

1. Article XX of GATT

Article XX of GATT allows for municipal law to circumvent the normal trading rules of the GATT/WTO in certain circumstances.[106] Municipal law may circumvent normal trade rules "if necessary to protect human, animal or plant life or health."[107] GATT prohibits such municipal laws from circumventing normal trading rules if the laws are "[1] arbitrary, [2] unjustifiable discrimination between countries where the same conditions prevail, or [3] a disguised restriction on international trade."[108]

2. The WTO Sanitary and Phytosanitary Agreement

The SPS[109] applies to measures that may affect international trade in animals and plants.[110] The SPS recognizes the right of member states to enforce measures necessary for the protection of human, animal, and plant life or health, however, the SPS states that such measures must be based on scientific principles and sufficient scientific evidence.[111] Under Art. 2(3), measures that are not based on scientific principle may constitute a GATT Article XX disguised restriction on international trade.[112]

States may enact measures which are more stringent than international standards as long as they fall within the limits set by SPS Article 5.[113] These limits state that measures, which are governed by the agreement, shall be "based on an assessment, as appropriate to the circumstances, of the risk to human, animal, or plant life, or health,"[114] and that such an assessment relies on factors such as "available scientific evidence, relevant

106. *See* Smitherman, *supra* note 26, at 491.

107. *Id.*

108. GATT, *supra* note 100, at art. XX; *see* Smitherman, *supra* note 26, at 491.

109. SPS, *supra* note 104. *See generally* Kevin C. Kennedy, *Resolving International Sanitary and Phytosanitary Disputes in the WTO: Lessons and Future Directions*, 55 FOOD & DRUG L.J. 81 (2002); David G. Victor, *The Sanitary and Phytosanitary Agreement in the World Trade Organization: An Assessment After Five Years*, 32 N.Y.U.J. INT'L & POL. 865 (2000).

110. *See* SPS, *supra* note 104, at Annex A(1)(a)-(d). See *id.* at Annex A(1) for the full definition of what is covered under the meaning of Sanitary and Phytosanitary Measures.

111. SPS, *supra* note 104, at arts. 2(1)-(2); *see also* Smitherman, *supra* note 26, at 492-93.

112. SPS, *supra* note 104, at art. 2(3); *see also* GATT, *supra* note 100, at art. XX; Smitherman, *supra* note 26, at 493.

113. SPS, *supra* note 104, at art. 5.

114. *Id.* at art. 5(1); *see also* Smitherman, *supra* note 26, at 493.

processes, and production methods."[115] Additionally, the SPS requires that states narrowly tailor such measures to ensure that they are not more restrictive on trade than is required to achieve the level of safety desired.[116]

3. *The Convention on Biological Diversity and the Cartagena Protocol on Biosafety*

Like the SPS, the CPB[117] affects both the EU and the United States. The EU is bound to the general principles and purposes set forth in the CPB, but the protocol has yet to go into effect.[118] Conversely, the United States adopted the convention but neither signed nor ratified the protocol.[119]

The CPB incorporates elements of the precautionary approach, as well as the U.S.-backed SPS risk assessment/scientific evidence approach. The precautionary approach appears in the Preamble,[120] where it reaffirms "the precautionary approach contained in Principle 15 of the Rio Declaration on Environment and Development."[121] The precautionary approach is also mentioned in Article 10 where the CPB discusses a state's procedures for decisions regarding importation.[122] The

115. SPS, *supra* note 104, at art. 5(2); *see also* Smitherman, *supra* note 26, at 493.

116. SPS, *supra* note 104, at art. 5(6). SPS also considers the situation, which many argue is relevant in the case of genetically modified food, where relevant scientific information is insufficient. *Id.* In such a scenario, the measures that are taken are subject to future objective risk assessment to be made within a reasonable period of time. *Id.* at art. 5(7); *see also* Smitherman, *supra* note 26, at 493.

117. CPB, *supra* note 105.

118. Smitherman, *supra* note 26, at 494 (stating that the EU is bound to the convention, though the CPB has yet to enter into force). Article 37 of the CPB covers entry into force. CPB, *supra* note 105, at art. 37; *see also Parties to the Convention on Biological Diversity / Cartagena Protocol on Biosafety*, *at* http://www.biodiv.org/world/parties.asp (last updated Dec. 13, 2002); U.S. DEP'T OF STATE, FACT SHEET: UPDATE ON THE CARTAGENA PROTOCOL ON BIOSAFETY (2002), *available at* http://usinfo.state.gov/topical/global/biotech/02071201.htm (last updated July 11, 2002) (discussing the current status of parties to the convention, including the United States).

119. Michael A. Gollin, *An Intellectual Property Rights Framework for Biodiversity Prospecting*, *in* WORLD RESOURCES INSTITUTE, BIODIVERSITY PROSPECTING: USING GENETIC RESOURCES FOR SUSTAINABLE DEVELOPMENT 159, 190 (1993); *Parties to the Convention on Biological Diversity / Cartagena Protocol on Biosafety*, *supra* note 118.

120. Smitherman, *supra* note 26, at 495 (citing CPB, *supra* note 105, at pmbl., arts. 1, 10, 11, Annex II).

121. *Report of the U.N. Conference on Environment and Development*, U.N. GAOR, 47th Sess., Annex I, Principle 15, U.N. Doc. A/CONF.151/26, 5 (1992).

122. CPB, *supra* note 105, at art. 10.

CPB also incorporates the permissive approach, stating that risk assessments based on scientific evidence shall be carried out before a state makes an Article 10 decision.[123] Importantly, the document emphasizes that it "shall not be interpreted as implying a change in the rights and obligations of a Party under any existing international agreements."[124] While the precautionary and permissive approaches are exclusive and cannot coexist, it appears that the drafters intended to give effect to both principles.[125]

The CPB furthers confusion as to the relevant international standard. For instance, it appears to ignore a 1998 decision in the WTO Appellate Body which favored the United States and the permissive approach, indicating that the precautionary approach is not favored as an international standard.[126] The moratorium and the current lack of a clear international standard for defining, testing, and regulating GMOs is causing friction in the market, resulting in lost trade and interruptions in humanitarian aid.[127]

E. THE CONFLICT AND LDCS – THE CASE OF ZIMBABWE

The impasse between the EU and the United States regarding genetically modified food touches LDCs, such as Zimbabwe, by impeding the distribution of international aid based on concerns that the acceptance of the aid would detrimentally affect Zimbabwe's export trade with the EU.[128] In late May 2002, the

123. Smitherman, *supra* note 26, at 495 (citing CPB, *supra* note 105, at arts. 15, 16).

124. CPB, *supra* note 105, at pmbl.

125. *See id. Compare id.* arts. 1, 10, 11, Annex II, *with* arts. 15, 16 (calling for risk assessment and risk management).

126. The WTO has issued interpretations about the precautionary principle, which tip the scales in favor of the permissive approach. *See* Smitherman, *supra* note 26, at 496. In 1998, U.S. and Canadian disputes against the EU involving the banning of beef injected with growth hormone, ended with a finding in their favor, determining that the level of impairment suffered by the United States was $116.8 million (US) per year of the ban. WTO Appellate Body Report, *European Communities – Measures Concerning Meat and Meat Products (Hormones)*,WT/DS26/AB/R (Jan. 16, 1998), *available at* http://www.wto.org/english/tratop_e/dispu_subjects_index_e.htm#bkmk63. The WTO Appellate Body decision stated that it is "less than clear that the precautionary principle is a principle of general or customary international law." Thomas J. Schoenbaum, *International Trade in Living Modified Organisms: The New Regimes,* 49 INT'L & COMP. L. Q. 856, 859 (2000); *see also* Smitherman, *supra* note 26, at 496.

127. *See* Smitherman, *supra* note 26, at 475.

128. The U.S. State Department issued a statement, which said, "We call upon the European Union to join us in assuring governments in the region (southern Af-

United States Agency for International Development told African officials there was not enough food certified free of genetic modification to maintain a continual supply to southern Africa for the anticipated famine.[129] States in need of food aid could either take the corn offered to them or reject it and seek other donors.[130] Forced with that decision, officials in Zimbabwe decided in May 2002 to refuse the food aid from the United States.[131] Europe's effective moratorium on GM food purportedly influenced Zimbabwe's refusal of aid.[132] Apparently, the officials feared that if any of the GM maize was planted, it could contaminate crops, making it difficult for African farmers to export their products to Europe.[133]

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rica) that food made from biotech crops is safe and should be distributed immediately to those who so desperately need it." Reuters News Serv., *US Asks EU to Assure Africans on Biotech Food* (Aug. 23, 2002), *at* http://www.planetark.org/ dailynewsstory.cfm/newsid/17414/newsDate/23-Aug-2002/story.htm.

129. *Zimbabwe Turns Away US Food Aid*, *supra* note 5. The U.S. Agency for International Development stressed that the food being offered to Zimbabwe has been tested and has been eaten by Americans every day for the last seven years. *See* Natsios, *supra* note 4. There seems to be confusion about this. *Id.* Contrarily, one U.S. scholar, who was lecturing in the EU, said that no one wants the GMO grain, and that even the Americans will not eat it, which obviously contradicts the statements of the State Department. *Id.*

130. In October 2002, the U.N. World Food Programme (WFP) sought another 16,000 tons of GM-free maize from within southern Africa for Zambia. Reuters News Serv., *WFP Says it Seeks Non-GM Food Aid for Zambia* (Oct. 9, 2002), *at* http://www.planetark.org/dailynewsstory.cfm/newsid/18103/story.htm. Zambia banned all genetically modified food aid in August, citing health concerns. *Id.* "The ban remains in place until the government establishes through its own tests if GM foods are safe for human consumption." *Id.* WFP spokeswoman Jo Woods said that approximately "$7 million in donations from Japan and the Netherlands would be used to buy the 16,000 tons of GM-free maize for Zambia." *Id.*

131. *Zimbabwe Turns Away US Food Aid*, *supra* note 5. The U.S. State Department blasted the President of Zimbabwe for pursuing policies that are seriously contributing to the problem of hunger, including an aggressive land reform act, which is taking the most valuable farmland out of production by kicking out white farmers to distribute to patrons of his party. *See* Natsios, *supra* note 4.

132. *See Zimbabwe Turns Away US Food Aid*, *supra* note 5; Reuters News Serv., *supra* note 128. "Harare feared farmers would use it for planting or as animal feed, thus jeopardizing Zimbabwe's beef exports to Europe, which has tough standards on genetically-modified foods." *Id.* While the United States has been criticized for its inability to offer GM free grains, it is really the EU's moratorium that is inhibiting the market, not the mere fact that U.S. farmers are not required to separate genetically modified grain from non-biotech grain when they deliver it to market. *See* Natsios, *supra* note 4. The EU does not regulate or mandate labeling of meat fed on GMO feed corn, therefore Zimbabwean fears were not founded by EU warnings, however, Zimbabwe was also reportedly worried about genetic "contamination" slipping into their grain crops. *Id.* If such contamination happened, the EU would likely reject "GMO contaminated food." *Id.*

133. *Id.*

Then on August 2, 2002, one day after a U.S. deadline, U.S. officials announced that the Zimbabwe government had reconsidered and decided to accept 20,000 tons of food aid needed to feed hungry Zimbabweans.[134] The Zimbabwean government accepted the maize with the condition that it is milled before importation.[135] While wide scale tragedy may have been averted by this decision, the delays associated with uncertain food policies affected the smooth transaction and efficiency of the food relief "market," mimicking the interruptions caused by market failures in the international GMO trade.

III. THREE INSTANCES OF GMO MARKET FAILURE

The lack of agreement on the appropriate GMO regulatory system has created a problem in southern Africa in particular, and has prevented the international community from addressing three types of market failure that exist in the GMO market: information asymmetry, environmental protection, and the free-rider problem. Market failure occurs where the force that drives market-based economies is interrupted or stymied and the market does not efficiently allocate resources to achieve the greatest possible consumer satisfaction.[136] This force is commonly referred to as the "invisible hand," which keeps markets moving or working efficiently.[137] The invisible hand is the force that allows producers to assess cost and consumers to assess value, such that the price of any good is set at that equilibrium point where consumer and producer satisfaction is maximized and ultimate social utility and efficiency is achieved.[138] While the invisible hand keeps economic trading systems efficient, this force does

134. *Zimbabwe Reconsiders GM Grain, supra* note 5.

135. *Id.* Milling solves the problem by making the maize unusable for planting. Reuters News Serv., *supra* note 128. Other states made special provision for acceptance of the food or accepted it only because there were no other options. *Id.* Malawi said it had no choice but to accept the GM maize. *Id.* Mozambique, where Malawi's food aid will pass through, had asked the World Food Programme to cover it with plastic sheeting to avoid spillage while in transit. *Id.* In Zambia, President Levy Mwanawasa said his government will have to examine donated GM food and established its safety first before giving it to the hungry. *Id.*

136. AMOSWEB ECONOMIC GLOSSARAMA, *at* http://www.amosweb.com/cgi-bin/gls_src.p1?fcd=dsp&key=market+failure (last visited Feb. 17, 2003).

137. ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 477 (Edwin Cannan ed., Univ. of Chicago Press 1976) (1776).

138. Don Fullerton & Robert Stavins, *How Economists See the Environment, in* ENVIRONMENTAL ECONOMICS AND PUBLIC POLICY: SELECTED PAPERS OF ROBERT N. STAVINS, 1988-1999, at 24 (Wallace E. Oates & Henk Folmer eds., 2000).

not contemplate issues of equity.[139] Capitalists often argue against government regulation or intervention in a market because it disturbs these forces, and because market forces rather than government interventions are often more efficient.[140] However, when markets fail, economists and policymakers are often able to justify government intervention because intervention will increase the utility of all parties.[141]

A. AKERLOF'S THEORY OF INFORMATION ASYMMETRY AND THE MARKET FOR LEMONS

In 2001, George Akerlof won a Nobel Prize in economics for his theories on information asymmetry and the market for "lemons."[142] Information asymmetry exists when three conditions are present: (1) quality is inconsistent between similar looking goods; (2) it is impossible for consumers to determine the qualitative difference between goods; and (3) the producer is capable of ascertaining the value difference between goods.[143] Because the consumer and producer do not have symmetrical information about the value of the product, the market cannot function smoothly and prices generally trend downward as skeptical consumers refuse to pay for "good quality" because they cannot distinguish it from "bad quality."[144] This downward spiral can lead

139. *See supra* text accompanying notes 136-37.

140. *See supra* text accompanying notes 136-37.

141. *See supra* text accompanying notes 136-37.

142. *See George Akerlof Wins Nobel Prize in Economics*, *at* http://www.berkeley.edu/news/features/2001/nobel (last visited Jan. 26, 2003). In his writings, Akerlof used the easy to understand example of the used car market as a means of illustrating the principle of asymmetry. George A. Akerlof, *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, 84 Q. J. ECON. 488, 489-92 (1970). He said that an individual buys a car in the used car market without knowing whether the car he buys will be good or a lemon, because the cars look the same and the buyer cannot tell the difference. *Id.* The buyer could assign a certain probability to the car about whether it was a lemon or a good car. *Id.* After owning a specific car for a length of time the car owner can form a good idea as to the quality of the machine. *Id.* This estimate is more accurate than the original estimate but good cars and bad cars must sell at the same price because no buyer can differentiate between a good car and a bad one. *Id.* Therefore, a buyer is locked in and can never expect to get the true value of his car at resale because it will be discounted by the uncertainty created by the presence of lemons in the market. *Id.* Nor can he expect to get the value of a new car, therefore a person with a good car is more likely to retain it while someone with a lemon is more likely to try to sell it, further exacerbating the problem until the discount is sufficient for the intrepid buyer to enter the market. *Id.*

143. Akerlof, *supra* note 142, at 489; *see also supra* note 141 and accompanying text.

144. Akerlof, *supra* note 142, at 490.

to decreasing market quality and market size, whereby social utility fails to be maximized and market failure occurs.[145]

Akerlof discussed that in such situations government intervention into the market may increase the welfare of all parties.[146] One example of government intervention to relieve information asymmetry is licensing.[147] Doctors, lawyers, and even barbers are licensed so that the consumer can know, without costly research, that such a person has met a least some minimal qualification to practice her particular profession.

Akerlof also describes institutions that may arise in markets to counteract information asymmetry without government-sponsored intervention, including guarantees, brand name goods, and chains.[148] For example, a customer might stop at a roadside fast food chain because he knows exactly what he will get - fast, inexpensive food at acceptable standards of hygiene.[149] Chain recognition is one non-government solution to the information asymmetry problem a road traveler encounters when looking for food, however, even this market-controlled solution is supported by government involvement in the form of trademark protection.[150]

One proposed solution to information asymmetry in the GMO market is identity preservation.[151] Identity preservation is a system of crop management and trade that allows the source or nature of materials to be identified, effectively segregating a market into two sub-markets.[152] Identity preservation subdivides the "food market" into two submarkets: one for organic

145. *See id.* at 488.

146. *Id.*

147. *See id.* at 500.

148. *Id.* at 499-500.

149. *See id.*

150. Akerlof, *supra* note 142, at 499-500. Chain recognition operates on consumer goodwill towards the chain, which is protected in part by laws that regulate brand names and trademarks. *Id.* A downside of such non-government market structures is that they do not act to increase distributional equity, because often brands are able to charge a premium, which prices items outside the reach of low-income individuals. *Id.*

151. *See* EUROPEAN COMM'N DIRECTORATE-GEN. FOR AGRIC., ECONOMIC IMPACTS OF GENETICALLY MODIFIED CROPS ON THE AGRI-FOOD SECTOR, ch. 5, *available at* http://europa.eu.int/comm/agriculture/publi/gmo/ch5.htm (last visited Jan. 26, 2003).

152. *Id.* Such a standard is used for organic foods and dolphin safe tuna. *See id.* at 1. Identity preservation ensures that a crop is monitored through the food chain to guarantee certain qualities that might command a premium. AGRIC. COMM., U.K. HOUSE OF COMMONS, THE SEGREGATION OF GENETICALLY MODIFIED FOODS, REP. NO. 3, paras. 6-7 (2000), *available at* http://www.publications.parliament.uk/pa/cm199900/cmselect/cmagric/71/7102.htm (last visited Jan. 26, 2003).

and another for inorganic.[153] In so doing, however, potential economies of scale are lost and production costs likely shift upward, thereby reducing the aggregate amount produced and increasing the prices of both markets.[154]

B. MARKET EXTERNALITIES AND ENVIRONMENTAL PROTECTION

According to environmental economists, market externalities are environmental costs that may be incurred due to promulgation of GMOs.[155] A market externality occurs when some consequence of producing or consuming a good is external to the market.[156] Because the consequence is external to the market, the market price does not reflect the true societal cost or benefit.[157] This creates a market disequilibria, which can only be remedied through intervention.[158] A typical example of a market externality is air pollution.[159] With a negative externality like air pollution the total social cost of production (poor air quality) may exceed the value of the product to consumers because the "true cost" of production is not captured in the market and passed on to consumers.[160] The government however, can intervene into the market to provide a mechanism to capture externalities.[161]

The United States typically uses two methods to capture the external cost of air pollution and charge it to the producer so that it may be reflected in consumer pricing.[162] The first is to set emission levels or standards.[163] Any source exceeding the allowed level may be subject to both civil and criminal penalties.[164]

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153. EUROPEAN COMM'N DIRECTORATE-GEN. FOR AGRIC., *supra* note 151, at 1.

154. *See id.* at 3. The EU Agriculture Commission has determined that identity preservation would increase commodity prices by six to seventeen percent worldwide. *Id.* Costs rise exponentially as tolerance levels increase. *Id.*

155. *See supra* notes 41-51 and accompanying text.

156. *See* Fullerton & Stavins, *supra* note 138, at 24.

157. *Id.*

158. *Id.*

159. *Id.* at 24-25.

160. *Id.* at 24.

161. *See id.*

162. *See* Fullerton & Stavins, *supra* note 138, at 24-25.

163. Point source water pollution and benzene pollution are commonly used as examples of areas where the government has set a standard that cannot be exceeded at a point source. *Id.* at 25. Benzene does not mix in the airshed and so a permit system might allow a hazardous build up in specific region, which would harm human health. *Id.*

164. *Id.*

The second method is to sell pollution credits.[165] To bring the externality into the market, the government creates a parallel market to buy and sell pollution credits that allow the holder to emit pollution.[166]

If the parallel market is not subject to market failure, the pollution credits are often regarded as more economically sound, as they tend to interfere less with the market by allowing companies to seek production solutions tailor-made to their particular situation.[167] The credit market achieves this efficiency through trades because any company that has high abatement costs can buy permits from another that has low costs, thereby reducing the total cost of abating pollution.[168] While a credit system is not appropriate for no-tolerance pollution such as nuclear waste, it has proved to be a very effective tool for regulating pollution that the general population is willing to tolerate at some level, such as air pollution.[169]

In the GMO market, gene transfers may cause genetic contamination to weedy native relatives and can be likened to air or water pollution.[170] Environmental activists wish to eliminate GMOs by adopting a "command and control" regulatory model with zero tolerance; a model that economists agree is most appropriate for hazardous materials, such as some heavy metal pollution which causes grave danger to human life but has localized effects.[171] Alternatively, economists often recommend a credit-based pollution rights system where production methods might vary the degree of pollution and where some contamination can be tolerated to pursue other societal benefits.[172]

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165. *Id.* at 24.

166. *See id.*

167. *See id.* at 24-25.

168. Fullerton & Stavins, *supra* note 138, at 25.

169. *Id.* at 24-25. The United States requires electrical producers to hold a permit for each ton of SO_2 emitted. *Id.* Overall, this market intervention has succeeded in reducing acid rain deposition by fifty percent in a cost-effective manner. *Id.*

170. *See supra* note 45 and accompanying text.

171. Richard Schmalensee et al., *An Interim Evaluation of Sulfur Dioxide Emissions Trading,* 12 J. ECON. PERSP. 53, 67 (1998). In the environmental economics field, command and control refers to government regulations on polluters through the use of licenses, permits, zoning regulations, or other controls. *Id.* This contrasts with economics-based controls which create secondary markets to limit, including Pigourian tax, pollution rights markets, and solutions based on the Coase theorem. *Id.*

172. *Id.*

C. MARKET INNOVATION INCENTIVES AND FREE-RIDERS

GMO developers are concerned about recapturing their research and development cost for GMOs.[173] In economic terms they are worried about the free-rider problem. A free-rider is someone who situates himself to enjoy the benefits of something without paying the costs.[174] For example, a producer can pass along the cost of research and development of a GMO to the consumer. However, if a free-rider can simply copy the product as her own without incurring the research and development costs, the free-rider can sell at a discount and undercut the creator's price.[175]

Without protection of innovation and creativity, the market harbors a strong disincentive to undertake research and development or other creative work.[176] In creative and innovative fields, intellectual property rights can often ameliorate this problem.[177] Intellectual property rights provide a mechanism by which the legal system protects producers' ability to recapture the cost of their creative work through the exclusive sale of their work.[178]

Unfortunately, there is not a universal understanding of intellectual property rights pertaining to seeds. In the 1980 decision, *Diamond v. Chakrabarty*, and in subsequent legal precedent, the U.S. Supreme Court decided that private firms engaged in developing new uses of plant and animal genetic materials may seek full patent protection for their inventions.[179] Other approaches acknowledge "breeders rights," to use a patented seed as an initial source of variation for ones own creation and a "farmer's privilege" to propagate a protected seed line for

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173. *See supra* note 60 and accompanying text.

174. WILLIAM BOYES & MICHAEL MELVIN, ECONOMICS 98 (Houghton Mifflin Co., 1991).

175. *See* Gollin, *supra* note 119, at 190.

176. *See* Fullerton & Stavins, *supra* note 138, at 24.

177. *See id.* at 23.

178. *See id.* at 20-21. Intellectual property rights create a new market to remedy the economic disincentive of research and development without assurance of being able to recapture costs. *Id.* at 19-20. However, no market mechanism determines the optimal balance or distribution of benefits produced by an invention. *Id.* at 47 n.7. An intellectual property regime may be abused so that a producer is receiving more benefits (or economic rent) than is efficient for the market. *Id.*

179. Diamond v. Chakrabarty, 447 U.S. 303, 317-18 (1980) (ruling that a genetically engineered bacterium could be granted a utility patent under standard patent law); *see, e.g.*, Ruckelshaus v. Monsanto Co., 467 U.S. 986 (1984); *In re* Hibberd, 227 U.S.P.Q. (BNA) 443 (1985); *In re* Allen 2 U.S.P.Q. 2d (BNA) 1425 (1987).

the farmer's own use.[180] The Western style system of property rights used in *Diamond* does not recognize these rights and privileges.[181]

Anthropologists argue that the current system of intellectual property rights for seeds altered with biotechnology amounts to an extension of colonialism that has continued seamlessly through the Green Revolution to the new era of biotechnology innovation.[182] Some Western companies have used their superior resources and understanding of the patent system to legalize their free-rider status.[183] For example, U.S. based property holders patented Andean quinoa, a grain developed by Andean farmers.[184] "Put crudely, [Andean] potato farmers are now expected to pay the [U.S. based] patent holders for the end-product of their own centuries-old knowledge," each time their quinoa enters into the United States.[185]

The United Nations Convention on Biological Diversity (CBP) provides the international framework for property rights as they concern plant, animal, and genetic material.[186] Article 11 allows countries to adopt, "as far as possible and as appropriate, economically, and socially sound" incentives for the conservation and sustainable use of biodiversity.[187] These incentives include intellectual property rights, national conservation, and natural resources laws.[188] The United States initially rejected the CBP because it felt that Articles 16 and 19 did not go far enough in protecting intellectual property rights.[189] The provisions are unclear and could be interpreted to permit national laws requiring technology transfers as a condition of access to habitats and linkage of technology transfer to conservation policy, both principles the that United States does not support.[190] It

180. PAARLBERG, *supra* note 15, at 5.

181. *See id.* (discussing the different levels of intellectual property rights recognized in Kenya, Brazil, India, and China).

182. *Id.* at 4.

183. *See, e.g., infra* notes 184-85 and accompanying text.

184. *See* POTTIER, *supra* note 39, at 184.

185. *Id. See also supra* note 63 and accompanying text.

186. Michael A. Gollin, *The Convention of Biological Diversity and Intellectual Property Rights, in* WORLD RESOURCES INSTITUTE, BIODIVERSITY PROSPECTING: USING GENETIC RESOURCES FOR SUSTAINABLE DEVELOPMENT 289, 290 (1993); *see also* CPB, *supra* note 105.

187. Gollin, *supra* note 186, at 295-99 (discussing the United Nations Convention on Biological Diversity).

188. *Id.*

189. *Id.*

190. *Id.*

is more likely, however, that these provisions can be interpreted as supporting two-way technology transfer as a voluntary matter.[191]

The Akerlof Lemon information asymmetry, externalities, and free-rider problems are all examples of market failure in the GMO market.[192] Such market failure, however, can often be corrected by government intervention.[193] Surveys have shown that consumers favor strict government regulation and suggest a preference towards international regulation of biotechnology, including the United Nations and the World Health Organization (WHO).[194] The food market is uniquely situated because of its dual identity as a traded commodity and as a necessity guarded by international human rights documents, which establish an aspiration to a basic right of food.[195]

IV. UNITED NATIONS CONVENTIONS AND THE UNIVERSAL DECLARATION OF HUMAN RIGHTS

Positive law does not presently guarantee any legally enforceable right to food.[196] This is partly because the right to food is seen as economic and aspirational in nature.[197] A growing number of scholars are beginning to recognize a universal obligation to act against the use of hunger as a weapon.[198] Strenuous efforts are being made to secure universal recognition to a right to food.[199] However, even if the right is perfect, there is not a right to a certain type of food.[200]

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191. *Id.* at 299.

192. *See supra* notes 128, 137-80 and accompanying text.

193. *See supra* note 141 and accompanying text.

194. *See* HALLMAN, *supra* note 52, at 7 (referring to recent studies in Europe, Japan, the United States, and Canada).

195. *See* ICESCR, *supra* note 8, at art. 11; UDHR, *supra* note 10, at art. 25; *infra* notes 194-212 and accompanying text.

196. Josee Domestici-Met, *Combating Man-Made Famine: Legal Instruments, in* THE GEOPOLITICS OF HUNGER, 2000-2001: HUNGER AND POWER, *supra* note 47, at 227.

197. *See generally id.* (describing the nature and limits to a legal right to food).

198. Domestici-Met, *supra* note 196, at 227.

199. *Id.*

200. ICESCR, *supra* note 8, at art. 11(a)-(b). The plain words of the ICESCR clearly lack any mention of GMOs and in interpreting the goals of the right, primacy is placed on equitable distribution and efficient use of resources not consumer choice or taste. *Id; see also infra* note 213 and accompanying text. There may be an exception for safety and religious reasons, with the aim of equity and efficient utilization of resources. ICESCR, *supra* note 8, at art. 11(a)-(b).

A. THE UNIVERSAL DECLARATION OF HUMAN RIGHTS

The Universal Declaration of Human Rights (UDHR) announces a general right to food.[201] The UDHR protects an individual's "right to a standard of living adequate for the health and well-being of himself and of his family, including food,"[202] and "to a social and international order in which the rights and freedoms set forth in the Declaration can be fully realized."[203]

B. THE INTERNATIONAL COVENANT ON CIVIL AND POLITICAL RIGHTS

Religious freedom is protected in Article 18 of the International Covenant on Civil and Political Rights (ICCPR), which guarantees the right of religious and ethical observance.[204] Article 18 states that "this right shall include freedom to have or adopt a religion or belief of his choice, and freedom, either individually or in community with others and in public or private, *to manifest his religion or belief in worship, observance, practice and teaching*."[205] If certain modifications to GMO food are forbidden by religious or ethical observance, a consumer would need information about the modification to protect the exercise of her right to religious and ethical observance.[206] Nevertheless, this right may be limited if the restriction is prescribed by law and is "*necessary* to protect public safety, order, health, or morals or the fundamental rights and freedoms of others."[207]

C. THE INTERNATIONAL COVENANT ON ECONOMIC, SOCIAL AND CULTURAL RIGHTS

The International Covenant on Economic, Social and Cultural Rights, 1966 (ICESCR) recognizes a broad right to food.[208]

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201. UDHR, *supra* note 10, at art. 25.

202. *Id.*

203. *Id.* at art. 28. Also relevant are guarantees that everyone has the right of religious observance (art. 2), life, liberty and the security of person (art. 3), and the right to not to be subjected to arbitrary interference with his privacy, family, home (art.12). *Id.* at arts. 2, 3, 12. Only after the EU and the United States have resolved the GM food impasse, and the international community has endeavored to address equity in the GM food market, will economic order be possible. *See* UDHR, *supra* note 10, at art. 28.

204. ICCPR, *supra* note 9, at art. 18(1).

205. *Id.* (emphasis added).

206. *See supra* notes 64-66 and accompanying text.

207. ICCPR, *supra* note 9, at art. 11 (emphasis added).

208. ICESCR, *supra* note 8; *see* D.J. HARRIS, CASES AND MATERIALS ON

Though the international community has not accepted all of the principles of the ICESCR into customary international law, many aspects are binding to the extent that a state must show progress toward the precepts in line with the state's resources[209] and refrain from acts that would destroy the object or purpose of the Covenant.[210]

Of the UDHR, ICCPR, and ICESCR, the ICESCR declares the most extensive rights regarding food and feeding the hungry. Article 11(1) of the ICESCR states that it is "the right of everyone to an *adequate standard of living for himself and his family, including adequate food . . . .*"[211] In Article 11(2), the ICESCR discusses the need for international co-operation as follows:

> The States parties to the present Covenant, recognizing the *fundamental right* of everyone to be *free from hunger*, shall take, individually and through international co-operation, the measures, including specific programmes, which are needed.
>
> (a) To improve methods of production, conservation and distribution of food by making full use of technical and scientific knowledge, by disseminating knowledge of the principles of nutrition and by developing or reforming agrarian systems in such a way as to achieve the most efficient development and utilization of natural resources;
>
> (b) Taking into account the problems of both food-importing and food-exporting countries, to ensure an equitable distribution of world food supplies in relation to need.[212]

The ICESCR balances two separate goals while supporting the right to food: (1) meeting the needs of the hungry through equitable distribution; and (2) achieving the most efficient development and utilization of resources.[213]

INTERNATIONAL LAW 625 (5th ed. 1998). The ICCPR embodies the primary generation of rights and is generally accepted as customary international law. *Id.* The ICESCR embodies second generation rights which frequently stop short of rising to customary international law but which parties to the ICESR must respect in object and purpose so as not to contravene the standards they embody. *Id.*

209. ICESCR, *supra* note 8, at art. 8. This is presently interpreted to infer an immediate obligation, and no floor threshold level of development need be attained prior to the perfection of the obligation. Domestici-Met, *supra* note 196, at 228.

210. Statute of the International Court of Justice, June 26, 1945, art. 38, 59 Stat. 1031, 33 U.N.T.S. 993; Vienna Convention on the Law of Treaties, May 23, 1969, art. XVIII, 1155 U.N.T.S. 331 (stating that those states which have signed but not ratified a treaty may not defeat the object and purpose of the treaty).

211. ICESCR, *supra* note 8, at art. 11 (emphasis added).

212. *Id.* at art. 11(2)(a)-(b) (emphasis added).

213. *See id.* at arts. 11(2), 25.

D. THE FORMAL RIGHT TO FOOD

The only fundamental right listed in either the ICCPR or the ICESCR is the right to food.[214] Nonetheless, legal analysts do not regard the standard announced by the ICESCR to be sufficient to establish a right to food under international law.[215] However, this standard garners further support from several General Assembly resolutions, including G.A. Res. 34/46, which recognizes a state's external duty to guarantee the right to proper nourishment, "through the adoption of measures at the national and international levels, including establishment of the new international economic order."[216] This duty includes the duty to aid the deprived, to protect from deprivation, and not to deprive.[217] Furthermore, while commentators recognize that the right to food is not determinate under international law, the states' external duties support the idea that international agencies should be encouraged to undertake an in-depth self-analysis of their own obligations regarding the right to food.[218]

Three arguments typically arise against the recognition of the general right to food.[219] The first is that the right to food is a moral or humanitarian consideration and is not alone sufficient to move states and other actors to respect a right to food.[220] The second argument is that the complexity of the problem and the absence of consensus regarding solutions make it impossible to

214. *Id.*

215. Philip Alston, *International Law and the Rights to Food, in* FOOD AS A HUMAN RIGHT 162 (Asbjørn Eide et al. eds., 1984). In an essay in support of a normative right to food under international human rights law, Alston asserts that ICESCR, art. 11(2)(a), promotes the realization of the right to food by establishing the objectives to improve the method of food production, distribution, and conservation and furthermore, establishes the proper means of doing so. *Id.* at 167-68 (applying the corollary of duties which attach to a subsistence right). Specifically the means of promoting these objectives is making full use of technical and scientific knowledge, disseminating knowledge about nutrition, and developing or reforming agrarian systems in such a way for the efficient development and utilization of natural resources. *Id.*

216. *Alternative Approaches and Ways and Means Within the United Nations System for Improving the Effective Employment of Human Rights and Fundamental Freedoms*, G.A. Res. 46, U.N. GAOR, 34th Sess., Supp. No. 46, at 171, U.N. Doc. A/Res/34/46 (1979); *see Alternative Approaches and Ways and Means Within the United Nations System for Improving the Effective Enjoyment of Human Rights and Fundamental Freedoms*, G.A. Res. 133, U.N. GAOR, 36th Sess., Supp. No. 51, at art. 7, U.N. Doc. A/Res./36/133 (1981).

217. Alston, *supra* note 215, at 169-70.

218. *Id.* at 173.

219. *Id.* at 163.

220. *Id.*

establish effective machinery for implementation of the right to food.[221] The final argument is that civil and political rights are primary and that economic, social, and cultural rights, such as the right to food, can only be realized once the people of the world have attained freedom.[222]

E. A HUMAN RIGHTS TEST FOR POLICYMAKERS [223]

Medical law frequently deals with the intersection of law and ethics.[224] The issue of GMO trade also falls at this intersection. This intersection led an Irish scholar, Tom A. Cooney, L.L.M., to propose a human rights impact assessment test for public health laws and policies.[225] Cooney's test is anchored on the fundamental principle of equality.[226] Cooney suggests several other important principles, including self-determination, justice, beneficence, and non-malfeasance.[227] Under Cooney's test, the scope and application of the principles are balanced after thoughtful moral and legal argument.[228]

Cooney proposes the elements of a test to help medical practitioners and public health policymakers balance these princi-

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221. *Id.*

222. *Id.*

223. Tom Cooney, Lectures at the University College Dublin (Sept. – Dec. 2002) (notes on file with author). Tom Cooney, BCL, LLM, lecturer at University College Dublin, developed a human rights test to help policymakers evaluate public health legislation. The human rights test illustrated in this article is the result of his work, translated by the author into the context of genetically modified food regulation. Any corruption of the public health human rights test by applying it to genetically modified food market regulation is the sole responsibility of the author.

224. *See id.* at 1.

225. *See id.* at 57.

226. *See id.* at 4.

> The evaluation holds that it is equally important that each person have the right to face up, according to his or her own lights, to the challenge of pursuing a worthwhile life. This assumes that each of us should appreciate the importance of living in a way that is appropriate to who and what he or she is . . . .
>
> On the one side, it means fashioning a cultural, political and legal context in which individuals are guaranteed *equal respect* for their capacity to take responsibility for their own lives. On the other side, it requires assuring each person *equal concern*. This means distributing resources from the community's finite pool of resources to repair, so far as practicable, inequalities in personal capabilities and luck so as to enable people to live worthwhile lived of their own choosing.

Id.

227. *See id.* at 4-6.

228. *See id.* at 6, 8.

ples to come to legally and morally right decisions.[229] Before attempting to apply the test, however, policymakers must first develop an appropriate framework for the test including: (1) examining whether the group the policy will affect is subject to social prejudice; and (2) examining the information regarding the policy to ensure that it is based on rigorous and impartial fact finding and that information is gathered from those who will be directly effected by the policy.[230] The test itself includes at least six important steps:

1. Clarify specific health objectives;
2. Evaluate likely effectiveness of the policy;
3. Ensure the policy is correctly focused or targeted;
4. Examine each policy for possible human rights interventions;
5. Find the least restrictive alternative; and
6. If the policy is coercive, it should be the most effective, least restrictive policy to prevent a real and substantial danger.[231]

V. PROMOTING THE REALIZATION OF THE RIGHT TO FOOD.

The culinary sovereignty[232] of the EU is important but the precautionary principle cannot be defended ad infinitum. It is a right that is limited, even in the Cartagena protocol, by the need

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229. *See* Cooney, *supra* note 223, at 7-8.

230. *See id.* at 157-60.

231. *See id.* at 160-69.

> 1. Any limitation on a patient's right should be intended to serve a demonstrable purpose of sufficient importance to warrant overriding the right involved. The demands of symmetry in balancing require that that purpose relate to competing human rights. The purpose should be, in the particular circumstances, pressing and substantial and not merely legitimate.
>
> 2. The limitation on a patient's right should be rationally related to the compelling purpose so as to accomplish that purpose under the existing circumstances, without causing hardships or deprivations unrelated or unnecessary to the achievement of that purpose.
>
> 3. The limitation should be carefully designed so as to impair as little as possible the right in question.

Id. at 7.

232. York, *supra* note 20, at 470. "In other words, while [the] *culinary sovereignty* [of the EU] is a significant value, it is not so much so that 828 million of the world's chronically undernourished should be sacrificed on its behalf." *Id.* (emphasis added).

for risk assessment based on scientific evidence.[233] The 828 million people in the world who are chronically malnourished have a right to improved production by making full use of science and technology.[234] A Kenyan agricultural researcher wrote:

> The needs of Africa and Europe are different. Europe has surplus food and has never experienced hunger, mass starvation and death on [the] regular scale we sadly witness in Africa. The priority of Africa is to feed her people with safe foods and to sustain agricultural production and the environment . . . . The criticism of agribiotech products in Europe is based on socioeconomic issues and not food safety issues; no evidence so far justifies the opinion of some in Europe that Africa should be excluded from transgenic crops. Africans can speak for themselves . . . . The African continent, more than any other, urgently needs agricultural biotechnology.[235]

The current international agreements regarding food and the environment are contradictory and ambiguous. In addition, the SPS, GATT, and CPB all fail to balance the health, political, and legal implications of a right to food, however poorly defined it is under international law.[236] State sponsored intervention, however, can address the GMO market failures.[237] One step towards remedying these issues is to develop a human rights test for policymakers, by which to scrutinize new regulations needed to govern the GMO Market.

A. THE EU MORATORIUM AND SOUTHERN AFRICA

The concern over accepting food aid in southern Africa is symptomatic of market failures promulgated by inadequate regulation in the international GMO market. Food is both a fundamental right and a widely traded commodity.[238] This dual status makes food unique among other goods.[239] In the case of southern Africa, both of these factors had a part in how the EU moratorium precipitated delays in humanitarian aid.[240]

A solution to the food aid acceptance problem, however,

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233. *See* Smitherman, *supra* note 26, at 495 (citing CPB, *supra* note 105, at arts. 15-16).
234. *See* ICESCR, *supra* note 8, at art. 11(2)(a).
235. *See* York, *supra* note 20, at 469-70.
236. *See supra* notes 16-21 and accompanying text.
237. *See supra* note 141 and accompanying text.
238. Alston, *supra* note 215, at 163.
239. *See supra* note 195 and accompanying text.
240. *See supra* notes 128-29 and accompanying text.

does not lie in WTO dispute resolution of the EU moratorium. If the EU moratorium is a disguised restraint, it is illegal under Article XX of GATT.[241] If the EU moratorium is justified, there is essentially a need to balance the rights of the hungry to food, and the rights of the EU to culinary sovereignty.[242] Under the ICESCR and U.N.G.A. Res. 34/46, the EU has a duty to avoid depriving other states from the right to food, including a duty to avoid international policies and practices that deprive other states of their means of subsistence.[243] Broadly interpreted, this duty could extend to avoiding international policies that inhibit delivery of food aid.[244]

However, there is a causal disconnect because the EU did not decide for southern Africa to decline food aid, nor did it give any indication whatsoever that acceptance of the aid would endanger exports to the EU.[245] Therefore, if the moratorium is justified, a rift could develop between states which accept GMO technology and those which reject it; this would in turn hamper global trade by bifurcating the market.[246] This would create a GMO cold war that would not resolve the humanitarian aid issue and would likely lead to continued restrictions on trade resulting in market inefficiencies.[247]

The most effective solution for the humanitarian aid acceptance issue, is the adoption of a single, clear, yet flexible, international standard that remedies market failure, while promoting the fundamental right to food outlined in the ICESCR Article 11.[248] The most acceptable standard is a human rights standard that embraces a thoughtful balance of efficiency and equity.

B. A HUMAN RIGHTS TEST TO EVALUATE MARKET INTERVENTION

The rights of the hungry take precedence over the rights of culinary sovereigntists.[249] International documents recognize a right to food, adequate for health and well-being,[250] and to be

241. *See* discussion *supra* Part IV.A.
242. *See supra* notes 132, 232 and accompanying text.
243. *See supra* notes 211-18 and accompanying text.
244. *See supra* note 217 and accompanying text.
245. *See supra* note 132 and accompanying text.
246. *See supra* note 132 and accompanying text.
247. *See supra* note 108 and accompanying text.
248. *See supra* notes 211-12 and accompanying text.
249. *See supra* note 232 and accompanying text.
250. *See supra* notes 10, 202 and accompanying text.

free from hunger,[251] limited only by measures to protect the environment, health, and safety.[252] However, no scientific evidence exists indicating GMOs are a threat to human health.[253]

In the balance between the right of culinary sovereignty[254] and the rights of individuals to be free from hunger,[255] the rights of the hungry must be given greater weight. The concern of the hungry is life over death. The concerns of culinary sovereigntists are only the claims of scientifically unsupported fears of the unknown.[256] Therefore, when considering food regulation schemes, policymakers must not only consider principles of free market economies and the desire to create a political consensus among the countries, they must also take into account human rights.[257] Any regulation which stands in the way of giving the hungry greater access to food should be viewed as suspect and scrutinized with the highest standards.[258]

A human rights test gives policymakers a tool with which to scrutinize regulations that might affect the ability of the hungry to exercise their right to food. The invisible hand of the market does not consider the desires of people who have no economic power in the market.[259] Therefore, without a human rights test, only the concerns of *culinary sovereigntists* will be addressed because they have market power.[260] Consequently, a human rights test with which policymakers can scrutinize regulations is needed to give effect to the choices of the undernourished.

C. OUTLINE FOR A GMO MARKET HUMAN RIGHTS TEST

Intervention in the GMO market is necessary to promote a free market. A human rights test is an important tool that would provide a means by which policymakers could justify

251. *See supra* notes 8, 208-13 and accompanying text.
252. *See supra* notes 109-16 and accompanying text.
253. *See supra* note 51 and accompanying text.
254. *See supra* note 232 and accompanying text.
255. *See supra* notes 202, 207 and accompanying text.
256. *See supra* note 53 and accompanying text.
257. *See supra* note 197-99 and accompanying text.
258. *See supra* notes 223-30 and accompanying text (discussing the use of a human rights test for deliberations regarding public health regulation, where policies affecting disadvantaged groups may be formulated). Because this is a legislative rather than a judicial deliberation there need not be a historical or juridical recognition of the group as historically disadvantaged, but rather a determination based on a reasonable person giving the matter thoughtful consideration. *See supra* notes 219-26 and accompanying text.
259. *See supra* note 139 and accompanying text.
260. *See supra* notes 139, 232 and accompanying text.

their decisions to consumer and environmental groups, which are more likely to be persuaded by regulations that have not only passed the scrutiny of GATT standards, but also those imposed by the UDHR, ICCPR, and ICESCR.[261]

It is important to note that the use of a human rights test is not dependent on a legally enforceable right to food.[262] The test can be applied by policymakers prior to achieving an internationally, legally recognizable right to food.[263] In a judicial framework, policy decisions regarding a right to food may be a social, political, and economic impossibility.[264] Policymakers are not limited, however, by the *jus cogens* of the international community, meaning they can use the test as an appropriate standard by which to analyze their own policy decisions.[265] Traditionally, the hungry have been susceptible to discrimination by policymakers.[266] Judicial recognition of a right to food may ameliorate this problem by facilitating a ruling that market interventions which harm the hungry contravene the object and purpose of the ICESCR and the ICCPR.[267]

A human rights test would essentially be a balancing test by which to consider proposed regulations.[268] The test must, first and foremost, be based on reliable fact finding.[269] GMOs are a multidisciplinary topic that touches not only upon science and market factors but also ethics, religion, consumer choice, development, law, environment, poverty, and hunger.[270] Therefore, in addition to hard scientific evidence, which is supported by the SPS,[271] voices of all these disciplines, as well as community-centered knowledge,[272] must be given a chance to make their arguments.

Once reliable facts are established, policymakers must ex-

261. *See supra* note 194 and accompanying text (illustrating consumer support for international regulation of GMOs and general mistrust of corporate self governance).

262. *See supra* notes 219-22 and accompanying text.

263. *See supra* notes 196-97 and accompanying text (discussing the right to food as an aspirational economic right rather than a legal right, enforceable by jurists under public international law).

264. *See supra* notes 219-22 and accompanying text.

265. *See supra* note 223 and accompanying text.

266. *See supra* note 223 and accompanying text.

267. *See supra* note 223 and accompanying text.

268. *See supra* note 213 and accompanying text.

269. *See supra* note 230 and accompanying text.

270. *See supra* note 230 and accompanying text.

271. *See supra* note 230 and accompanying text.

272. *See supra* note 111 and accompanying text.

amine proposed regulations through the lens of the test.[273] The policymaker's first job is to ensure that the regulation has a clear and specific purpose with detailed objectives.[274] Second, the policymaker must test the means by which the objective is to be achieved to determine that it is rationally related to the proposed purpose.[275] Next, the effectiveness of the regulation must be evaluated.[276] Policymakers must then judge whether there is a more effective means by which to achieve the same objective without intruding on consumers' rights to food or culinary sovereignty.[277] Fourth, the policymakers should discern whether the policy considers the populations most at risk and in need of protection.[278]

Each regulation must also be examined to determine the nature of the human right it infringes, because all regulations will not infringe in the same manner.[279] To do this, policymakers must ask four questions: (1) what is the nature of the right infringed upon?; (2) what is the degree of interference?; (3) what is the frequency and scope of the interference?; and (4) what is the duration of the interference? [280] Throughout this examination, policymakers should keep in mind the premise that consumers should be afforded the opportunity to make real decisions regarding the potential risks and benefits of GMOs.[281]

D. USING THE HUMAN RIGHTS TEST TO RESOLVE THE LEMON DILEMMA

The genetically modified food market shares many characteristics of an Akerlof lemon market.[282] Producers plant and originate the seeds and, therefore, are able to distinguish the modified from the unmodified seeds, so long as processors maintain a segregation of products.[283] This information asymmetry present in the GMO market must be addressed to eliminate

273. *See supra* note 230 and accompanying text.
274. *See supra* note 231 and accompanying text.
275. *See supra* note 231 and accompanying text.
276. *See supra* note 230 and accompanying text.
277. *See supra* note 230 and accompanying text.
278. *See supra* note 230 and accompanying text.
279. *See supra* note 231 and accompanying text.
280. *See supra* note 231 and accompanying text.
281. *See supra* note 226 and accompanying text.
282. *See supra* notes 142-48 and accompanying text.
283. Akerlof, *supra* note 142, at 189; *see also supra* note 143 and accompanying text.

market failure.[284] However, maintaining segregation, standardizing labeling information, and passing such information on to the consumer is a costly endeavor, and producers might lose much of the price advantage they received from engineering the GMO seed if they were to undertake these measures.[285]

In countries where there is a significant consumer base that does not want to eat GMO foods, a natural market solution may arise in response to a lemon dilemma.[286] Entrepreneurs may develop brand name goods that are GMO free and sold at a premium.[287] One downside of brand name goods, however, is that the premium usually charged by brand name goods may price low-income families out of any real choice to consume non-genetically modified food.[288] Therefore, while brand name goods may be an efficient market centered response, it may not be an equitable response.

Instead of relying on this potentially inequitable market response, states should institute an appropriate labeling regime to protect consumer choice and the free exercise of ethical and religious observance.[289] At a minimum, a labeling scheme informs the consumer of what exactly she is consuming. As a result, even if brand name GMO free goods are out of her reach, she has the information needed to avoid certain foods, which might be contrary to her ethical and religious observance.[290] In states without labeling regimes, a consumer has no way of knowing how her food has been produced or what genetic material it might contain.[291]

The WTO or the WHO should develop international guidelines for national labeling standards of GMO food products, utilizing the human rights test to balance the benefits and burdens of regulations. These guidelines should cover issues that affect

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284. *See supra* note 145 and accompanying text.

285. *See supra* notes 41-42, 151-54 and accompanying text.

286. *See supra* notes 142-45 and accompanying text.

287. *See supra* notes 148-50 and accompanying text. It is also quite possible that a brand name line might be introduced which is genetically modified for nutritional value-added characteristics, such as vitamin and mineral enhanced foods, lower fat content items, or higher protein products, and that these goods would have a premium value due to their modification. *See supra* notes 148-50 and accompanying text.

288. *See supra* note 150 and accompanying text.

289. *See supra* notes 64-66 and accompanying text. Consumer choice is tied to a human rights test based on the principle of equity. This is equivalent to the concept of informed consent in the medical field. *See supra* note 226.

290. *See supra* notes 64-66 and accompanying text.

291. *See supra* note 129.

free exercise of the right to religious and ethical observance embodied in the ICCPR,[292] as well as address and advise consumers of any scientifically supportable health threats or concerns.[293] The labeling regime should be state specific and narrowly tailored to account for differences in marketing, household markets, literacy, food concerns, and enforcement capabilities.[294] Setting such guidelines at an international level would acknowledge an international aspirational right to food, as well as lend a credible and trusted measuring stick to national standards.[295]

In order for a labeling scheme to work, the national governments must set standards and provide enforcement.[296] The state-specific regulatory system is important because of the huge difference in how people buy their food and the nature of their concerns in various states.[297] For example, the regulatory system appropriate for states where open-air markets are standard, little food is packaged, and the populous is not highly literate, would be different than that which would be appropriate for a state which has more invested in the infrastructure of food distribution, most food is packaged, and the literacy rate is high.[298] Other factors that would influence the creation of a national standard include money available for enforcement and genetic bio-test kits, as well as the prevailing concerns of the populous.[299]

A labeling regime provides consumers with more information and, therefore, ameliorates the GMO information asymmetry.[300] While the standards for the labeling regime should be state specific, an international body such as the WHO or WTO should provide guidelines for such regulations because they are considered the most trustworthy by consumers.[301] In its guidelines, the international body should recommend a human rights test for labeling regulations and enforcement, which would bal-

292. *See supra* note 42 and accompanying text.
293. *See supra* note 111 and accompanying text.
294. *See supra* note 223 and accompanying text.
295. *See supra* notes 194, 200 and accompanying text.
296. *See supra* notes 204-07, 289 and accompanying text.
297. *See supra* notes 204-07, 289 and accompanying text.
298. *See supra* notes 204-07, 289 and accompanying text.
299. *See supra* notes 204-07, 289 and accompanying text.
300. *See supra* Part III.A. (discussing information asymmetry and the lemon dilemma). One disadvantage of a labeling regime is that it does not provide an equitable mechanism to ensure that low-income people who do not want to eat GMO food will not have to eat it. *See supra* note 150 and accompanying text.
301. HALLMAN, *supra* note 52, at 7.

ance the benefits of regulation against the burdens placed on the right to religious and ethical observance.[302] This would help policymakers select the scheme, which is narrowly tailored to place the fewest limitations on religious and ethical observance.[303]

E. AMELIORATING EXTERNALITIES IN THE GMO MARKET

Environmental contamination and destruction of biodiversity are appropriate cases for government intervention and regulation because they are structural externalities, the cost of which is not included in the value of the good.[304] The task of regulations involving externalities is to capture the environmental effects of production in order to pass them along to the consumer.[305] Environmentalists argue that GMOs will destroy biodiversity and create super-insects and weeds that will cause environmental degradation and contamination.[306] But a pollution credit system would help internalize environmental degradation by creating a market for "genetic contamination" credits similar to air pollution credits.[307] In the case of GMOs, environmental contamination has occurred, but damage is difficult to assess or value for a credit system.[308] An environmental impact test prior to market release could provide information that economists need to model potential damages, weigh the scientific probability estimates, and come up with a reasonable credit price.[309]

Another potential solution is a tradable or credit permit system.[310] Such a system would recognize the rights of future generations to the world's natural resources.[311] Environmental economists would include in their permit model the capture of

302. *See supra* note 231 and accompanying text.

303. *See supra* note 223 and accompanying text.

304. *See supra* notes 174-95 and accompanying text (discussing the concept of externalities).

305. *See supra* notes 155-61 and accompanying text.

306. *See* discussion *supra* Part I.C.1.

307. *See supra* text accompanying notes 165-69.

308. *See supra* note 45 and accompanying text.

309. *See supra* note 45 and accompanying text.

310. See, for example, the discussion regarding tradable permits or credits used to regulate sulfur dioxide emissions, *supra* notes 167-68, 175-79 and accompanying text.

311. The ICESCR says, that the right to food is to be achieved though the most efficient development and utilization of natural resources. *See supra* text accompanying note 212.

any effects that might be cumulative in nature, the costs of which would then burden future generations.[312] Because future generations do not have current market power, the market does not capture their interests.[313] A human rights test would help policymakers consider the rights of future generations to food and a clean and livable environment. This test would help policymakers to evaluate market interventions for their ability to capture current and cumulative externalities that would affect both current and future generations.[314]

An international body such as the WTO, WHO, or FAO can provide guidelines for a credit system.[315] The credit system should be nationally based because it is likely that contamination would be localized.[316] However, the WTO should create a trade agreement in which states agree to be liable under the WTO dispute resolution process for contamination that spreads across international borders.[317] Nations should divide money from the sale of tradable permits or credits into at least two funds.[318] One fund should be kept in a trust for clean-up projects if damages occur across borders or for national ecological disasters where recovery proves inadequate.[319] The state or court could then distribute the funds through the WTO or through the courts once liability for an environmental accident is determined and direct recovery is attempted.[320] Another fund could be set up from the credits to help develop germ plasma[321] banks to protect biodiversity and the gene pool.[322] The purpose of these two funds is directly linked to the protection of natural resources and the gene pool.[323] The credit system recognizes the balance that must be achieved between providing food to a hungry world and protecting the environment by allowing tolerable levels of

312. *See supra* note 158 and accompanying text.
313. *See supra* note 158 and accompanying text.
314. *See supra* note 223 and accompanying text.
315. HALLMAN, *supra* note 52, at 7.
316. *See supra* notes 169-70 and accompanying text.
317. *See supra* notes 169-70 and accompanying text.
318. *See supra* notes 169-70 and accompanying text.
319. *See supra* notes 169-70 and accompanying text.
320. *See supra* notes 169-70 and accompanying text.
321. *See supra* note 46 and accompanying text.
322. *See supra* note 46 and accompanying text.
323. Permit funds should not be used to develop scientific understanding in LDCs because such programs are not directly linked to potential environmental pollution. Tax incentives might be used to encourage private public partnerships between businesses and LDCs in regards to research and development of plants and traits suited to the needs of LDCs.

pollution, much as is done with energy needs and pollution from coal.[324]

F. THE NEED FOR FLEXIBLE INTELLECTUAL PROPERTY RIGHTS IN THE GMO MARKET

Intellectual property rights are a necessary market intervention to achieving market efficiency.[325] Markets may not adequately support innovation unless there is a way to ensure reward.[326] The Western system of intellectual property rights is based on expert scientific knowledge, availability of a large capital outlay to achieve such protection, and the cultural standard of individual reward for individual effort. This type of a system is likely to fail in recognizing the innovative efforts of farmers who have developed genetic material outside the framework of western style scientific thought, who do not have the capital or expertise to pursue patenting, and who are not predisposed to the idea of individual reward for individual effort.[327] Because property rights are a necessary market intervention to encourage innovation, a human rights test, which provides structure and limits to the system, will assist policymakers in balancing the market's competing needs of rewarding innovation and protecting community knowledge with the traditions of farmers in LDCs.[328]

A rigid western-style system of property rights ignores the fundamental right to food and treats food as it would treat intellectual property rights for computer software.[329] The international system of property rights regarding plant and animal material for consumption as food should allow small farms "breeder's rights" to use a patented seed as an initial source of variation for one's own creation and a "farmer's privilege" to propagate a protected seed line for the farmer's own use.[330] In addition, the U.N. should develop a program of technical assistance, which increases the ability of farmers in LDCs to protect their property rights and thereby inhibits western free-riders from mining the LDCs for patents.[331] Only through a flexible

324. *See supra* notes 162-69 and accompanying text.
325. *See supra* notes 176-77 and accompanying text.
326. *See supra* notes 176-77 and accompanying text.
327. *See supra* note 63 and accompanying text.
328. *See supra* notes 174-91 and accompanying text.
329. *See supra* notes 174-91 and accompanying text.
330. *See supra* notes 180-81 and accompanying text.
331. *See supra* notes 184-85 and accompanying text.

system of property rights can policymakers ameliorate the problem of free-riders and maintain market incentive for innovation while providing some protection for traditional cultural and farm practices.[332]

Intellectual property rights can be supportive of the goals of the CPB. Article 11 of the CPB does not spell out a property rights regime but provides a justification on which a system can be built.[333] Conversely, Articles 16 and 18 do not mandate technological transfer access to biological resources.[334] Ultimately, as a practical matter, a strong intellectual property rights regime will offer the greatest protection to an LDC to control the uses of its resources.[335] However, this protection will only come about if western countries help LDCs increase their technical expertise regarding intellectual property and enforcement, simplify the process, and make it more economical.[336]

CONCLUSION

The GMO market has its shortfalls. Adoption of a human rights test in the evaluation of GMO regulations is one tool with which policymakers can assure consumers that not only market factors are driving decision making. In addition, it brings structure to the thoughtful and rigorous consideration of important human rights. The test is not necessarily a legal test to be applied by courts, but rather it is a preemptive attempt towards favorably shaping GMO regulation based on a plurality of voices including those who are underrepresented in the market, so that the best, most equitable possible policy choice can be made.

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332. *See supra* notes 329-31 and accompanying text.

333. *See supra* note 104.

334. *See* discussion *supra* notes 186-95 and accompanying text.

335. *See supra* notes 184-85. A strong intellectual property rights system allows LDCs to create monetary value on their diverse natural resources. *See generally* Plotkin, *supra* note 49 (arguing that extensive intellectual property rights are an effective tool for developing countries to protect their environmental interests); *see generally* WORLD RESOURCES INSTITUTE, BIODIVERSITY PROSPECTING: USING GENETIC RESOURCES FOR SUSTAINABLE DEVELOPMENT (1993) (arguing that controlled exploitation of natural resources under an intellectual property rights regime will ultimately lead to great environmental protections.) This value in the market insures a level of protection, which is more secure than measures of protection that are based on environmental protection for its own sake. *See supra* note 49 and accompanying text.

336. *See supra* notes 184-85 and accompanying text.