The Cartagena Biosafety Protocol: Mutation of International Trade in Genetically Modified Organisms

by

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Section 1. Introduction

1.1 The Winter Night of December 2, 1984

I was 7 years old, living in a small neighbourhood of Bhopal. My whole family was asleep in our EWS (Economically Weaker Section) home on a winter night in 1984. Suddenly, I woke up due to a burning sensation in my nose and the noise of people talking. Every member of my family was awake and my father was not in the house. My mother told me that the strange feeling in my nose and throat might be due to somebody in the neighbourhood cooking spicy food at this hour of night. My father ran back into the house and described the scene on the main road outside our home. He said everybody was running aimlessly on the streets. He didn't know why.

My father ran back to the main street to try to figure out what was happening. Meanwhile, my mother, my elder brother, and I went up to the roof of the building. By the time we reached the top of the stairs, I felt intense irritation in my eyes, nose, and chest; my mother and brother felt the same. Looking out from the top of the building, we witnessed the most horrifying scene of our lives. People were panicked; they were running on the streets. Others were hanging on to whatever mode of transportation they could find. Everybody was just running without knowing where they were going. The horrifying scene was lit by orange halogen street lights and I kept thinking that it must be the lights causing people to fall from the overloaded moving buses and trucks and die. I couldn't see any other reason for it.

In my family, my father was the most affected that night. He went to the most severely affected areas of the railway station and old Bhopal during the night, trying to help other people. His eyesight and sense of smell were permanently damaged. The next morning my mother and other women from the neighbourhood prepared food and bought medicine for those who were injured. We went to Kailash Nath Katju Hospital, and on the way I saw hundreds of dead bodies and animal carcasses. The hospital compound was also full of dead bodies and grieving relatives. The following day my father took my brother and me to see the site of the disaster; I remember being so excited to see an army helicopter pouring water onto the manufacturing plant to cool it off. But as a seven year old child, I had no idea what it all meant.

1.2 The Bhopal Gas Disaster

On December 2, 1984, the city of Bhopal was covered in the poisonous fumes of methyl isocyanate gas (MIC). The fumes were released from a pesticide manufacturing plant that was co-owned by the US multinational (and majority stakeholder) Union Carbide

Corporation (UCC) and the Government of India. The Bhopal Gas Disaster is regarded as one of the world's worst industrial disasters to date.[1]

Law professor Jamie Cassals quotes one of the Indian newspapers describing the immediate effects of the gas leak:

> An entire settlement was scampering out of their homes running southwest, towards the city centre without really knowing where to go or what to do. Many collapsed on the way, some forever. Children vomited blood. Pregnant women stumbled and fell on the ground crying in pain and bleeding profusely. With the grey clouds chasing them their fear turned into panic. Relatives did not wait to pick up the bodies of those they loved and were alive only moments ago. Many were trampled to death…the resourceful and the affluent had already fled in whatever transport they could manage to secure. Only the poor were left behind.[2]

Based on interviews with survivors, Lapierre and Morro described the scene at the Bhopal Railway station as:

> There were no vendors, lepers, beggars, coolies, children or travellers. Platform number one was nothing more than a charnel-house of entangled bodies, stinking unbearably of vomit, urine and defecation. Weighed down by the gas, the toxic blanket had draped itself like a shroud over the people chained to their baggage. Here and there, the odd survivor tried to get up. But the deadly vapours very quickly entered their lungs and they fell back with mouths contorted like fish out of water.[3]

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[1] Numerous organizations have described the Bhopal Gas Disaster as one of the world's worst industrial disaster, including Amnesty International and Greenpeace "Accountability of Union Carbide in Clouds of Injustice: Bhopal Disaster 20 Years On" (United Kingdom: Amnesty International, 2004) at 10; Greenpeace New Zealand online: Greenpeace <http://www.greenpeace.org.nz/news/news_main.asp?PRID=773> (date accessed: 2 March 2006).

[2] *Sunday Magazine* (16-22 December 1984) cited by Jamie Cassels, *The Uncertain Promise of Law: Lessons from Bhopal* (Toronto: University of Toronto Press, 1993) at 4 [hereinafter *Lessons From Bhopal*].

[3] Dominique Lapierre & Javier Moro, *Five Past Midnight In Bhopal*, Trans. Kathryn Spink, (London: Scribner, 2002) at 304.

The magnitude of the catastrophe was unprecedented. The official death count was more than 2,000; by 1987, it was about 3,500 and by 1992, it was over 4,000.[4] In addition, 30,000 to 40,000 people were maimed and seriously injured, and 200,000 were otherwise affected through lesser injury, loss of a family member, and economic and/or social dislocation.[5] In fact, non-governmental organizations have always contested these "official" figures. These organisations believe that 7,000 to 10,000 people died on the fateful night, and an additional 15,000 have died between 1985 and 2003.[6]

The Union Carbide plant at Bhopal has been manufacturing agricultural chemicals since 1969. The plant underwent a major expansion in 1979 to produce Carbaryl (1-napthol, N-methylcarbamate), an insecticide sold under the brand name "Sevin," a trademark of the Union Carbide.[7] The poisonous methyl isocyanate gas (MIC) is an "intermediate"[8] to manufacture Carbaryl. At the time of the disaster, the plant's insecticide-manufacturing unit from which MIC escaped had been in operation for only four years.[9] This insecticide was one of several essential ingredients used in a new form of agriculture associated with the so-called "Green Revolution"[10] that spread throughout

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[4] *Lessons From Bhopal*, *supra* note 2 at 5.

[5] *Ibid.*

[6] Accountability of Union Carbide in Clouds of Injustice: Bhopal Disaster 20 Years On, (United Kingdom: Amnesty International, 2004) at 11.

[7] United States Patent and Trademark Office, Serial # 72043282, Registration # 0671672, USPTO home page <http://tess2.uspto.gov/bin/showfield?f=doc&state=cqjfvt.2.11> (date accessed: 25 February 06).

[8] John Daintith, ed., *Oxford Dictionary of Chemistry* (Oxford: Oxford University Press, 1995) 3rd ed., *s.v.* <<intermediate>> A substance formed during a chemical process before the desired product is formed.

[9] *Lessons From Bhopal*, *supra* note 2 at 4.

[10] See *below*, section 2.3.2.

the Third World beginning in the 1960s. The green revolution utilized these industrial products as the basis for a new form of agriculture that promised to increase "productivity", and thus helping to alleviate poverty and hunger.

It is alleged that the UCC stored more than the allowed quantity of MIC in Bhopal, and did not equip the plant with the required safety mechanisms in the event of a mishap. Moreover, UCC did not employ the same safety standards in the design or operation of the Bhopal plant as were in place in the United States.[11] UCC was aware that some of the technology that it transferred from the US had not been proven safe, and that its export thus involved operational and safety risks.[12] Impoverished families, who had no idea that the factory's safety standards were low, inhabited the entire area surrounding the factory. The factory should have had seven different kinds of safety devices, in order to avert any type of disaster. In the case of Bhopal, at the time of the disaster none of the safety standards were working.[13] The people of Bhopal were the direct victims of the lax standards of a corporation that managed the plant from another continent. After the incident, the Indian government established The Bhopal Gas Leak Disaster (Processing

[11] Accountability of Union Carbide in Clouds of Injustice: Bhopal Disaster 20 Years On (United Kingdom: Amnesty International, 2004) at 28.

[12] *Ibid.* at 28.

[13] *Ibid.* at 46. These safety standards involved: 1. Emergency scrubbers: To neutralize any escape of MIC (none in Bhopal); 2.Computerized Monitoring: To monitor pressure gauges (No computerization of Bhopal Plant); 3.Cooling System: To keep the MIC storage Tanks cool (In Virginia Chloroform was used, but in Bhopal Brine was used which is highly reactive to MIC); 4. Refrigeration Unit: To keep the temperature in the tanks low and was never turned off (In Bhopal turned off since June 1984); 5. Nitrogen pressure: MIC maintained under Nitrogen pressure (In Bhopal, No nitrogen pressure since October 1984); 6. Emergency Plan: Four Stage Emergency plan to notify public authorities and general public (In Bhopal, no information was shared with community); 7. Lab Analysis: To test the quality and contamination prior to storage (no such analysis was carried out in Bhopal).

of Claims) Act, 1985.[14] The government of India's litigation, in the United States, was dismissed on the ground of *forum non conveniens*; the dismissal was conditional to Union Carbide's submission to the jurisdiction of Indian courts.[15]

Despite the legislation and government action, only a small amount of compensation was paid to the victims. The Supreme Court of India exercised its special powers under Article 142(1) of the Constitution for settling the case.[16] Although the initial claim was $3 billion, in a one-time settlement, UCC was directed to pay $470 million to the government of India that had pursued litigation on behalf of the victims and survivors.[17] In 2001, Dow Chemical took over UCC for approximately $10 billion. In 2002, Dow Global Public Report stated that, "all responsibility related to the Bhopal accident has been fully and fairly resolved."[18] However, Union Carbide is still facing litigation from the survivors of the gas disaster in the United States.[19]

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[14] *The Bhopal Gas Leak Disaster (Processing of Claims) Act*, 1985, No. 21 of 1985, enacted 29th March 1985. Preamble: An Act to confer certain powers on the Central Government to secure that claims arising out of, or connected with, the Bhopal gas leak disaster are dealt with speedily, effectively, equitably and to the best advantage of the claimants and for matters incidental thereto.

[15] In *Re Union Carbide Corp. Gas Plant Disaster*, 634 F.Supp. 842 S.D.N.Y, 1986. at 867 [Westlaw].

[16] Article 142 of the *Constitution of India*, reads "Enforcement of decrees and orders of Supreme Court and orders as to discovery, etc.- (1) The Supreme Court in the exercise of its jurisdiction may pass such decree or make such order as is necessary for doing complete justice in any cause or matter pending before it…" *The Constitution of India with Comments & Subject Index: With Selective Comments by P.M. Bakshi*, (New Delhi: Universal Law Publishing, 1996) at 120 (footnote omitted).

[17] *Union Carbide Corp.* v. *Union of India,* A.I.R. 1990 S.C. 273, 274-76.

[18] Corporate Social Responsibility in The Dow Global Public Report 2002, at 49 online at <http://www.dow.com/PublishedLiterature/dh_0244/09002f1380244bfc.pdf> (date accessed: 24 February 2006).

[19] *Sajida Bano, et al., Plaintiff,* v. *Union Carbide Corp. and Warren Anderson, Defendants*. No. 99 Civ. 11329(JFK). Oct. 5, 2005. WL 2464589 (S.D.N.Y.).

Lying behind this paper is a simple question: How did an endeavour that was supposed to benefit all, become so fatal in its application? The application of science that the green revolution represented was justified as being for the betterment of the people of the Third World by enhancing production of food, and providing them with employment opportunities. The Green Revolution's rationale of reducing poverty and hunger is a good one, but as the Bhopal Gas Disaster has shown, we must always be aware of the costs associated with our efforts to advance this goal. Today, in dealing with these same issues, a new buzz exists about the "gene" revolution where similar optimism is evident. But with the apprehensions left by the Bhopal Disaster, this paper argues that an awareness of the potential risks should be taken seriously in the regulatory regime.

This paper argues that a lot of history and ideology lies behind Bhopal and the green/gene revolutions. In particular, these revolutions reflect a type of science and a model of development that is "not cautious" in its application. This history has led to a new approach being advocated for industrial development, incorporated in a new principle, the precautionary principle. This principle is now enshrined in international law, in particular, in a new trade regime under the so-called Cartagena Protocol on Biosafety,[20] a protocol added to the Convention of Biological Diversity.[21] This regime represents a paradigm shift in regulating the trade arising out of the gene revolution, and has the potential of dramatically reshaping the future of trade law. Of particular importance, for the purposes of my paper, are the precautionary principle's effect on the

[20] *Cartagena Biosafety Protocol to the Convention on Biological Diversity*, 29 January 2000, 39 I.L.M. 1027 (entered into force 11 September 2003) [hereinafter *the Protocol*].

[21] *UN Conference on Environment and Development: Convention on Biological Diversity*, 5 June 1992, 31 I.L.M. 818 (entered into force December 29, 1993) [hereinafter *CBD*].

World Trade Organization[22] and the associated agreement on the application of Sanitary and Phytosanitary measures.[23] The precautionary principle challenges the foundations of a model of development that has been pursued over the centuries.

This paper is divided into five sections. Section 1 gives a brief overview of my personal experiences and the circumstances of the Bhopal gas disaster along with its connection with the "green revolution." Section 2 starts with the historical perspective of our ideas and material condition. The analysis begins in the 13th century and follows with the Age of Reason, and the Enlightenment through the 16th to 18th centuries. Then to gain a better understanding of the "development model", the paper will examine the dogmas of enlightenment regarding concepts of scientific development and rationality, and its application on nature. The key themes in this section are: intellectual aspects focused on prominent thinkers and the development of science; material aspects focusing on economics; the multiple forces that have contributed to shifts in economic systems promoting accumulation of wealth, the rise of mercantilism are explored that connects to colonization. Through colonization the ideas of Enlightenment were exported to

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[22] *General Agreement on Tariffs and Trade*, 30 October 1947, 58 UNTS 188 (entered into force 1 January 1948), as a result of the Uruguay Round of trade negotiations, this was amended as 'GATT 1994'establishing the World Trade Organization online <http://www.wto.org/english/docs_e/legal_e/04-wto.pdf > [hereinafter *GATT*].

[23] The Agreement on the application of Sanitary and Phytosanitary Measures, WTO Agreement, Annex 1A, The Legal Texts at 59. online: WTO Homepage <http://www.wto.org/english/tratop_e/sps_e/spsagr_e.htm> (date accessed: 28 March 2006) [hereinafter *SPS agreement*] (emphasis in the original).
Preamble:

> *Reaffirming* that no Member should be prevented from adopting or enforcing measures necessary to protect human, animal or plant life or health, subject to the requirement that these measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between Members where the same conditions prevail or a disguised restriction on international trade.

different parts of the world and shows how the experience of colonialism and the birth of the Third World are inextricably linked. I then return to aftermath of the colonization and show that even after the decolonization of the territories the ideas that were introduced during colonization remain entrenched. The Green Revolution serves as an example of the development objective in operation and its effects. The underlying theme of this section is "development" and its different manifestations. I then critically examine the gene revolution, which has been put forward as the solution to the problems of the earlier green revolution. This section evaluates the gene revolution's potential benefits and harms, concluding that we cannot afford to repeat the same mistakes again and need a different way of approaching these problems. Section 3 introduces the precautionary approach as a revolutionary alternative to the development model and examines its history and inception in international law. In Section 4, I revisit the issue of the gene revolution and explore the international laws that are responsible for regulating the trade arising out of gene revolution. Section 5 reflects upon the conclusions of the earlier sections.

Section 2. The Enlightenment: Producing the Idea of Development

The idea of development wields considerable influence in today's world. To understand our idea of development, it is important to understand the particular intellectual context in which this idea originated. The Enlightenment was an intellectual movement, originating in Europe, that has had a profound effect on modern-day thinking and the reasoning that informs our current ideas of development. It is difficult to establish a direct causal link between the ideas of the past and the specific institutions and practices

that shape our present state of being. However, by tracing the development of Enlightenment rationality, it is possible to gain a better understanding of both the nature of science that underpins the green/gene revolutions and the model of development.

2.1 The Enlightenment as an Intellectual Revolution

The most widely shared belief among Enlightenment thinkers was that human reason could be successfully used to overcome superstition, ignorance, and tyranny, and thus help to develop a better world. Thinkers in this period understood themselves to be acting against the prevailing religious and aristocratic dominations of the previous era. In some ways, then, the Enlightenment can be understood as a reaction against the past. Forerunners of Enlightenment ideology can be found as early as the 13th century, although the Enlightenment itself is associated with the 18th century.

The 13th century witnessed the emergence of so-called Scholastics (Schoolmen) like Thomas Aquinas (1225-1276). The Schoolmen proposed to critically examine religious texts to defend the doctrines of Christianity. For the next couple of centuries, other thinkers pursued this goal to uphold every aspect of faith with logic.[24] In the 14th and 15th centuries, during the Renaissance in Western Europe, the humanists emerged. Humanism involved the revival and study of Greek and Latin languages to revisit science, art, literature, and philosophy. The humanists emphasized the power of man; they valued the human capacity for understanding and human dignity. The 17th century

[24] *Encyclopædia Britannica*, *s.v.* "ethics" online: <http://search.eb.com/eb/article-60045> (date accessed: 15 March 2006).

produced some of the great philosophers and scientists who paved the way for Enlightenment thinking. The great astronomer, Galileo Galilei (1564-1642) developed upon Scholastic thought, expanding upon its principles of logic and reason. Galileo is known for his achievements in astronomy, which were based on two guiding principles: "first, that in making statements and hypotheses about nature one must always appeal to observation and not to authority; secondly, that natural process can best be understood if they are represented in mathematical terms."[25] These ideas were significant as they established a particular way of thinking that established a new framework for understanding complex processes of nature.

Another philosopher, Francis Bacon (1561-1626), advocated the adoption of empirical methods in science and stressed the importance of systematically "putting nature to the question."[26] Bacon propounded the *inductive method* of reasoning, wherein reasoning develops from specific to general observations, which could later be proven false by way of scientific experiment. As Stuart Hampshire notes:

> Bacon suggests a method of discovering more and more, new and true statements of fact. The method of induction by simple enumeration – that is the mere listing of what is seen to occur together in nature – is to be replaced by a method of systematic experiment, which will rely on proper rejections and exclusions.[27]

Philosopher René Descartes (1596-1650) is also recognized as one of the predecessors of the Enlightenment era. According to Hampshire, Descartes believed that with the

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[25] Stuart Hampshire, *The Age of Reason: The Seventeenth Century Philosophers* (Cambridge: Riverside Press, 1956) at 32.

[26] *Ibid.* at 22.

[27] *Ibid.* at 21.

application of analytical and mathematical methods, the "nature of things, and the laws that govern their behavior" could be revealed.[28] Such ideas became the foundation for the future thinkers and the works of these philosophers, among others, paved the way for Enlightenment thinkers. The period between the 16th and 17th centuries saw a significant shift away from religious authority and a movement towards scientific rationality. This age is often referred to as the "age of reason" and its tenets became ideas that were central during the Enlightenment period. By the 18th century, the continuous application of reason became the "unifying and central point of this century, expressing all that it longs and strives for, and all that it achieves."[29] "Enlightenment" literally means coming out of the darkness, or becoming aware of something about which one was previously in the dark. German philosopher Immanuel Kant (1724 – 1804) described the Enlightenment as "man's release from his self-incurred immaturity,"[30] where individual's self-imposed infancy was the inability to use one's reason without the guidance of another. So according to Kant, the motto of the Enlightenment was "*Sapere aude*: Have the courage to know."[31] This clearly indicates a challenge to forms of reasoning based on religious or aristocratic authority. The Enlightenment was reacting against prevailing religious authorities that relied on

[28] *Ibid*. at 65.
[29] Ernst Cassier, *The Philosophy of the Enlightenment*, Trans. Fritz C.A. Koelln & James P. Pettegrove (Boston: Beacon Press, 1955) at 5.

[30] Immanuel Kant, *What Is Enlightenment?* (Konigsberg, Prussia: 1784) as cited by Dorinda Outram, *The Enlightenment* (New York: Cambridge University Press, 1995) at 2.

[31] *Ibid*.

providence[32] and obedient worship of God. Until that time, the order of religious leaders was considered the final word or word of God on almost all matters, and disobedience of religion and religious leaders was severely punished. Kant insisted on the application of "one's own intelligence," and this was seen as an important step in breaking out of the restrictive thinking of religion. For the Enlightenment, the main obstacle to unending human progress was, ignorance; the education of all strata of society in the light of reason and science was expected to lead to a rational, free from religious constraints, and developed society.[33] The idea of creating a better world and surging toward development was prevalent during the Enlightenment. As Cassier put it, the 18th century was characterized by the development of the *analytical spirit.*[34] By the end of the 18th century, the central ideas of Enlightenment, which first emerged with the Schoolmen and progressed through humanism, challenged the authority of religion.

The major themes of the Enlightenment may be summarized as:

- Reason is man's central capacity
- Man is by nature rational and good
- Both individuals and humanity as a whole can progress to perfection

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[32] William Coleman explains that according to the Christian faith, Providence "refers to divine superintendence in the ordering of affairs of man and the world." William Coleman, "Providence, Capitalism, and Environmental Degradation: English Apologetics in an Era of Economic Revolution" (1976) 37:1 Journal of the History of Ideas 27 at 30, online: <http://www.jstor.org>.

[33] Amilcar O. Herrera, "Science, Technology and Human Rights: A Prospective View" in C. G. Weeramantry, ed., *The Impact of technology on Human Rights- Global Case Studies* (Tokyo: United Nations University press, 1993) online: <http://www.unu.edu/unupress/unupbooks/uu08ie/uu08ie00.htm#Contents> (date accessed: 24 March 2006).

[34] Ernst Cassier, *The Philosophy of the Enlightenment*, Trans. Fritz C.A. Koelln & James P. Pettegrove (Boston: Beacon Press, 1955) at 27 & 28.

- Beliefs are to be accepted only on the basis of reason and not on the authority of priests, sacred texts or tradition
- Local customs and prejudices are to be rejected where they owe their development to historical peculiarities rather than to the exercise of reason[35]

These themes of the Enlightenment generated the momentum behind the movement towards perfection through progress, reason, and scientific rationality. As the Enlightenment's influence increased, resulting movement towards perfection gained momentum. It is within the context within this movement that the idea of development started to gain significance. The influence of the Enlightenment era and the growing pressure towards development can be seen operating in our changing understandings of science, the environment, economy, and people.

2.2 Enlightenment and Progress: Developing Science, Environment, Economies and Peoples

Both the (preceding) Age of Reason and the Enlightenment witnessed not only intellectual changes in philosophy and science, but also material changes in the economy and social organization. What led to these diverse changes in science, economy, and society? Was it that the Enlightenment resulted from material changes? Or were the physical, economic, and social changes due to the Enlightenment? Or were physical and philosophical changes mutually related and caused? These issues will always be contested.

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[35] T. Honderich, ed., *The Oxford Companion to Philosophy* (New York: Oxford University press, 1995) *s.v.* <<enlightenment>>.

2.2.1 The Development of Science: Scientific revolution

The history of Western sciences is often also seen as the history of conquest, with science seen as an 'agent' of European colonialism.[36] The themes of Enlightenment aided the development of physical and natural sciences. The application of man's reason, scientific rationality coupled with empirical analysis, and the task of putting nature into question, all themes of Enlightenment, provided the foundation for the sciences. The development of science during the Enlightenment is an absolute implementation of *scientific positivism* that preceded the 18th century. The era of 1543 to 1687 is often referred to as the foundation period for modern sciences. In this period Copernicus's *De revolutinibus orbium coelstium* and Newton's *Philosophiae naturalis principia mathematica* were published.[37] Copernicus concluded that the earth revolves around the Sun (heliocentric theory) thereby disproving the divine theory of the earth being the centre of the universe. Similarly, Newton proposed, through the application of scientific reason, the laws of gravitation, and stated that the laws of motion are the same for the earth and for celestial bodies. The findings by Copernicus and Newton were a blatant challenge to the ethos of divinity, observed by religious authorities. The shift that occurred from the 16th century science to 18th century science was massive; in the former, science was used to describe the connection between the God and the creation

[36] Bernard Cohen cited by Jean-Jacques Salomon, "Modern Science and Technology" in Jean-Jacques Salomon & Francisco R. Sagasti, eds., *The Uncertain Quest: science, technology and development* (Tokyo: United Nations University, 1994) online: <http://www.unu.edu/unupress/unupbooks/uu09ue/uu09ue00.htm#Contents> (date accessed: 24 March 2006).

[37] Jan Beating, "Technological Impacts on Human Rights: Models of Development, Science and Technology, and Human Rights" in C. G. Weeramantry, ed., *The Impact of technology on Human Rights-Global Case Studies* (Tokyo: United Nations University press, 1993) online: <http://www.unu.edu/unupress/unupbooks/uu08ie/uu08ie00.htm#Contents> (date accessed: 24 March 2006).

of the world, and in the latter it was used to disprove those findings. Galileo confirmed Copernicus' hypothesis. However, when he challenged the divine planetary theory, he was attacked by the religious authorities of that time, and compelled to disavow his findings.

In the 18th century, the fear of persecution was transformed into a celebration of the intellectual autonomy that was proving so effective in creating "progress". This period set the foundation that would govern the application of sciences for centuries to come. It also saw the development of the reductionist approach and conversion of natural processes into deducible mathematical calculations. The reductionist approach grew out of the *inductive method* introduced by Francis Bacon. As a result of this method, nature was divided into different units and sub-units to facilitate the conducting of experiments on different sub-units, so as to confine them individually to reach an empirical finding:

> For example, if some conjunction of features *a*, *b*, *c*, is observed, it is not enough merely to record it and to go on recording similar particular matters of fact indefinitely; one must make experiments which will leave out systematically each one of the features in turn, and so enable us to discover, for instance, that only *a* or only *b* is necessary for the production of *c*, and not *a* and *b* together.[38]

Utilizing the *inductive method*, Carl Von Linné (1707-1778), popularly known as Linnaeus, developed a scientific classification to define classes and species of every living creature, including humans. This "development" of science during the age of

[38] Stuart Hampshire, *The Age of Reason: The Seventeenth Century Philosophers* (Cambridge: The Riverside Press, 1956) at 21.

reason and the Enlightenment is well described by David S. Landes. The period witnessed:

1. the growing *autonomy* of intellectual inquiry;

2. the development of unity in disunity in the form of a common, implicitly adversarial *method*, that is, the creation of a language of proof recognized, used, and understood across national and cultural boundaries; and

3. the invention of invention, that is, the *routinization* of research and its diffusion.[39]

Autonomy of intellectual inquiry placed emphasis on a "do it yourself" attitude that resulted in individual observation of different processes. This was radically different from following the words of elders or the readings of religious institutions. Personal experiences that could be validated mattered more than the preconceptions of established authority that could not. *Method* became central, so that personal observations could lead to repeatable experiments that could then establish general scientific principles. Emphasis was put on making science a discipline that was physically defined, unlike the previous age of "natural philosophy."[40] *Routinization* of research became a common theme, after the establishment of science as a discipline. This was considered essential in order to continue scientific exploration in ways that everyone followed, and that could be applied to unexplored parts of the world, nature, and unexamined natural processes.

[39] David S. Landes, *The Wealth and Poverty of Nations* (New York: WW Norton and Co, 1999) at 201.

[40] Dorinda Outram, *The Enlightenment* (New York: Cambridge University Press, 1995) at 49ff.

Indeed, during the 18th century, the development of science and technology did come with economic benefits. As stated by Robert Heilbroner, during the Enlightenment, society as a whole started accumulating a surplus to spend in many directions, such as improving living standards, and also for developing technology and armed forces.[41] An illustrative example of the material changes following the application of scientific development is well captured by Donald Worster in explaining the rise of the modern city of Manchester:

> In the late eighteenth century the surplus capital accumulated from years of trade with the Orient and the New World financed the development of a new mode of production: the factory system. The organizing skills perfected over two centuries by English merchants, and the rational use of capital to stimulate as well as satisfy demand, were extended with sudden vigour to revolutionize the apparatus of manufacturing. In 1765 James Hargreaves invented the spinning jenny. During the 1770s Richard Arkwright introduced the water frame for spinning thread. Then in 1785 Edmund Cartwright's power loom completed the transformation of the textile industry to machine production. Along with James Watts' new steam engine, these innovations signalled the end one long era of human history and the beginning of another. And the driving motive behind the technological development was the pure and simple desire to increase productivity and wealth.[42]

This desire to increase productivity and wealth led to the economic re-organization of European society during and after the Enlightenment. The re-organization occurred in two distinct stages: firstly, a shift from feudalism to mercantilism, and secondly, a shift from mercantilism to capitalism.

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[41] Robert Heilbroner & William Milberg, *The Making of Economic Society*, 10th ed., (New Jersey: Prentice Hall, 1998) at 18.

[42] Donald Worster, *Nature's Economy: A History of Ecological Ideas*, 2nd ed., (New York: Cambridge University Press, 1994) at 12.

2.2.2 Organization of Economy: Physical Aspect

To understand economic development during the Enlightenment, one must start with the economic organization of the pre-Enlightenment period. Before the Enlightenment, the organization of economic behaviour was one of feudalism.[43] The term feudalism encompassed economic organization that included, in effect, the whole social structure of society. Max Weber described feudalism as a "characteristic of all social institutions that are based on a ruling class which is dedicated to war or royal service and supported by privileged land holdings, rents or labour services of a dependent, unarmed population."[44] Lacking a strong central government, the power of feudal governments had eroded through wars and feudal rebellion by the end of 15th century.[45] This and other factors paved the way for the emergence of the nation-state with the Treaty of Westphalia in 1648. The fall of feudalism also fuelled the intensification of market culture. People were independent to interact in markets without any fear of the lord. The authorities of newly created states realised the great expense of maintaining strong central governments. The states could no longer rely on noble rulers for an income from land. They needed an army. Increasing both the tax base and production were viable

[43] In Europe, during Middle Ages, the society was organized into three "orders" of hierarchy: at the top, "those who pray" (the religious leaders who prayed and were considered closest to God, and their professional task was to save souls of all humankind); "those who fight" (professional warriors, who defended the society from outside attack); and "those who work" (peasants, who worked on the estates of the first two and generated wealth to sustain them and himself) Joel Mockyr, ed. in chief, *The Oxford Encyclopaedia of Economic History*, vol. 2, (Oxford: Oxford University Press, 2003) *s.v.* <<feudalism>>.

[44] Max Weber cited by Andreski, Stanislav, ed., *Max Weber On Capitalism, Bureaucracy and Religion*, (London: George Allen & Unwin, 1983) at 31.

[45] Ricardo Contreras, "How the Concept of Development Got Started" (1999) 9 Trans. L. & Cont. Prob. 47 at 50.

options for the newly formed states.[46] The authorities widely promoted trade to increase the tax base. Apart from spending the revenues on maintaining an army, authorities started spending it on local development. Gradually, this idea of sustained economic growth became an accepted aspect of state policy and the tool to achieve this objective became known as mercantilism.

As a new "state project", mercantilism was focused on strengthening the fiscal basis of the nation by custom duties and levies to support the activities of licensed monopoly traders.[47] Mercantilism depended on a strong central authority to protect the merchants. It advocated more governmental control to protect the domestic industries that worked with imported raw materials to produce finished products for exports. The proponents of mercantilist thinking realised the "importance of manufacturing industries [and] they believed that it was fostered by, and the basis of, foreign trade, and that foreign trade was a source of national wealth."[48] Different European countries sent expeditions to other parts of the world in search for raw materials and to develop new markets. The idea was to accumulate precious metal (gold and silver) by increasing exports and to reduce imports of anything except raw materials. This made it important to foster a powerful merchant class which would keep feeding the momentum of development. Another crucial aspect of mercantilist thinking was the need to out compete rival countries. Mercantilism worked on a two-pronged approach: First, accumulate raw materials from distant resources (colonies). Second, strive to have a highly favourable

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[46] *Ibid.*

[47] Makoto Itoh, *The Basic Theory of Capitalism: The Forms and Substance of the Capitalist Economy* (London: Macmillan Press, 1988) at 3.

[48] *Ibid*. at 5ff.

balance of trade with other countries (these countries include other colonial powers such as France, Spain, and Netherlands). Mercantilism was at the basis of "reorganising" territorial relations between the states. It ultimately paved the way for capitalism as the most profound form of economic interaction, which was already in place for "internal production" during mercantilism.[49]

A central element in the growth of capitalism involved the ownership of the "means of production," which rested on a small capital-owning class. The majority of society were mere wage earners, the "working class". The working class sold its labour to the merchants to produce commodities. Their sale and trade, in turn, resulted in a massive build up of physical capital and ultimately led to the rise of capitalism. There are three major, and interconnected, explanations for the rise of capitalism: first, the expansion and increasing efficiency of the market; second, the increasing accumulation of capital; and third, the change in values and motivation leading to the emergence of capitalist entrepreneurs.[50] The system of capitalism was dominated by competition and conflict (and arguably remains so today).[51] The ultimate objective for capitalists was to accumulate more and more profit, whereas for the working class it was to gain better wages. This resulted in a continuous "class-struggle." At the same time, the capitalist himself was competing with other capitalists to survive in the market. Ironically capitalists saw themselves as saviours of the labour class. Under feudalism, the working

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[49] Michael M'Gonigle, "Between Globalism and Territoriality: The Emergence of an International Constitution and the Challenge of Ecological Legitimacy" (2002) 15:2 Can. J. L. & Jur. at 166 [hereinafter *Globalism and Territoriality*].

[50] Joel Mockyr, ed. in chief, *The Oxford Encyclopaedia of Economic History, Vol. 1* (Oxford: Oxford University Press, 2003) <<Capitalism>>.

[51] Alan K. Smith, *Creating a World Economy: Merchant Capital, Colonialism and World Trade, 1400-1825* (Boulder: Westview Press, 1991) at 96.

class had no freedom to sell their labour and had to work as serfs or slaves under the master. However, with the "reorganization" of the economic system, the labourer not only gained the freedom to sell his or her labour but also the liberty to choose to whom he or she would sell it.[52]

With the advent of the Enlightenment, capitalism became significant in Europe and the newly independent North America. Capitalism received new momentum with Adam Smith's famous book "An inquiry into the Nature and Causes of The Wealth of Nations" (1776). The basic tenet of capitalism grew into a new form of liberal economics that advocated a free market with the least control by the government. Heilbroner comments on the economic shift to capitalism:

> The market achieved this by the lure of monetary rewards. It was this hope of profit that lured manufacturers into turning out more capital goods. It was the attraction of better wages (or some times of any wages) that directed workers into the new plants. It was the signal of rising prices that encouraged, and falling prices that discouraged, the production of this or that particular capital good. Here is Smiths' market mechanism, joined to his growth model."[53]

The ideas of economic individualism coupled with independence, freedom of expression, and exchange of ideas, laid the foundations of *liberalism* that underpins the model of development.

> In general Liberalism means the belief that it is the aim of politics to preserve individual rights and to maximize freedom of choice. In common with socialism and conservatism it emerged from the conjunction of the Enlightenment, the Industrial Revolution, and the political revolutions of

[52] *Ibid.* at 95-96.

[53] Robert Heilbroner & William Milberg, *The Making of Economic Society*, 10th ed., (New Jersey: Prentice Hall, 1998) at 74-75.

> the seventeenth and eighteenth centuries. Liberalism retains a faith in the possibilities of improvement in present social conditions, which is related to the idea of progress widely accepted in the late eighteenth and nineteenth centuries[54]

The development of European market economies was based on a policy of rigorous market expansion and the active effort to establish trade monopolies in other parts of the world. The economic ideas of Mercantilism and Capitalism were not isolated in their application but resulted in international spin-offs.

2.2.3 Colonization and the Development of Peoples

The effects of changes in the economic patterns of European countries had not only a continental impact but affected other parts of the world as well. The mercantilist sent expeditions to other parts of the world to acquire material resources and export markets that could create wealth through trade. The idea was to capture other markets to keep a favourable balance of trade under the mercantilist economic system. These new territories were commonly viewed as static societies that lacked development and progress. For example, in order to legitimize the ideology of colonization in India, colonial officials and their masters thought of British rule as "the bearer of new Enlightenment for the natives."[55] In many cases, the merchants also propagated their religion. For example, the Portuguese took priests with them on their voyages, "for their own safety and salvation, for the propagation of faith among infidels and pagans, and as

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[54] Andrew Reeve, *The Concise Oxford Dictionary of Politics*. Iain McLean and Alistair McMillan, eds., (Oxford: Oxford University Press, 2003) *s.v.* <<liberalism>> *Oxford Reference Online* online: <http://www.oxfordreference.com/views/ENTRY.html?subview=Main&entry=t86.e740> (date accessed: 22 March 2006).

[55] Hamza Alavi, et al, *Capitalism and Colonial Production*, (London: Croom Helm, 1982) at 25.

slaves to their own conscience. The priests were viewed as men of God who legitimated and sanctified greed."[56] On the other hand, this rule also led to a process of de-industrialization, as was the case in India's textile industry. India was a world leader in textile trade before British rule, but this position was gradually lost over the years during the colonial period.

> The share of Indian textiles in the West African trade was about 38 percent in the 1730s, [India was colonized in 1757 after the battle of Plassey between British East India Company and Nawab of Bengal] 22 percent in 1780s and fell to a mere 3 percent in 1840s. The share of Indian textiles in total English trade with Southern Europe was more than 20 percent in the 1720s, but this share fell to about 6 percent in the 1780s and less than 4 percent in the 1840s.[57]

In India, handlooms manufactured the textiles; however, as soon as the imperialist policy makers controlled the country, manufacturers were forced back into agriculture to produce commodities, such as spices, coffee, tea, indigo and sugar, that were in demand in the European countries. The base for manufacturing textiles was shifted to Britain who was witnessing the "industrial revolution." Cecil John Rhodes (1853-1902) later argued in the imperial policy, that Britain:

> …must find new lands from which we can easily obtain raw materials and at the same time exploit the cheap slave labour that is available from the natives of the colonies. The colonies would also provide a dumping ground for the surplus goods produced in our factories.[58]

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[56] David S. Landes, *The Wealth and Poverty of Nations* (New York: WW Norton, 1999) at 126.

[57] David Clingingsmith & Jeffrey G. Williamson, "India's De-Industrialization Under British Rule: New Ideas, New Evidence" Discussion paper # 2039 (2004) at 3 Harvard University Homepage, online: <http://post.economics.harvard.edu/hier/2004papers/HIER2039.pdf> (date accessed: 22 February 06).

[58] Cecil Rhodes, as cited by Clive Ponting, *A Green History of The World: The Environment and The Collapse of Great Civilizations* (New York: St. Martin's Press, 1991) at 222.

As a result of the imperial policy, Britain became the leading producer of textiles. Agriculture was also badly affected by these policies. Monoculture plantations of cash crops, like coffee, tea, and rubber, became common during colonialism with a direct impact on soil fertility.[59] The industrial revolution and the industrialized nations' drive to establish and expand their base of mass production of goods also led to massive exploitation of natural resources in colonized nations, and established patterns of development that are directly related to present environmental concerns. This wave of colonization was materially beneficial to the colonizing nations, but wrought huge changes, many of which were very detrimental to the colonized territories, even where they possessed sufficient resources to support their local population. For example:

> More than 3.5 million people starved to death in the Bengal famine of 1943. Twenty million were directly affected. Food grains were appropriated forcefully from the peasants under a colonial system of rent collection. Export of food grains continued in spite of the fact that people were going hungry.[60]

As the Bengali writer, Kali Charan Ghosh, reports, "80,000 tons of food grains were exported from Bengal in 1943 just before the famine. At the time India was used as supply base for the British military."[61] Another economic impact of colonization was that it initiated a re-structuring of India society along capitalist lines. This new process of development undermined the self-sufficiency of Indian village communities.[62] As Karl Marx wrote over a century before Bhopal: "The misery hardly finds a parallel in

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[59] *Ibid*. at 195.

[60] Vandana Shiva, *Stolen Harvest: Global Hijacking of Global food supply*, (London: Zed books, 2000) at 5.

[61] Kali Charan Ghosh, *Famines in Bengal* 1770-1943, cited in *Ibid*. at 5-6.

[62] Hamza Alavi et al, *Capitalism and Colonial Production* (London & Canberra: Croom Helm, 1982) at 26.

the history of commerce; the bones of cotton-weavers are bleaching the plains of India."[63]

As we have seen, throughout colonialism, the costs of development were born disproportionately by the colonies, for the benefit of the colonizing powers. The 'development' that occurred in the colonial period was not about developing the capacity of the colony, but rather, was tailored to fulfill the needs of the colonizing powers.

2.2.4 Enlightenment and its Effects

As noted, the rigorous application of reason was the main ideal during the 'age of reason' and the Enlightenment. This ideology was apparent in justifying the colonization of other territories as *liberating* them from the darkness. At the same time, philosopher, Gothold Mendelssohn, argued that "unlimited development of *reason* in individuals might conflict with their role as subjects and citizens; *reason* if carried too far with unlimited questioning and redefinition, could dissolve social, religious and political order into chaos and leave men isolated in intellectual egoism."[64] This concern was especially relevant where that ideology was exported to non-western societies: "Our modern environmental crisis is intimately bound to the practices and beliefs which have, at different periods in the experience of Western society, defined acceptable standards of

[63] Karl Marx cited by David Clingingsmith & Jeffrey G. Williamson, "India's De-Industrialization Under British Rule: New Ideas, New Evidence. Discussion paper # 2039 (2004) at 5 Harvard University, Homepage online: <http://post.economics.harvard.edu/hier/2004papers/HIER2039.pdf> (date accessed: 24 February 06).

[64] Cited by Dorinda Outram, *The Enlightenment* (New York: Cambridge University Press, 1995) at 1-2.

economic behaviour."[65] The Enlightenment worked on the premise of objectifying nature and continually exploiting it, as if it were subservient to humans. Adorno and Horkheimer stated that, "[w]hat men want to learn from nature is how to use it in order wholly to dominate it and other men; that is the only aim."[66] This ideology builds on Linnaeus' argument that "man must vigorously pursue his assigned work of using his fellow species to his own advantage…[t]his responsibility must extend to eliminating the undesirables and multiplying those that are useful to him, an operation which nature, left to herself, could scarcely effect."[67]

Another illustration of how the Enlightenment affected nature is the concept of property. One of the leading Enlightenment thinkers, John Locke (1632-1704), defines property:

> Though the earth and all inferior creatures be common to all men, yet every man has a property in his own person; this nobody has any right to but himself. The labour of his body and the work of his hands we may say are properly his. Whatsoever, then, he removes out of the state that nature hath provided and left in it, he hath mixed his labour with, and joined to it something that is his own, and thereby makes his property.[68]

Property is thus understood as the inherent entitlement of human beings to exert "rational" mastery over nature, the limit of which is defined only by the limits of the human capacity to extract and exploit, and the benefits of which are understood to

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[65] William Coleman, "Providence, Capitalism, and Environmental Degradation: English Apologetics in an Era of Economic Revolution" (1976) 37:1 Journal of the History of Ideas 27 at 28 online: <http://www.jstor.org>.

[66] Max Horkheimer & Theodor W. Adorno, *Dialectic of Enlightenment*, Trans. John Cumming, (New York: Continuum, 1994) at 4.

[67] Donald Worster, *Nature's Economy: A History of Ecological Ideas*, 2nd ed. (New York: Cambridge University Press, 1994) at 36.

[68] John Locke, *Second Treatise of the Government* (Oxford: Oxford University Press, 1956) at 15.

accrue only to the individual by whose labour a resource is exploited. In this conception, natural resources are understood as subservient to human beings. As such, a surplus (an extraction or exploitation of resources beyond the actual needs of the individual or community) is not only possible, but also desirable insofar as it can be used to accumulate capital for profit and development. The unstated premise that natural resources are endless, and that their exploitation has no detrimental effect, underpins the notion that the accumulation is justified, beneficial, and infinite.

The shifts in scientific development during the Enlightenment have persisted to the present day. For example, the value of autonomy in intellectual inquiry has led to unfettered intellectual development being considered normal. This can be harmful in situations where risks outweigh probable benefits, and the people likely to be harmed do not have the power to make decisions. The unknown, long-term consequences of Genetically Modified Organisms (GMOs) on biodiversity are one example. As for forming a common adversarial language of proof across national boundaries, there can also be negative impacts for the Third World. All countries are expected to agree on the way developed countries make decisions and on the values that influence how decisions are made, even if their decisions are made to benefit rich countries and in practice, may cause harm to the majority.[69] It is not only the methodology, that is problematic but also its universalisation. The "routinization of research," and "invention of invention" makes invention the normal way of things, and marginalizes "collective" decision-making about the issues involved. Such discussion is delegitimized as being "political" while the

[69] BASMATI PATENT ISSUE: For a detailed discussion on this see Vandana Shiva: *Stolen Harvest: The Global Hijacking of Global Food Supply* (Cambridge: South End Press, 2000).

science of development is seen as apolitical, neutral, objective and, after all, about progress.[70]

2.3 Decolonization and the Post-Colonial World Order

2.3.1 Political Independence, but Continuous Dependence

With the dismantling of colonial empires after World War I, long-established colonies and their inhabitants throughout the world began to achieve independence. Afghanistan was liberated from British protectorate status in 1919 and Lebanon from France in 1941. Decolonization continued after World War II, fifty-three more territories were freed from colonial rule from between 1941 (Ethiopia) and 1999 (Macao).[71] This independence often came after a long period of the destruction of economic infrastructure. For example, during the direct colonial rule of India by Britain from 1858 to 1947, a vast transfer of funds to the U.K. occurred through "Home Charges," that were comprised of debt service, pension, India offices expense, and the purchase of military and railway equipment. By the 1930s, these charges were costing up to £40 to £50 million a year.[72] Furthermore, in 1919, India contributed two "voluntary war gifts"

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[70] DOLLY the SHEEP: For a detailed discussion on this see Steven P. McGiffin, *Biotechnology: Corporate Power and Public Interest* (London: Pluto Press, 2005).

[71] Over one hundred territories gained independence during 1941 and 1999; however, most of these territories became part of a larger independent country or in some cases the territories were divided to form two different countries such as India and Pakistan in 1947. See Jan Palmowski, ed., *A Dictionary of Twentieth Century World History*, (New York: Oxford University Press, 1997) *s.v.* <<colonization>> at 163 and 164.

[72] Angus Maddison, *Class Structure and Economic Growth: India and Pakistan Since the Moghuls*, (London: George Allen & Unwin, 1971) at 64.

to the U.K. of £150 million.[73] As a result, critics note that the way the Western colonial powers became "developed and the way another part of the world given the collective title of *Third World*, became underdeveloped are not separate phenomena; they are inextricably linked."[74] This new group of countries became part of the "Third World," or less developed countries (LDCs) or the "global south."

Some colonies did well after decades of colonial rule, such as Taiwan and South Korea. In these two countries, per capita annual growth rates from 1950 to 1973 exceeded those of the industrialised nations, with the exception of Japan.[75] To try to keep up with these regional leaders, and to fit the model of development being exported by the West, the policies of "development" became an imperative tool in most decision-making across the globe.

As British hegemony was declining after World War II, a group of new economic structures were designed to reconstruct the economies of the Allies and the defeated countries at Bretton Woods, New Hampshire.[76] The allied countries came together in 1944 in Bretton Woods to form two international economic institutions: the International Bank of Reconstruction and Development (World Bank) and the International Monetary Fund (IMF). Both institutions have their respective roles, although, "their joint objective is to provide the monetary and financial machinery that

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[73] *Ibid.* at 66.

[74] Clive Ponting, *A Green History of The World: The Environment and The Collapse of Great Civilizations* (New York: St. Martin's Press, 1991) at 222.

[75] David S. Landes, *The Wealth and Poverty of Nations* (New York: WW Norton, 1999) at 437.

[76] Michael J. Trebilcock & Robert Howse, *The Evolution of International Trade Theory, The Regulation of International Trade*, 2nd ed., (London: Routledge, 2001) at 20.

would enable nations to work together toward world prosperity, thus aiding political stability and fostering peace among nations."[77] The Bank functions on a voting mechanism, where the vote is valued according to the nation's contribution to the bank. The ten developed countries (including the US, Germany, France, Japan, Netherlands, and Italy) together control 48.52 percent of the total voting power in the World Bank.[78] These two financial institutions work under the principles of development economics, where the model of "development" has important similarities with earlier conceptions of development that came from the Enlightenment.[79] These institutions advocate an active government role in restructuring the economic system along with what is aptly called "neoliberal" economic patterns.[80] The influence of western ideology and economics in these two institutions is explained in frank terms by the World Bank itself:

> There is no doubt that the Bank has been heavily influenced by the "Western powers," and especially United States. This was inevitable because of the location of its head quarters, the financial strength of the United States and Western Europe vis-à-vis the rest of the world, and the fact that until recently, a major source for people with experience in development work has been with the United States, the United Kingdom, France, and other Western European Countries.[81]

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[77] The World Bank, *Questions and Answers Booklet* (Washington: The World Bank Group, March 1976) at 3 [hereinafter *Questions*].

[78] The World Bank Group Homepage, online: <http://web.worldbank.org/WBSITE/EXTERNAL/EXTABOUTUS/ORGANIZATION/BODEXT/0,,contentMDK:20124831~menuPK:64020035~pagePK:64020054~piPK:64020408~theSitePK:278036,00.htm> (date accessed: 4 March 2006).

[79] Knut G. Nustad, "The Development Discourse in the Multilateral System" in Morten Bøås and Desmond McNeill, eds., *Global Institutions and Development: Framing the World* (London: Routledge, 2004) at 13.

[80] *Ibid.* at 17.

[81] *Questions*, *supra* note 77 at 6.

John Ruggie states that the fundamental basis of these institutions was *embedded liberalism*:[82]

> Success of the these institutions was the miracle of embedded liberalism – trade liberalization was embedded in the political commitment, broadly shared among the major players in the trading system of that era, to the progressive, interventionist welfare state; in other words to a particular political and social vision, including at the same time respect for diverse ways of implementing this vision.[83]

Embedded liberalism assumed that only the state has the power and legitimacy to undertake collective decision-making.[84] The World Bank and International Monetary Fund undertake various development projects in developing countries, and offer long-term or interest free loans. They also provide grants for improving healthcare facilities or for improving the agricultural market of the developing countries.[85]

These supranational structures were created with very limited participation from the people who were affected by the implementation of the policies on the ground. As mentioned, the policies devised under the two institutions were done under the influence of the Western countries that also embodied Enlightenment ideas of progress and development. This influence was then applied to the developing countries in the form of

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[82] See generally John G Ruggie, "Embedded Liberalism and Post War Economic Regimes" in John G. Ruggie, ed., *Constructing the World Polity: Essays on International Institutionalization* (London: Routledge, 1998) at 62.

[83] As cited by Robert Howse, "From Politics to Technocracy – And Back Again: The Fate of the Multilateral Trading Regime: Symposium on the Boundaries of the WTO" (2002) 96 The A.J.I.L. at 97.

[84] *Ibid.* at 115

[85] For example: A grant of $30 million to Afghanistan to build better healthcare facilities, and to reduce child mortality rates. Similarly, $35 million grant was provided to Senegal for improving domestic market of crops, and increase agricultural export. The World Bank Group Homepage, online: <http://www.worldbank.org> (date accessed: 4 March 2006)

a “development package” which was given to them when they applied for assistance to these two international financial institutions. This package worked in a similar way as previous imposing colonizing policies, except without an army.

2.3.2 The Green Revolution: The Effects of Enlightenment in Action

Traditionally, agriculture has been a mainstay of societies. The propensity to develop, connected to the Enlightenment, touched every sphere of society, including agriculture. The “green revolution” gives a window of opportunity to analyse the continuing, and rather lingering, effects of the Enlightenment. It has all the essential ingredients of the Enlightenment ideals: the goal of a better life, with the development and application of science to achieve that goal, and the consequential effects of that “pursuit.”

The term “green revolution” was coined by William S Gaud, Director of United States Agency for International Development (USAID) to describe advancements in the 1960s in the development of High Yielding Varieties (HYVs) of wheat and rice.[86] The green revolution is said to have started in the 1954 when Norman Borlaug ‘invented’ “miracle seeds” of dwarf wheat and dwarf rice for the farmers of the Third World. He received the Nobel Peace Prize for his efforts in 1970.[87] The Rockefeller Foundation and the Ford Foundation from United States funded the research, and then assisted in setting up the International Rice Research Institute in the Philippines and the International Maze and Wheat Improvement Centre (CIMMYT) in Mexico. The Green Revolution involved the

[86] Peter B.R Hazell, “Green Revolution: Curse or Blessing?” (2002) International Food Policy Research Institute at 2.

[87] Noble Prize Organization Homepage, online: <http://nobelprize.org/peace/laureates/1970/index.html> (date accessed: 31 March 2006).

breeding of improved varieties of crops coupled with the extensive use of fertilizers and chemicals, and the mechanization of agriculture. These varieties were created with the explicit goal of eliminating hunger and poverty in developing countries, and of making them self reliant in food production. A major claim associated with the green revolution was that significant use of fertilizers was necessary to obtain adequate crop yields. Seeds and fertilizer were to be made available *together* to the cultivator as a single "package deal".[88] The increased yields would mean more income for poor farmers, and more food to solve the hunger problem.

Success of the green revolution was dependent on its adoption by governments of the Third World. The initiative to adopt new policies came from the World Bank and private American foundations with support from the US government. In 1965, the Indian sub-continent was facing a drought, but North America shared a large harvest with the starving population in the form of food aid. The Perkins Committee, a special presidential advisory group on foreign aid that included David Gaud (Director USAID), Dwayne Andreas (Agri-business owner), and David Rockefeller of the Rockefeller Foundation, urged that this momentary leverage be used "to force India to increase her agricultural productivity." The force had to be subtle, however, as "any such use of power must be done cautiously", the committee warned;[89] "such a policy has hazards and the powerful and rich cannot do this sort of thing too publicly."[90] For various

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[88] Andrew Pearse, *Seeds of Plenty, Seeds of Want, Social and Economic Implications of the Green Revolution*, (Oxford: Oxford University Press, 1980) at 12.

[89] Perkins Committee minutes cited by Nick Cullather, "Miracles of Modernization: The Green Revolution and the Apotheosis of Technology" (2004), 28:2 Diplomatic History 227 at 242.

[90] *Ibid.*

reasons (including the need to buy expensive agricultural fertilizers) India defaulted on its debt payments in 1966 and was forced to devalue its currency by 37.5%.[91] The foreign exchange component of the green revolution was $2.8 billion for a given five year period, which was six times more than what the government allocated for agriculture during the same period.[92] Most of the foreign funding was required to pay for the import of fertilizers, seeds, and pesticides, as well as new agricultural equipment for the chemically intensive strategy.[93]

There was a dramatic increase in food production during the Green Revolution. The world's wheat production increased from 308 million tons in 1966 to 541 million tons in 1990.[94] Total rice production doubled over the same period from 257 million tons to 520 million tons.[95] In four years, wheat production in India rose from 10 million tons to 17 million tons, and similar success was obtained with semi-dwarf varieties of rice.[96] Per capita availability of staple foods in Third World countries increased during this period and, subsequently, developing countries like India and Indonesia declared self-sufficiency in food production. True to the promise, they were no longer dependent on

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[91] Devika Johri & Mark Miller, "Devaluation of the rupee: Tale of two years 1966 and 1991" (New Delhi, Centre for civil society, 2002) < http://www.ccsindia.org/Intern2002_12_devaluation.pdf > (date accessed: 22 July 2005).

[92] Vandana Shiva, *The Violence of the Green Revolution: Third World Agriculture, Ecology and Politics* (London: Zed Books & Third World Network, 1991) at 30.

[93] *Ibid.*

[94] David W. Paul, "A Historical Perspective from the Green Revolution to the Gene Revolution" (2003) 61:6 Nutrition Reviews 124 at 125.

[95] *Ibid.*

[96] Rajalakshmi Swaminathan, "From Green Revolution to Gene Revolution' (2004) 2 PBI Bulletin at 4, online: National Research Council, Canada homepage <http://pbi-ibp.nrc-cnrc.gc.ca/en/bulletin/2004issue2/index.htm#toc> (date accessed: 20 December 2005).

food aid. In India, policies were adjusted in the mid-1960s to utilize and promote the new HYVs on the basis of the Ford Foundation's recommendations. The application of these recommendations concentrated on one tenth of cultivable land and to a great extent on one crop, wheat.[97] The governments showed keenness in adopting this new strategy, as necessary inputs were made available even where foreign exchange was scarce.[98] More than 92% of rice and wheat croplands under the HYV seeds in 1972 were found in Asia, of which nearly half of that cropland was in India.[99]

To achieve these results, however, farmers in these Third World countries abandoned their centuries-old ways of doing *subsistence* agriculture, for a new "revolutionized" way of doing *industrial* agriculture. Even at the start of the Green Revolution, warnings existed about the use of chemical fertilizers and their negative effects on the environment. Dr. M.S. Swaminathan, an eminent scientist who led the Green Revolution in India, told the Indian Science Congress in 1968 that, "irrigation without arrangements for drainage could result in soils getting alkaline or saline, and indiscriminate use of herbicide and pesticide could cause adverse changes in the biological balance."[100] Intensive use of chemicals also resulted in increased costs of production. The cost of producing one ton of wheat has continuously risen, for example, going from $30 in

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[97] Andrew Pearse, *Seeds of Plenty, Seeds of Want, Social and Economic Implications of the Green Revolution* (Oxford: Oxford University Press, 1980) at 81.

[98] *Ibid.*

[99] *Ibid.* at 38.

[100] Dr. M.S. Swaminathan, as cited by Kukum Das Gupta, "Poverty amidst plenty" (2001) 54:1 UNESCO Courier at 27.

1984-85 to $80 in 1997-98, almost a three-fold increase in 12 years.[101] There were severe health effects associated with their use. In Costa Rica, prolonged use of the pesticide Dibromochloropropane (DBCP) left over one thousand banana-plantation workers sterile. The American Environmental Protection Agency (EPA) issued a notice of intent to cancel all food uses of DBCP by a federal regulation. The EPA followed this with an order suspending registration of pesticides containing DBCP. Before and after the EPA's ban of DBCP in the United States, however, Shell and Dow shipped several hundred thousand gallons of the pesticide to Costa Rica for use by a fruit company.[102] In this particular instance, moreover, while the pesticide was banned in United States, it continued to be exported to a Third World country. This is a common pattern, and the Bhopal gas disaster is an extreme example of the adverse effects of pursuing chemical intensive agriculture, with different standards being applied in the global south. In the end, all of these chemicals make their way into the human food chain that all consumers eat, even though many of "these traditional chemical pesticides are considered as human carcinogens."[103]

Considered as a one-time solution to the world's hunger problems, many now argue that the Green Revolution was a Pandora's Box of problems. Two international financial institutions, the IMF and the World Bank, helped to open this Box. Applying new policies based on increasing export capacity, these organizations promoted a model of

[101] These figures are in US dollars and may not depict the actual problem but in Indian terms, is a huge shift, cited in *Ibid.* at 27.

[102] See *Dow Chemical Co*. v. *Castro Alfaro*, 786 S.W. 2d 674, 681 (Texas 1990) (Westlaw).

[103] Committee on Genetically Modified Pest Protected Plants, National Research Council, Genetically Modified Plants: Science and Regulation 33 (2000) The National Academies Press Homepage, online: at <http://www.nap.edu/books/0309069300/html/R1.html> (date accessed: 29 December 2006) [hereinafter *NRC 2000*].

development that believed that somehow all countries in the world could export more than they imported. Serge Latouche points out that "this is a fallacy of cumulation and far from obvious."[104] While critiquing the actions of the IMF and the World Bank, the report of International Financial Advisory Commission, set up in 2000 by the US Congress, also known as Meltzer Report (after Allan H. Meltzer), argued that such policies by the IMF actually institutionalized economic stagnation and that the World Bank was ineffective in eliminating global poverty.[105] The report stated that both institutions were to a great extent driven by the interests of key political and economic institutions in the G-7 countries – particularly the US government and the country's financial interests.[106]

In the 1980s, the development policies of these institutions were transformed into a whole package, becoming known as the Structural Adjustment Programs. Walden Bello argues that while these agencies "have assisted the world's poorest countries and these are the countries with very weak political structures, it is no exaggeration to say that under the guise of providing aid, an IMF-World Bank condominium has been imposed over these countries."[107] As Professor Michael M'Gonigle charges with regard to this form of development, "on the one hand, it reduces a state's bottom-up power as a protector of its own territorial foundations; on the other hand, globalism extends the

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[104] Serge Latouch, *In The Wake of The Affluent Society: An Exploration of Post-Development* (London: Zed Books, 1993) at 41.

[105] *Meltzer Report,* Asian Development Bank Homepage, online: <http://www.adb.org/Documents/Slideshows/Meltzer_Report/Meltzer_Report.pdf> (date accessed: 10 February 2006).

[106] *Ibid.*

[107] Walden Bello, *Brave New Third World: Strategies For Survival in the Global Economy* (London: Earthscan Publications, 1990) at 56.

state's ability to act as an enforcer of externally-generated, top-down rules of transnational control."[108] One recent and dramatic example of imposing a particular type of "development" over a developing country is the American occupation of Iraq. Issued by the interim administrator of Iraq, under Order 81, "Patent, Industrial Design, Undisclosed Information, Integrated Circuits and Plant Variety" was passed. This Order amends Iraq's patent law of 1970, making the practice of saving and exchanging seeds illegal.[109] In contrast, Iraq's earlier constitution of 1970 prohibited private ownership of biological resources and under Articles 13, 16, and 18, placed limitations on foreign ownership.[110]

In the example of the Green Revolution we can see how the unwarranted influence of colonizing powers over development within colonized countries and that even post-decolonization, the development agenda has continued to be driven by forces outside the Third World countries like India (i.e. The WTO and IMF).

2.3.3 Repeating History? The Gene Revolution

The pursuit of reason and the perfection of society through development, started with the Enlightenment, continued through colonization, and were manifested in the Green

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[108] *Globalism and Territoriality*, *supra* note 49 at 176.

[109] The Coalition Provisional Authority of Iraq CPA/ORD/26 April 2004/81, The Coalition Provisional Authority of Iraq Homepage, online:, <http://www.cpa-iraq.org/regulations/20040426_CPAORD_81_Patents_Law.pdf> (date accessed: 5 January 2006); also available on Iraq Investment and Reconstruction Task Force (IIRTF) official homepage of the U.S. Department of Commerce <http://www.export.gov/iraq/pdf/cpa_order_81.pdf> (date accessed: 10 February 2006).

[110] Blaunstein & Flanz, eds., *Constitutions of the Countries of the World*: *Historic Constitutions*, Looseleaf (New York: Oceania Publications, 1974) at 2-3.

Revolution. This pursuit has now reached a new level: the genetic level. Emulating the gods of the Green Revolution, to produce more and eliminate hunger, a whole new form of highly developed science is applied to create the "gene revolution." It is argued that the manipulation of genes would allow growing more, and providing more for even more people with less negative effects.

The structures we now call "genes" are understood as a result of research begun by the 19th century geneticist, Gregor Mendel, that specifically came from his observations of the dominant characteristics in peas.[111] At a molecular level, the genes are composed of strands of DNA, and are carried in the form of chromosomes. Genes carry the information that directs the production of molecules that form the structures of a cell. They determine the inherited characteristics that distinguish one individual from another. The revolutionary discovery of the structure of DNA, by Watson and Crick in 1953, introduced the double-helix concept[112] that underpins genetic manipulation today. By the early 1970's, Herbert Boyer and Stanley Cohan demonstrated that pieces of the DNA could be taken from one organism and inserted into another. This technique provided the technical means for transcending the species barrier by manipulating desirable traits to create what are called "transgenic organisms."[113] In simple terms, a transgenic organism is an organism or plant containing genes from a different species

[111] Linda Tagliaferro, *Genetic Engineering: Progress or Peril* (USA: Lerner Publications Company, 1997) at 15.

[112] *Ibid.* at 18-20.

[113] *Ibid.* at 31.

than those of its "parents." This technique is called recombinant (rDNA)[114] technology. As more and more genes of diverse species are being mapped, the process and technique is becoming more powerful and more specific to different organisms.

Biotechnology has redefined the way agriculture is done. The difference between the traditional *hybridization* techniques and *rDNA* is the vastness of possibilities. Farmers have used traditional breeding methods to improve crops or animals by transferring genes that lead to desirable traits, such as disease and insect resistance, from one variety to another. However, with traditional breeding, inter-breeding was limited as it was dependent upon chance as thousands of genes were mixed and often resulted in the loss of desired traits.[115] For example, a healthy plant is considered as carrying particular pest resistant traits. It is then crossed with another variety of plant hoping that the new plant will inherit the pest resistance. But in crossing the two plants many times, other traits, such as the taste or color of the new plant, may be lost. Another important limitation of traditional breeding was that only closely related species could be interbred. With *rDNA* techniques, interbreeding is possible *between different species,* and it is also possible to ensure the precise transfer of desired traits. The evolutionary profundity of the technique creates many potential benefits, and many risks associated with genetic mutations. There are different views on potential benefits and harms associated with the use of biotechnology in agriculture. Such views often reflect the political or economic interests of the exponent, their different paradigms of science and development.

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[114] Recombinant DNA has been defined as "[t] he hybrid DNA produced by joining pieces of DNA from different organisms together in vitro."

[115] Health Canada Homepage, online: <http://www.hc-sc.gc.ca/fn-an/gmf-agm/fs-if/faq_4_e.html#2> (date accessed: 10 Feb 06).

The dominant paradigm is evident in the 1992, a report by the National Biotechnology Policy Board, that concluded that:

> [t]he risks associated with biotechnology are not unique and tend to be associated with particular products and their applications, not with the production process or the technology *per se*. In fact biotechnology processes tend to reduce the risk because they are more predictable. The health and environmental risk of not pursuing biotechnology-based solutions to a nation's problem are likely to be greater than the risks of going forward.[116]

Today, one of the most well known examples of genetic engineering is "Bt Corn"[117] and other Bt crops. Creating these crops requires incorporating Bt genetic material to make it insect and pest resistant, thereby modifying conventional crops. In these modified crops the "Bt toxin is continuously produced to maintain its effectiveness to kill insects."[118] One of the most acclaimed benefits of transgenic crops is enhanced food production and disease-free crops. Higher yields achieved through biotechnology are seen to have reduced the need to convert land for food production.[119] One of the major manufacturers

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[116] Jonathan H Adler, "More Sorry Than Safe: Assessing the Precautionary principle and the Proposed International Biosafety Protocol" (2000) 35 Texas Int'l. L. Journal at 177.

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> Bacillus thirungiensis (B.t.) is a bacterium found in soil and on plant. Under low nutrient conditions, Bt produces a dormant spore and [a particular type of] protein, which is highly toxic to particular types of insects. When a susceptible insect ingests the spore and its accompanying crystal, it becomes paralyzed and dies…. By isolating the gene that encodes this toxin and introducing it into plants, researchers [have created genetically engineered plants that contain] the insecticidal toxin in their tissues, thus making those plants resistant to insect damage.

David J Earp, Comment,"The Regulation of Genetically Engineered Plants: Is Peter Rabbit Safe in Mr. McGregor's Transgenic Vegetable Patch?" (1994) 24 Envtl. Law 1650 at 1651.

[118] John Charles Kunich "Mother Frankenstein, Doctor Nature, And the Environmental Law of Genetic Engineering" (2000-2001) 74 Southern California Law Rev 807 [hereinafter "Mother Frankenstein"].

[119] Margaret Rosso Grossman, "Biotechnology, Property Rights and the Environment" (2002) 50 Am. J. Comp. L 215 at 218.

of genetically modified seeds, Monsanto Company, describes its contribution in its 2004 pledge report-Growing options:

> Through higher yields, traits that require less tillage and pesticides, and knowledge of integrated agricultural systems, Monsanto is in a position to help growers, both large and small, to increase food production and thereby improve food security….It works with governments and non-government groups to give small growers access to the inputs they need and to commercial markets of their surplus[120]

Another major use of biotechnology in agriculture is the "Round-up Ready" variety of crops. These crops are genetically altered to be herbicide resistant to 'glyphosate,' (brand name Round-up) a common herbicide. When the fields are sprayed with these herbicides, crops remain unharmed and only weeds are eliminated.[121]

Like the Green Revolution before it, the most acclaimed aspect of biotechnology is increased productivity. The progression in thinking is simple: more investment, more production, less labour, more trade, more profits, all of which leads to a reduction in poverty and hunger. The success of transgenic crops is evident in the meteoric rise in the acreage-area production since their inception in 1996. Within nine years from 1996 to 2004, the acreage of transgenic crops increased forty-seven fold, from 1.7 million

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[120] Monsanto Company 2004: Pledge Report, Global Challenge #2 Food Security at 9, Monsanto Company Homepage, online: <http://www.monsanto.com/monsanto/content/media/pubs/2004/pledgereport.pdf> (date accessed: 24 March 2006).

[121] *Mother Frankenstein*, *supra* note 118 at 811.

hectares to 81.0 million hectares.[122] Interestingly enough, only 4.2 million hectares of transgenic crops are found in the two most populous countries of the world (3.7 million hectares in China and 0.5 million hectares in India).[123] This means that the countries that are home to 40 percent of the world's population contain only 5 percent of the world's transgenic acreage. This may be an indication of the lack of confidence in the new technology in these two countries (who are to feed almost 40% of the world population) due to the past effects of the *Green Revolution*.[124] The people who promoted the Green Revolution now claim that genetically modified crops are the solution to the overuse of pesticides and fertilizers that resulted from the Green Revolution.[125] With the planting of genetically engineered pest-resistant Bt crops, pesticide use has been reduced. One study estimated that the adoption of new insect-resistant varieties of corn, cotton, potato, soybean, peanut, broccoli and eggplant has the potential to reduce insecticide use by a further 17.6 million pounds, for a total reduction in insecticide use of 22 million pounds annually.[126] The National Centre for Food and Agriculture Policy (NCFAP) studied 40 different Biotech cultivars (i.e. a variety of a plant that has been created or selected intentionally and maintained, as distinguished from naturally occurring varieties) and concluded that their use led to an increased yield of 14 billion pounds per year, a reduced growing cost $1.6 billion, and a pesticide use reduction of

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[122] Clive James, International Service For the Acquisitions of Agri-Biotech Applications (ISAAA), Executive Summary: Global Status of Commercialized Transgenic Crops 2004, ISAAA Homepage, online: <http://www.isaaa.org> (date accessed: 30 December 2006).

[123] *Ibid.*

[124] See negotiation of the Cartagena Protocol, *below*.

[125] *Mother Frankenstein*, *supra* note 118 at 813.

[126] Biotechnology Industry Organization, Farming and Environmental Benefits: Biotechnology Delivers Clear Benefits to the Farmers and the Environment, BIO Homepage, online: <http://www.bio.org/foodag/background/benefits.asp> (date accessed: 18 February 2006).

163 million pounds per year.[127] Achieving the commercial success of agricultural biotechnology, however, requires sizeable investments in new biotechnology (labs, equipment, costly reagents, and skilled staff).[128] The corporate sector plays an important role in providing these investments, while also leading more concentrated efforts to develop these technologies through new research facilities, and cooperation with other companies and educational institutions.

Considering how recent the development of biotechnology has been, it is difficult to assess the long-term effects or consequences of genetic engineering. The Green Revolution, which was considered a boon for the farmers, was later discovered to deplete the nutrient carrying capacity of soil due to the prolonged use of insecticides and fertilizers. Other related harms were also discovered. Certainly, the field of biotechnology develops from and reinforces a mechanistic, reductionist, and utilitarian view not only of genetic information, but also of life itself.[129] This view can be traced back to the Enlightenment—the quest to understand every aspect of natural processes and the desire to overcome the limits of nature. Realising some of the negative consequences of upholding those (enlightened) views, consumer groups, farmers and states have raised concerns regarding the safety of GMOs. According to the

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[127] Leonard P. Gianessi et al, "Plant Biotechnology: Current and Potential Impact for Improving Pest Management in US Agriculture-An Analysis of 40 Case Studies" (2002) National Centre for Food and agricultural Policy, Washington at 4 NCFAP Homepage, online: <http://www.ncfap.org/40CaseStudies/NCFAB%20Exec%20Sum.pdf> (date accessed: 15 February 2006).

[128] Ian Scoones, *Science, Policy and Regulation: Challenges for Agricultural Biotechnology in Developing Countries*, ISD Working Paper 147, (Sussex: January 2002) at 10. Also available International Sustainable Development Homepage, online: <http://www.ids.ac.uk/ids/bookshop/wp/wp147.pdf> (date accessed: 18 February 2006).

[129] Richard Heinberg, *Cloning the Buddha: The moral impact of biotechnology* (USA: The Theosophical Publishing House, 1999) at 139.

Organisation of Economic Development (OECD), the possible adverse effects of GMOs are of five main types:

- potential impacts of GMOs on non-target species such as beneficial insects
- potential spread of GMO crops as weeds
- potential for cross-pollination between GM and non-GM crops and wild plants (referred to as 'genetic pollution')
- potential impacts on soil bacteria and the nitrogen cycle…
- potential effects on human health, for example through consumption of food produced using GMOs and their derivatives, or, more specifically, through potential transfer of antibiotic resistance marker genes in humans [This may lead to developing resistance to useful processes].[130]

The constant presence of Bt toxins in altered crops has also led to concerns about the possibility that pests will evolve to overcome the protection mechanism.[131] One study has suggested that the transgenic pollen of Bt corn has caused the death of Monarch butterflies leading to concerns over the impact of transgenic crops on non-targeted species.[132]

In response to the claim of increasing a country's food security, it is also widely accepted that food shortages arise due to failures in distribution, not production. If this is true then transgenic crops will have different effects in industrialised and southern economies. Socio-economically, the impact of the biotech industry is evident on the

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[130] OECD, The OECD Conference on the scientific and Health aspects of Genetically Modified Foods, *Chairman's Report GM Food Safety: Facts, Uncertainties, and Assessment*, Edinburgh (28 Feb-1 March 2000), OECD Homepage, online: < http://www.oecd.org/dataoecd/34/30/2097312.pdf (date accessed: 15 November 2005).

[131] *NRC 2000*, *supra* note 103 at 28.

[132] Losey E. John et al, "Transgenic Pollen Harm Monarch Larvae" (20th May 2000) 399 Nature 214.

traditional conservation of seeds that have never been controlled by any industry or by one corporation. Most farmers have saved and shared their seeds over the centuries, but with the advent of patent systems, these practices have begun to change:

> The pressures to deliver marketable products that can gain a return within the lifetime of patent are enormous, given the huge upfront investments that private companies have made. The practices of commercial science are far from the leisurely pursuit of more knowledge under unconstrained conditions, but firmly linked into commercial targets and objectives.[133]

The new legal mechanisms also support this tendency to extract maximum gains out of development of a technology through patenting it. This practice of commercialisation of science is resulting into blurring of public, and private science; such blurring in science for knowledge advancements and science for commercial gains- has deep implications.[134] From an industry perspective, the consolidation of seed-producing companies is also occurring as a by-product of international competition. The pursuit of global competitiveness has led to the massive industrial consolidations among seed-producing corporations. For instance, with its $7.7 billion purchase of Pioneer Hi-Bred, DuPont became the largest seed company in the world.[135] Monsanto, Novartis and Dow made similar moves, and by 2000 DuPont and Monsanto controlled more than 70% of the market for US corn seed.[136] Mergers of these big multinational biotech corporations are not confined to the developed world's markets. Through aggressive licensing

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[133] Ian Scoones, Science, Policy and Regulation: Challenges for Agricultural Biotechnology in Developing Countries, IDS Working Paper 147, (Sussex: January 2002) at 14 International Sustainable Development Homepage, online: <http://www.ids.ac.uk/ids/bookshop/wp/wp147.pdf> (date accessed: 18 February 2006).

[134] *Ibid.*

[135] *Ibid.* at 26.

[136] *Ibid.* at 27.

strategies and acquisition of seed companies, Monsanto emerged in the number one position in Brazilian, Mexican and Argentinean corn seed markets, and in the European wheat market.[137] This consolidation in production has generated the impetus for the consolidation of the retail market sector as it also allows the companies to hold influence over its suppliers.[138] This again ties into the idea of accumulation or profit maximisation through application of commercial science. Nevertheless, in this "globalized" world, the loss of control over seeds may undercut the foundation of food security and cultural identity for many nations.[139] For example, because the science is new and unique, the after-effects of the use on crops are uncertain. The economic costs of seed development create motivation to merely break-even, and this affects the will of government to adopt preventive measures of negative after-effects.

To many, the "progress" in agriculture is unprecedented. At the same time, this "progress" has come at a cost to the environment, to social inequality and to alternative practices. Today, the uncertain long-term effect of GMOs on biodiversity is critically important, leading many to argue that the economic regimes supported by scientific knowledge need to be rethought in order to protect against damages like those emerging from the Green Revolution.

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[137] *Ibid.* at 28.

[138] A.M. Shelton, J. Z. Zhao & R.T. Roush, "Economic, Ecological, Food Safety and Social Consequences of the Deployment of BT Transgenic Plants" (2002) 47 Annual Review of Entomology at 870.

[139] William Boyd, "Wonderful potencies? Deep structure and the problem of monopoly in agricultural biotechnology," in Rachel A. Schurman & Dennis Doyle Takahashi Kelso, eds., *Engineering Trouble: Biotechnology and its Discontents*, (California: University of California, 2003) at 25.

Section 3. Approaching Science and Development Differently: The Precautionary Principle

The science developed during the Enlightenment underpins the way the world has "developed" to date, and has contributed to many harmful effects on the environment and on diverse social groups. The application of science during the green revolution, and more recently the gene revolution, highlights the uncertainty[140] of scientific knowledge. This uncertainty inherent in science was theorised in Heisenberg's uncertainty principle, which states that it is not possible to locate simultaneously the position and speed of an atom (either practically or in theory).[141] Laboratory-based methods are unreliable for dealing with risk in the environment and are therefore limited in practical risk management.[142] Nevertheless, using these methods, risk assessment is done as an experiment, with a limited number of indicators and well-defined parameters. The indicators are then noted as statistical figures to conclude the possibility of a risk. When a similar risk assessment technique is applied in environmental decision-making, it only

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[140] Uncertainty may be defined in many forms. Such as:

> Risk- where all the outcomes are, and the probability of their occurrence, are known, for example mechanical failure rates of components for a well-established product. Such risk, so defined, can be assessed by uncontroversial methods;
>
> Uncertainty-defined here as where outcomes are identified, but not their probability of occurrence. This uncertainty might be reduced to risks by research; or may turn out to be insoluble;
>
> Ignorance-where the outcomes are not known. An example is an ecosystem effect that may occur via a key but unknown species or processes.

M. McGarvin, "Science, Precaution, Facts and Values" in Tim O' Riordan, James Cameron & Andrew Jordan, eds., *Reinterpreting the Precautionary Principle* (London: Cameron May, 2001) 35 at 42. [Footnotes omitted]

[141] A Dictionary of Chemistry, (Oxford University Press, 2000) Oxford Reference Online, Oxford University Press *s.v.* <<uncertainty principle>>
online: <http://www.oxfordreference.com/views/ENTRY.html?subview=Main&entry=t81.e4215> (date accessed: 16 March 2006).

[142] See generally Michael M'Gonigle et al, "Taking Uncertainty seriously: From Permissive Regulation to Preventative Design in Environmental Decision Making" (1994) 32:1 Osgood Hall L.J. 99-169 [hereinafter *Taking Uncertainty Seriously*].

provides limited capacity to foresee uncertain results. If an "indicator" of an unknown attribute is left out of the experiment, harmful consequences will not be detected.

Historically, risk assessment has tended to favour the goal of minimising Type I errors (incorrectly concluding that there is an effect when one does not exist). This concern is to prevent the imposition of unnecessary regulations. The effect of this bias, however, is to increase the chance of Type II errors (incorrectly concluding that there is no effect when there is one).[143] Type I and Type II errors are inversely related to each other, which means that every time tests and standards try to avoid a Type I error there is an increased chance of a Type II error. This is similar to the high burden of proof that exist in criminal law to avoid putting innocent people in jail (a Type I error). This high *standard of proof* inevitably means that many guilty people go free. To reduce Type II errors in criminal law would mean that many innocent people would inevitably end up in prison. For industry, however, the preference for avoiding Type I errors is to minimise economic costs; the result is to create environmental costs, especially as the burden of proof is on the person alleging an environmental problem, not on the industrial cause of the problem.[144]

This typical approach works on many assumptions. One such assumption is that there exists an "*assimilative capacity* (a predictable level of harm from which an ecosystem can recover) or a safe level when the exact effect, its magnitude, an interconnectedness

[143] *Ibid.* at 101.

[144] *Ibid.*

are unknown."[145] This assumption means that the environment is treated as if it can assimilate the negative effects resulting from an activity, and thus there is no need to deal with uncertain effects early, because they can be dealt with later. Yet, given the magnitude of current "development," especially in the case of GMOs, the cost of uncertainty, and threat to biodiversity is enormous. In short, it is perilous for us to continuously ignore or to fail to take uncertainty seriously.

For example, polychlorinated biphenyls (PCBs) were first synthesized in the laboratory in 1881, and by 1899 a pathological condition named chloracne (a disfiguring skin disease) was identified. However, it still went to commercial production in 1929. Monsanto was certainly aware of the adverse health effects to workers exposed to PCBs, but the economic interest overshadowed the potential harms.[146] Many other chemicals are currently present in our ecosystem for which we do not have adequate knowledge about their adverse effects, or how those chemicals interact with others. The experiments to identify their usefulness or the negative effects of these chemicals are generally carried out in controlled environments and only take into account a few indicators. For example, they don't take into consideration their *synergetic effects*[147]on the environment. Also, the inability of mechanistic science to deduce the complex inter-

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[145] Carolyn Raffensperger & Joel Tickner, "Introduction" in Carolyn Raffensperger & Joel Tickner, eds., *Protecting Public Health & the Environment: Implementing the Precautionary Principle* (Washington D.C: Island Press, 1999) at 3 [hereinafter *Protecting Public Health*].

[146] Janna G Koppe & Jane Keys, "*PCBs and the Precautionary Principle*" in Poul Harremoës et al, eds., *The Precautionary Principle in the 20th Century: Late Lessons From Early Warnings* (London: European Environment Agency & Earthscan Publications, 2002) 64 at 64-65.

[147] The combination of various substance and energy in a recipient may thus entail synergetic effects, resulting in the 'sum' of harmful effects being greater then merely the adding of one substance's harmfulness to that of another (1+1=3):
Arie Trouwborst, *Evolution and Status of Precautionary Principle in International Law* (Hague: Kluwer Law International, 2001) at 9.

relationships within ecosystems, and the cause-effect relationships of substances introduced into ecosystem limits the effectiveness of scientific risk assessment. For example, the use of DDT as an insecticide since 1940s severely harmed the ecosystem and made its way into our food chain. It was considered safe when it came on the market for the first time. As Barrett and Raffensperger state, "mechanistic science is reductionist science, which ignores the larger context of the research subject" – a typical approach in molecular and toxicological experiments.[148] In philosophical terms, "the mechanistic model [of science] embodies many assumptions of positivist science in which methods are based primarily on deduction, experiments are replicable, theories are predictive, and the scientific endeavour is considered to be value free."[149] This shows that the experimental analysis under the mechanistic science is reductionist in nature and has limited capacity to identify the risks of irreversible harms. This problem of scientific uncertainty, on which the "model of development" is based, is the primary reason why so many people have embraced the precautionary principle. The environmental costs of non-precautionary developments create an imperative for a different development paradigm that adequately and effectively address the issue that exists today -- *pervasive* uncertainty. The precautionary principle represents the foundation of this paradigm and challenges the current model of development.

3.1 The Principle of Precaution

[148] Carolyn Raffensperger & Joel Tickner, eds., "Precautionary Science" in *Protecting Public Health, supra* note 145 at 109-110.

[149] *Ibid.*

The response to uncertainty should not be inaction or a "wait and see" approach. Rather, as scientist Albert Schweitzer states, negative consequences should be "*foreseen and forestalled*."[150] When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically.[151] Beyond this technical definition, the precautionary principle is about an attitude of caution based on having a "functionally respectful relationship with nature."[152] It is one of the many principles that should guide human activities in a limited and fragile environment. It also "incorporates parts of others (principles) such as justice, equity, respect, common sense, and prevention."[153] The principle is a response to the growing distrust of the consequences of our technical and scientific know-how. Advocates argue for the need to use precaution to avoid serious and irreversible damage to the global ecosystem. Arguably, observing precaution has always been part and parcel of our day-to-day life, such as fastening the seat belts before driving or using an eye protector while welding, or wearing a parachute while flying a fighter aircraft. These safety measures, however, only came about in response to the costs of not using them. The important distinction between the aforementioned precautions and the precautionary approach in environmental decision-making is taking action without conclusive evidence of harm. Instead, the precautionary approach urges making a conscious decision not to undertake

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[150] Albert Schweitzer, as cited in *Protecting Public Health*, *supra* note 145 at 1.

[151] Wingspread Statement on the Precautionary Principle, 25 January 1998, Science and Environmental Health Network Homepage, online: <http://www.sehn.org/state.html#w> (date accessed: 20 march 2006).

[152] Carolyn Raffensperger & Joel Tickner, "Appendix A" in *Protecting Public Health*, *supra* note 145 at 350.

[153] *Ibid*. at 350

an activity where serious scientific uncertainty exists with a possibility of irreversible harm. For each of the safety measures mentioned above, we began taking precautions because our experience taught us that we would be harmed if we didn't. This makes such measures part of a "reactive response". Similarly, the precautionary approach challenges the theoretical assumption of *assimilative capacity* because it has been proven to be limited in practice. Harms done to the environment are not always deducible in advance, nor will studies provide a suitable response time for a reaction.[154] Incorporating the precautionary principle means moving from a reactive to a pro-active approach where a preventative measure is taken where the possibility of harm exists but where the harm is not provable in advance.

3.2 Development of the Precautionary Approach

The precautionary approach has been applied in various ways in the recent past as well as historically. The history of the application of the precautionary approach can be traced to the 19th century. In 1854, Dr John Snow recommended removing the handle from the Broad street water pump in London in an attempt to stop a cholera epidemic. At the time, how cholera was contracted was unknown. This recommendation was based on evidence, not "proof beyond reasonable doubt." But it was enough for Snow to recommend a precautionary public health action. As it turned out, the costs of inaction

[154] Ellen Hey, "The Precautionary Concept in environmental Policy and Law: Institutionalizing Caution" (1991-1992) 4 Geo. Int'l L. Rev. 303 at 305.

would have been far greater than the possible costs of action.[155] Thirty years later, in 1884, Dr. Robert Koch discovered the bacterium that spread cholera.

The recent history of the precautionary principle can be traced to Europe. In the 1970s, as a legislative measure, the precautionary principle was applied in Germany when it was discovered that the country's forests were dying. There was no scientific proof at the time that it was due to acid rain, but the government acted to reduce power-plant emissions, citing the principle of "Vorsorge" or "Forecaring." Soon, Vorsorgeprinzip – the forecaring, or precautionary principle – became part of German environmental law.[156] This approach to acid rain indicates the effectiveness of legislation to minimize the effects of human activities on the environment, even without definitive proof of cause and effect.[157] The need for the precautionary principle arises from the extent of the current threats posed by human activities on the global environment, and recognises the negative consequences for nature as a result of the limits of "science." In contrast, during the Enlightenment, science was pursued with limited need to consider its consequences for the environment.

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[155] Poul Herremoes et al, eds., *The Precautionary Principle in the 20th Century: Late Lessons From Early Warnings* (London, Sterling, VA: European Environment Agency & Earthscan Publications, 2002).

[156] Arie Trouwborst*; Evolution and Status of Precautionary Principle in International Law* (Hague: Kluwer Law International, 2001).

[157] *Protecting Public Health*, *supra* note 145 at 16.

3.3 Precautionary Principle under International Law

The precautionary principle emerged on the international scene in the 1980s. In 1982, the UN General Assembly adopted a resolution on the World Charter of Nature.[158] Principle 11 of the charter states that:

> 1. Activities that are likely to cause irreversible damage to nature should be avoided.
>
> 2. Activities that are likely to pose significant risk to nature shall be preceded by an exhaustive examination, their proponents shall demonstrate that expected benefits outweigh potential damage to nature, and where potential adverse effects are not fully understood, the activities shall not proceed.[159]

The precautionary principle doesn't appear in specific terms here, but the language foreshadows the present precautionary approach. A more formal application of the precautionary principle is found in the *Ministerial Declaration of the Second International Conference on the Protection of the North Sea* in 1987. In it the ministers:

> Accept the principle of safeguarding the marine ecosystem of the North Sea by reducing pollution emissions of substances that are persistent, toxic and liable to bioaccumulate source by use of the best available technology and other appropriate measures. This applies especially when there is reason to assume that certain damage or harmful effects on the living resources of the sea are likely to be caused by such substances, even when there is no scientific evidence to prove a causal link between the emissions and effects. ("the principle of precautionary action")[160]

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[158] UN General Assembly Resolution on the World Charter for Nature, G.A., Res 317/7, U.N. GAOR, 37th Session., Supp. No. 51, at 17, U.N. Doc. A/37/51 (1983).

[159] *Ibid.,* Principle 11.

[160] 27 I.L.M (1988) 835 at 840.

This approach recognizes the "uncertainty of scientific information" and applies the precautionary principle as a preventative measure without waiting for a definitive "causal link between emission and effects."[161] There are many other international legal instruments[162] that incorporate the principle; however, the most important expression of the precautionary principle that established it in the international arena is found under Principle 15 of the Rio Declaration:

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.[163]

The above definition points to some of the key aspects of the precautionary principle that have been summed by Cameron and Aboucher; they argue that

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[161] *Taking Uncertainty Seriously*, *supra* note 142 at 158.

[162] Other multilateral agreements citing the precautionary principle:

- •1991 Bamako Convention on the Ban of Imports into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa;
- •1992 UN Framework Convention on Climate Change;
- •1992 UN/ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes;
- •1992 Paris Convention for the Protection of the Marine Environment of the North-East Atlantic;
- •1992 Convention on Biological Diversity, preamble;
- •1992 Helsinki Convention for the Protection of the Baltic Sea Area;
- •1994 Oslo Protocol on sulfur emission reductions;
- •1995 Straddling Fish Stocks Agreement, implementing the UN Convention on the Law of the Sea;
- •1996 Syracuse Amendment Protocol (to the 1976 Barcelona Convention) for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, preamble;
- •1996 London Amendment Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter;
- •Two 1998 Aarhus Protocols on heavy metals and on persistent organic pollutants;
- • 1999 Gothenburg Protocol on acidification, eutrophication and ground-level ozone to the 1979 UN/ECE Convention on Long-Range Transboundary Air Pollution, preamble;
- • 1999 (UN/ECE) London Protocol on Water and Earth;

Source: Ragner et al, "Precautionary Principles: General Definitions and Specific Applications to Genetically Modified Organisms" (2002) 21:3 Journal of Policy Analysis and Management 381at 385.

[163] *Rio Declaration on Environment and Development*, 14 June 1992, UN Doc. A/Conf.151/26 (Vol. I) (1992), reprinted in 31 I.L.M. 876 (1992) at Principle 15.

threat of serious or irreversible harm must become the threshold of evidence in any interpretation of the precautionary principle.[164] The Rio definition has faced criticism for incorporating the term, "cost-effective" as some have argued that this reference reiterates the importance of economic-objectives over environmental concerns, and weakens the precautionary principle. This paper will not discuss the efficacy of these international legal instruments, but it is important to show the inclusion of this principle in international law, and how it can be used to effectively address environmental issues such as GMOs. Its wide applicability makes it an important tool in dealing with scientific uncertainty.

3.4 Practical application of the Precautionary Principle

But how does the precautionary principle deal with the scientific uncertainty in practical terms? An important question that arises is how we decide when the available scientific information is enough or not? The definition of "risk" is one of the critical issues in implementing the precautionary principle. Different cultures define or perceive risk differently, which makes it even more difficult to adopt a universal approach on the ground.[165] However, mass adoption of GMO's amidst the vast uncertainty of their effects on the environment could well be regarded as a "risk" that logically entails taking a precautionary approach. A favourable decision may be made if the extent of

[164] James Cameron & Juli Aboucher, "The Precautionary Principle: A Fundamental Principle of Law and Policy for the Protection of the Global Environment" (1991) 14:1 B.C. Int'l & Comp. L. Rev. at 21-22.

[165] Andrew Jordan & Timothy O'Riordan, "The Precautionary Principle in Contemporary Environmental Policy and Politics" in *Protecting Public Health, supra* note 145 at 18.

probable harm appears to be limited; In the case of GMOs, however, it doesn't.[166] "If the geography of potential harm is limited, we may agree that the larger the area the more precaution we must exercise."[167] For GMOs the geographical limit is our planet. The precautionary principle takes into consideration the welfare of all species,[168] not only the human species as was the case during Enlightenment. If the social cost is limited, we may say yes to the economic activity. We say yes when the economic gains are attractive. If the introduction of the material compromises the future economic well-being or it is achieved in one sector at the expense of another, we should say no. In the case of GMOs, the economic benefits may come at the cost of biodiversity.[169]

A decision based on the precautionary principle in the discussion of Type I and Type II errors above would be to minimise Type II errors (i.e. incorrectly concluding that there are no effects of GMOs when there are) because of the possibility and extent of irreversible harm. The precautionary principle appears to be well equipped to deal with many limitations of scientific uncertainty. Instead of forging ahead with risk and dealing with the consequences later, the precautionary principle urges viable alternatives to minimize or remove the possibility of negative affects of the activity on the environment and public health. This discussion sets out the way precautionary decision-making

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[166] Fredrick Kirschenmann, "Can We Say "Yes" To Agriculture Using The Precautionary Principle: A Farmer's Perspective" in Carolyn Rafflsenperger & Joel Tickner, eds., *Protecting Public Health & the Environment: Implementing the Precautionary Principle* (Washington D.C.: Island press, 1999) 279 at 281.

[167] *Ibid.*

[168] *Ibid.*

[169] *Ibid.*

should work. The process of decision-making with respect to GMOs is dealt with in the next section.

Section 4. International Trade Law: Trade in Biotechnology and the issue of Biosafety.

Currently, the international trade of goods, including GMOs, falls under the general ambit of the WTO.[170] On the other hand, another international legal instrument, the Cartagena Protocol on Biosafety[171] to the Convention of Biological Diversity (CBD),[172] has come into effect to regulate specifically the trade and transboundary movement of GMOs. This double regulation involves a potential conflict between the two international legal instruments. This section elaborates how the two regulatory regimes overlap, pointing out the differences between them relating to the precautionary principle.

[170] *GATT*, *supra* note 22.

[171] *The Protocol*, *supra* note 20.

[172] *UN Conference on Environment and Development: Convention on Biological Diversity*, June 5, 1992, reprinted in 31 I.L.M. 818 (entered into force Dec. 29, 1993).

4.1 SPS Agreement

The WTO envisages the promotion of international trade to contribute to economic growth and development, [173] building on three *fundamental principles* to promote free trade. Under GATT 1994, a contracting party (member country) cannot discriminate between trading partners. A favour, privilege, immunity or advantage accorded to one trading country must be unconditionally accorded to all other WTO members' "like products." This is known as the Most Favoured Nation principle.[174] Another fundamental principle of the WTO agreement is "National treatment." Once goods, services or intellectual property enter a country's market, the country is obliged to provide equal treatment to the imported products and to locally produced "like products."[175] Also, Article XI prohibits any quantitative restrictions on goods in the forms of quotas and import licenses.[176] A country can adopt trade restrictive measures, contrary to the principles, if they satisfy the requirements of Article XX:

> Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:
>
> …
>
> (*b*) necessary to protect human, animal or plant life or health;

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[173] The preamble of *GATT* reads: "*Recognizing* that their relations in the field of trade and economic endeavour should be conducted with a view to raising standards of living, ensuring full employment and a large and steadily growing volume of real income and effective demand, and expanding the production of and trade in goods and services, while allowing for the optimal use of the world's resources in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and to enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development" *GATT*, *supra* note 22.

[174] *Ibid.*, Art. I.

[175] *Ibid.*, Art. III.

[176] *Ibid.*, Art. XI.

> …
> (g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption;[177]

The restrictive measures adopted by a state are subjected to the chapeau (introductory paragraph) of Article XX which states that measures must not constitute a means of arbitrary or unjustifiable discrimination between countries where similar conditions prevail. The states may adopt national risk policies to achieve certain objectives, especially those described in Article XX (b) and (g). Interestingly, the word 'environment' does not appear in Article XX.

The measures adopted under Article XX are subjected to the WTO's dispute settlement mechanism. Specifically, the Sanitary and Phytosanitary agreement (SPS) under the WTO deals with measures "necessary to protect human, animal or plant life or health."[178] In case of a dispute, the measures must be consistent with the SPS agreement that provides a framework within which a member country can apply these measures. In the preamble, the agreement states that the measures should not be "arbitrary and unjustifiably discriminatory or constitute disguised restrictions on international trade."[179] The SPS agreement is closely linked with Article XX (b) of the GATT agreement, and provides that it "elaborate rules for the application of the provisions of

[177] *Ibid.*, Art. XX.

[178] *SPS agreement*, *supra* note 23.

[179] *Ibid.*, Preamble at para 1.

GATT 1994 rules"[180] Article 2 of the SPS agreement sets out rights and obligation for the members:

> 2. Members shall ensure that any sanitary or phytosanitary measure is applied only to the extent necessary to protect human, animal or plant life or health, is based on scientific principles and is not maintained without sufficient scientific evidence, except as provided for in paragraph 7 of Article 5;
>
> 3. Members shall ensure that their sanitary and phytosanitary measures do not arbitrarily or unjustifiably discriminate between Members where identical or similar conditions prevail, including between their own territory and that of other Members. Sanitary and phytosanitary measures shall not be applied in a manner which would constitute a disguised restriction on international trade.[181]

The SPS agreement is a trade agreement not a health agreement, although the preamble recognises a government's desire to protect human, animal and plant health. However, the agreement specifically targets overuse of such protective measures.[182] For example, if a country lowers its health provisions or exports lower grade food to foreign consumers, it does not violate the SPS agreement.

Article 2 of the agreement, seeks to differentiate between acceptable and non-acceptable measures by forcing nations to base their policies on scientific findings.[183] The measures must be (a)"necessary for the protection of human, animal or plant life or health;" (b)

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[180] *Ibid.* at para 8.

[181] *Ibid.*, Art. 2.

[182] Steve Charnowitz, "The Supervision of Health and Biosafety Regulation by World Trade Rules" (1999-2000) 13 Tul. Envtl. L. J 271 at 277.

[183] Brett Grosko, "Genetic Engineering and International Law: Conflict Or Harmony? An Analysis of the Biosafety Protocol, GATT, and the WTO Sanitary and Phytosanitary Agreement" (2001) 20 Va. Envtl. L.J. 295 at 309.

"based on scientific principles;" and (c) not be "maintained without sufficient scientific evidence."[184]

Further, Article 3 sets out a *harmonization* clause. The parties shall *harmonize* their sanitary and phytosanitary measures "on as wide a basis as possible" and in accordance with "international standards."[185] The purpose of harmonization is to have common standards to protect plant, animal, and human health. To achieve this objective, the agreement sets up its own Committee on Sanitary and Phytosanitary Measures (Committee) to consult, negotiate and facilitate the implementation of the agreement, and work toward international harmonization of such measures.[186] In the absence of international standards in a particular area, the agreement urges member countries to accept the standards adopted by the exporting country as equivalent. This is regarded as "equivalence" of measures,[187] and is based on the assumption that countries will mutually agree to a common risk management policy. "Equivalence" also recognises that states would have confidence in other countries' measures.[188] For this reason, risk assessment becomes even more important, as different cultures/states may have different perceptions of risk.

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[184] *SPS agreement*, *supra* note 23, Art. 2.2.

[185] *Ibid*., Art 3.1 & 3.2.

[186] *Ibid*., Art. 3.5, 12.1 & 12.4.

[187] *Ibid.,* Art. 4.1.

[188] Peter-Tobias Stoll, "Controlling the Risk of Genetically Modified Organisms: The Cartagena Protocol on Biosafety and the SPS Agreement" in Jutta Brunnée & Ellen Hey, eds., Yearbook of International Environmental Law vol. 10 (Oxford: Oxford University Press, 1999) 82 at 105.

Risk Assessment:

Article 5.1 of the agreement requires members to undertake risk assessment to justify their sanitary and phytosanitary measures while "taking into account the risk to human, animal or plant life or health." Most importantly, the assessment must be based on "available scientific evidence."[189] In addition to protecting human, plant and animal health, the SPS agreement urges member countries to take into account "the economic factors: potential damage in terms of loss of production or sales in the event of entry."[190] To minimise negative trade affects[191] the agreement urges members to avoid arbitrary or unjustifiable distinctions in the levels of measures.[192] The focus of the provisions is to minimize negative effects on trade. For example, a country applying trade restrictive measure to protect human health should also consider other cost-effective measures to limit risk. The members shall also "ensure that such measures are not more trade-restrictive than required to achieve their appropriate level of sanitary or phytosanitary protection."[193] This means that if there are other measures available to achieve similar levels of sanitary and phytosanitary protection, the measure that is the least trade restrictive should be applied. The provisions set out in Article 5 of the SPS agreement "amounts to a duty on the states to ensure some consistency in SPS-related

[189] *SPS agreement*, *supra* note 23, Art. 5.1 & 5.2.

[190] *Ibid.*, Art. 5.3.

[191] *Ibid.*, Art. 5.4.

[192] *Ibid*., Art. 5.5.

[193] *Ibid*., Art. 5.6

areas of national policy that may have an impact on trade."[194] Furthermore, the standards for risk assessment adopted by a country should conform to international standards, where they exist. These standards are set by Codex Alimentarius Commission for food safety;[195] the International Office of Epizootics for animal health and zoonoses;[196] and, the International Plant Protection Convention for plant health.[197] In matters not covered by these organizations, the relevant standards would be those promulgated by "other relevant international organizations open for membership to all Members, as identified by the Committee."[198] Member countries are bound to apply trade-restrictive measures on the sound scientific basis prescribed by these organizations. In 2003, the Codex Commission published its Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants, and Microorganisms.[199] These guidelines lay out standards that every member state is expected to adhere to when adopting any sanitary and phytosanitary measures. One important aspect of these guidelines is the inclusion of "unintended effects." This broadens the realm of risk assessment.[200] Further, the guideline includes a framework

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[194] Peter-Tobias Stoll, "Controlling the Risk of Genetically Modified Organisms: The Cartagena Protocol on Biosafety and the SPS Agreement" in Jutta Brunnée & Ellen Hey, eds., Yearbook of International Environmental Law vol. 10 (Oxford: Oxford University Press, 1999) 82 at 107.

[195] *SPS agreement*, *supra* note 23, Annex A, Section 3(a).

[196] *Ibid.*, Section 3(b).

[197] *Ibid.*, Section 3(c).

[198] *Ibid.*, Section 3(d).

[199] Codex Alimentarius Commission, Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants, CAC/GL 44, 45 & 46, (2003) Codex Commission Homepage, online: <http://www.codexalimentarius.net/web/standard_list.do> (date accessed: 23 March 2006).

[200] Alexender B. Haselberger, Commentary, "Codex Guidelines for GM Food Include the Analysis of Unintended Effects" (2003) 21:7 Nature Biotechnology 739 online: <http://alexander-haslberger.at/pdf/CODEX,%20NB.pdf> (date accessed: 28 March 06).

for food safety assessment including definitions for: an r-DNA plant; a donor organism; genetic modification; and the characterization of genetic modification.[201] A pre-market assessment would assess: possible toxicity (of non-nucleic acid substances); possible allergenicity; a compositional analysis of key components; potential accumulation of substances significant to human health followed by a post-market assessment.[202]

The Precautionary Approach:

The precautionary principle appears, obliquely, in the SPS agreement:

> In cases where relevant scientific evidence is insufficient, a Member may provisionally adopt sanitary or phytosanitary measures on the basis of available pertinent information, including that from the relevant international organizations as well as from sanitary or phytosanitary measures applied by other Members. In such circumstances, Members shall seek to obtain the additional information necessary for a more objective assessment of risk and review the sanitary or phytosanitary measure accordingly within a reasonable period of time.[203]

The available WTO jurisprudence on this section is limited. While interpreting the precautionary language used under Article 5.7 in the *Beef Hormones* case, the appellate body stated that the precautionary principle "has not been written into the *SPS Agreement* as a ground for justifying SPS measures that are otherwise inconsistent

[201] *Codex Guidelines, supra* note 199.

[202] *Ibid.*

[203] *SPS agreement, supra* note 23, Art. 5.7.

with the obligations of Members set out in particular provisions of that Agreement."[204]

The appellate body further stated that:

> We agree, at the same time, with the European Communities, that there is no need to assume that Article 5.7 exhausts the relevance of a precautionary principle. It is reflected also in the sixth paragraph of the preamble and in Article 3.3. These explicitly recognize the right of Members to establish their own appropriate level of sanitary protection, which level may be higher (i.e., more cautious) than that implied in existing international standards, guidelines and recommendations. Thirdly, a panel charged with determining, for instance, whether "sufficient scientific evidence" exists to warrant the maintenance by a Member of a particular SPS measure may, of course, and should, bear in mind that responsible, representative governments commonly act from perspectives of prudence and precaution where risks of irreversible, e.g. life-terminating, damage to human health are concerned. [205]

First, the Appellate body expressed uncertainty as to whether the precautionary principle has crystallized into international environmental law.[206] Second, it stated that outside the environmental law (i.e. health law), the status of the precautionary principle still awaits authoritative formulation.[207] Third, the precautionary principle is not written in the agreement as grounds for justifying a measure that otherwise violates the SPS.[208]

This limited recognition of the precautionary principle does not override the provisions of Article 5.1 and 5.2.[209] This exception to the requirement of conducting science-based

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[204] European Communities- Measures Concerning Meat and Meat Products (Complaint by Canada and U.S.) (1998) WTO Doc.WT/DS26/AB/R & WT/DS48/AB/R (Jan. 16, 1998) at para. 12 (Appellate Body Report), WTO, online: <http://www.wto.org/english/tratop_e/dispu_e/dispu_status_e.htm#1998> [hereinafter *Beef Hormones*].

[205] *Ibid.* at para. 124. Also see Steve Charnowitz, "The Supervision of Health and Biosafety Regulation by World Trade Rules" (1999-2000) 13 Tul. Envtl. L. J 271 at 289.

[206] *Beef Hormones, supra* note 204 at para. 123.

[207] *Ibid.*

[208] *Ibid.* at para. 124.

[209] *Ibid.* at para. 125.

risk assessment fails to address many crucial issues concerning the overall effectiveness of the SPS Agreement. How do we determine the sufficiency or lack of relevant scientific evidence? What would the criteria be for pertinent or available information? What time period would qualify as reasonable?[210] The test for determining if a risk assessment is sufficient to permit the imposition of a protective measure is whether there is a "rational relationship between the measure and the risk assessment."[211] Reference to "available pertinent information" indicates that the measure must be based on actual relevant information rather than on "general concerns."[212] In the Japan Measures case, the Appellate body stated that a member country may provisionally adopt a trade restrictive health measure if the measure is based on Article 5.7 of the SPS agreement (adopted on the basis of available pertinent information despite the lack of scientific evidence). The measure may not be maintained unless the member adopting it "seeks to obtain" additional information for an objective risk assessment; and reviews the measure within a reasonable time period. [213]

The Appellate body further elaborated on these comments: Firstly, the requirements are "cumulative" in nature which means if either one of the requirements is not met then the

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[210] G. York, "Global Foods, Local Tastes and Biotechnology: The New Architecture of International Agriculture Trade" (2001) Columbia Journal of European Law, online: Westlaw (JRL).

[211] WTO Appellate Body Report on EC Measures Concerning Meat and Meat Products (Hormones) WT/DS26/AB/R, WT/DS48/AB/R (Jan. 16, 1998), WL 1998 WTO 25520, para 193. Also see M. Victor, "Precaution or Protectionism? The Precautionary Principle, Genetically Modified Organisms, and Allowing Unfounded Fear to Undermine Free Trade" (2001) Transnational Lawyer 295 at 308.

[212] Peter-Tobias Stoll, "Controlling the Risk of Genetically Modified Organisms: The Cartagena Protocol on Biosafety and the SPS Agreement" in Jutta Brunnée & Ellen Hey, eds., Yearbook of International Environmental Law Vol. 10 (Oxford: Oxford University Press, 1999) 82 at 108.

[213] Report of the Appellate Body, Japan-Measures Affecting Agricultural Products WT/DS76/AB/R (February 22, 1999), p.89 online: WTO Homepage <http://www.wto.org/english/tratop_e/dispu_e/distab-e.htm> [hereinafter *Japan Measures*], Also see Olivette Rivera-Torres, The Biosafety Protocol and The WTO, B. C. Int'l & Comp. L. Rev. 26 (2003) 263 at 301.

measure is inconsistent with Article 5.7.[214] Secondly, the reference to the wording "shall seek to obtain" denotes an obligation to actively pursue information that would result in an objective risk assessment.[215] And thirdly, with respect to reasonable period of time, the appellate body stated that it should be "established on a case-by-case basis and depends on the specific circumstances of each case, including the difficulty of obtaining the additional information necessary for the review *and* the characteristics of the provisional SPS measure."[216] These kinds of assessments may work in the cases where the extent of potential harm would be limited or where the harm would be clearly reversible. However, with GMOs, it may not be possible to reverse broad harm to biodiversity once a product is out of the laboratories. In 2003, the United States requested the establishment of a panel to look into the measures adopted by the European Union, alleging unnecessary delay in the Approval and Marketing of Biotech products (EC Biotech Products).[217] The decision is pending whether this dispute will be a deciding factor in the future course of action regarding trade in GMOs. The stakes in this case, which will certainly be appealed, are very high. If the panel decides against EC, and the Appellate Body upholds, then the EC would have to change its approval policy for Biotech products – a policy that is, at present, very restrictive. The EC would

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[214] *Japan Measures, ibid.* at para. 89.

[215] *Ibid.* at para. 92.

[216] *Ibid* at para.93.

[217] World Trade Organization, Request for the Establishment of a Panel by the United States, *European Communities- Measure Affecting the Approval of Biotech Products*, WT/DS291/17 (Aug 8, 2003). Similar request for panel was made by Canada and Argentina in WT/DS/292/17 and WT/DS/293/17 online <http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds291_e.htm> (last accessed 24 March 06) [hereinafter EC *Biotech Products*]; For a detailed discussion on this see Steven Suppan, Backgrounder on WTO Dispute: U.S. V EC Biotech Products Case (Minnesota: Institute for Agriculture & Trade Policy, September 2005) online : <http://www.wto.org/english/forums_e/ngo_e/posp50_iatp_e.pdf> (date accessed: 24 March 06) [hereinafter "Biotech Dispute Backgrounder"].

also have to pay fines for the period of non-compliance.[218] The ruling is likely to be treated as a precedent and would affect developing countries that have yet to establish a regulatory framework for GMOs.[219] A ruling is expected in October 2006.

Other provisions of the SPS agreement outline the members' corollary obligations. Members are required to observe a certain level of transparency by informing other countries regarding any change in their sanitary and phytosanitary measures.[220] Even though the rules outlined in SPS agreement are based on "sound" science and are meant to regulate the safety measures that protect human, plant and animal health, a new international legal instrument specifically dealing with Biosafety issues has come to the fore.

4.2 The Cartagena Protocol

The need for a protocol dealing with trade, safe handling, and the use of GMOs arose from diverse environmental, social and economic concerns of farmers, consumers, governments, and Non Governmental Organizations (NGOs).[221] The Cartagena Protocol emanates from the United Nations Convention on Biological Diversity (1992). Article 19.3 of the Convention states:

> The Parties shall consider the need for and modalities of a protocol setting out appropriate procedures, including, in particular, advance informed

[218] See generally *Biotech Dispute Backgrounder*, *ibid.*

[219] *Ibid*.

[220] *SPS agreement*, *supra* note 23, Art. 7, read with Annex B.

[221] *CBD*, *supra* note 21, Article 19.

> agreement, in the field of the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity.[222]

In November 1995, the delegates to the Convention created an open-ended Ad Hoc working group on Biosafety (BSWG).[223] Between 1996 and 1999, experts met on six different occasions to prepare a text for negotiation by the parties. After six meetings, however, countries failed to reach consensus on a Protocol.[224] Differences included the scope of the Protocol, its relation to other international instruments (particularly the WTO agreements), and, especially, the role of the precautionary principle.

These differences were partly reflected in five negotiating groups that addressed a variety of overlapping issues.[225] The Like Minded Group (the "LMG") consisted of many developing countries (known as the Group of 77 and China) with the exception of Argentina, Chile, and Uruguay.[226] This large group shared a common scepticism over the development of GMOs and advocated for a strong Biosafety Protocol based on the inclusion of a strict precautionary approach. The "Miami Group" consisted of six countries including the United States,[227] Canada, Australia, Argentina, Uruguay, and

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[222] *Ibid.* Article 19(3).

[223] See IISD Report of the Sixth Session of the open-ended adhoc working group on Biosafety and the First Extraordinary Session of the CBD Conference of the Parties: 14-23 February 1999, Earth Negotiations Bulletin vol. 9, No 117 (26 February 1999), online: IISD <http://www.iisd.ca/vol09/enb09117e.html> [hereinafter *IISD Report of the Sixth Session*].

[224] *Ibid.*

[225] *Ibid.*

[226] *Ibid.*

[227] The United States is not a party to the CBD and cannot be a party to the Protocol. It officially participated in the negotiations as an observer only. *CBD*, *supra* note 21, Art. 32 (1).

Chile.[228] This group represented the major players of the biotechnology trade who were in favour of a less trade restrictive Protocol that was subject to other international legal instruments (especially the WTO). A major difference between the two groups arose over the insertion of a *savings clause* that would ensure the Protocol was parallel to the existing SPS agreement and the Technical Barriers to Trade (TBT).[229] The Miami group argued that the issue of GMOs is already covered under the SPS agreement and TBT agreement, and introducing it again in a Multilateral Environmental Agreement (MEA)[230] would be a duplication of work. Moreover, they argued that the precautionary approach adopted under the Protocol would also encourage disguised trade restrictions against the spirit of the WTO agreements. The Miami group further argued that any possible restrictions should be based on "sound science and a rigorous risk assessment" rather than a precautionary approach.[231] The LMG proponents countered that the "argument of sound science was used as an excuse to limit the use of an established principle of international environmental law."[232] The third major group was the European Union (EU). Growing consumer concerns about biotechnology resulted from a number of incidents such as those associated with Bovine Spongiform Encephalopathy (BSE or Mad Cow disease) in Britain. These incidents were also responsible for

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[228] *IISD report of the Sixth Session.*

[229] Agreement on Technical Barriers to Trade, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organzation, Annex 1 A, Legal Instrument—Results of the Uruguay Round vol. 1 (1994), 18 I.L.M. 1079 (1979) [hereinafter *TBT agreement*].

[230] Multilateral Environmental Agreement are the agreements between countries with an over riding concerns for protecting the environment, such as the CBD. Often, there have been debates about the relationship between MEAs and the WTO.

[231] Aaron Cosby & Stass Burgeil, "International Institute of Sustainable Development, The Cartagena Protocol on Biosafety: An Analysis of Results: An IISD Briefing note" (2000) online: <http://www.iisd.org/pdf/biosafety.pdf> (date accessed: 15 March 2006) [hereinafter Cosby & Burgeil].

[232] *Ibid.*

invigorating debates on the limits of science, and "this block was in favour of the inclusion of the precautionary principle into the Advanced Information Agreement (hereinafter AIA) procedures."[233]

The other two groups were smaller, and were willing to adopt any approach that would lead to successful implementation of the Protocol. One group included Norway, Japan and Switzerland, and was dubbed the "Compromise Group." The second group was comprised of central and eastern European Countries, and tended to take their lead from the European Union's stance.[234]

Non Governmental Organizations (NGOs) performed a significant role by "ensuring that the governments are conscious of and feel responsible for, the full consequences of the MEA that affect the world's population and the future health of the planet."[235] From the beginning of the negotiations, these representatives of the public pressured the governments to seriously consider the necessity to develop an international legal agreement on biosafety under the convention, and maintained a visible campaign to keep that pressure on.[236]

The compromise that was reached in Montreal, Canada after five years of negotiations and a deadlock of 11 months reflected an accommodation between all these interests, but it was also probably the most significant application of the precautionary principle in

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[233] *IISD report of the Sixth Session.*

[234] Peter-Tobias Stoll, "Controlling the Risk of Genetically Modified Organisms: The Cartagena Protocol on Biosafety and the SPS Agreement" in Jutta Brunnée & Ellen Hey, eds., *Yearbook of International Environmental Law* vol. 10 (Oxford: Oxford University Press, 1999) 82 at 87.

[235] Louise Gale, "Greenpeace International" in Christoph Bail et al, eds., *The Cartagena Protocol on Biosafety: Reconciling Trade in Biotechnology with Environment & Development?* (London: Earthscan Publications, 2002) 251 at 251.

[236] *Ibid* at 252.

any international legal agreement yet concluded. The Protocol came into force on 11 September 2003. It has 132 members as of 23 March 2006.[237]

As stated above, the need for a protocol came out of the CBD's mandate to address the risks associated with biotechnology especially to biodiversity. Its key element is the AIA with its prior notification and consent procedure for the export and import of Living Modified Organisms (LMOs). The overall objective of the protocol is set out in its first article:

> In accordance with the precautionary approach contained in Principle 15 of the Rio Declaration on Environment and Development, the objective of this Protocol is to contribute to ensuring an adequate level of protection in the field of the safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health.[238]

The Protocol is specifically focussed on risks associated with recombinant DNA technology and does not include organisms produced by traditional breeding methods.[239] It also excludes pharmaceuticals, covered by other international agreements (such as those of the World Health Organization).[240]

Due to the ever-increasing varieties of GM crops and products "thereof", it became crucial to identify the scope of the Protocol. The LMG demanded a strong notification procedure that would give extensive rights to the importing country to reject the LMOs and the products derived from them. The Miami group argued that such a broad

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[237] Signatories to Cartagena Biosafety Protocol to the Convention on Biological Diversity, online: <http://www.biodiv.org/biosafety/default.asp> (date accessed: 23 March 2006).

[238] *The Protocol*, *supra* note 20, Art. 1.

[239] *Ibid.* Art 3 (g).

[240] *Ibid.* Art 5.

inclusion would adversely affect international trade in agriculture. The Protocol tries to strike a balance between different interests and divide LMOs into three groups for the sake of regulation. Firstly, the transboundary movement[241] of LMOs, to be intentionally released into the environment, are subjected to an Advanced Information Agreement procedure. Secondly, commodities derived from LMOs are not subjected to an AIA procedure. And thirdly, the Protocol allows for a subsequent exclusion of an LMO, by each party of import,[242] and if the governing body of the Protocol identifies an LMO of having no adverse effects.[243]

The AIA procedure forms the core of the Protocol and is based on Prior Informed Consent (PIC) that regulates the trade in hazardous materials.[244] According to the AIA procedure an exporter has to seek the consent of the party of import "prior to the first intentional transboundary movement of LMOs."[245] The party of export, or exporter, sends a notification to the importing party with specific information as laid down in Annex I, including procedures relating to risk assessment.[246] Any transfer of LMOs (such as new varieties of cotton seeds or fish) will fall under the purview of AIA procedures. The importing party shall acknowledge receipt of notification within 90

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[241] *Ibid.* Art. 3 (c) & (e). Export and Import means intentional transboundary movement from one party to another party and movement into one party from another party respectively.

[242] Art 13(1)(b).

[243] Art 7(4).

[244] Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides, done at Rotterdam, entry into force 24 February 2004, 38 I.L.M 1 [hereinafter *Rotterdam Convention*]; Basel Convention on the Control of Transboundary Movements of Hazardous wastes and their Disposal, entry into force 5 May 1998, 28 I.L.M 657 [hereinafter *Basel Convention*].

[245] *The Protocol*, *supra* note 20, Art. 7(1).

[246] *Ibid.* Art. 8, read with Annex I.

days of receiving it[247] and shall take a decision on the notification within 270 days.[248] The decision may be to approve the import, prohibit it, or request for additional relevant information.[249] Most significant is that the AIA procedures do not apply to an intentional transfer of LMOs intended for "direct use as food, feed or for processing" (FFP-LMOs),[250] such as packaged food, feed intended for cattle or genetically modified seeds used for oil extraction. Also, the provisions of AIA procedures are not applicable to LMOs that are in transit or are subjected to contained use.[251]

Procedure for (Food Feed or for Processing) FFP-LMOs

For FFP-LMOs, which make up 90 percent of trade in GM products, a specific procedure has been developed.[252] The protocol requires the parties to set up Biosafety Clearing House to inform other parties as to the final decision regarding "domestic use of FFP-LMOs with in 15 days of making a decision."[253] The Biosafety Clearing-House will operate as part of the Clearing-House mechanism that has already been established under Article 18 of the CBD.[254] They would serve as an important resource, providing parties with the information they need to make decisions about whether or not to import

[247] *Ibid.* Art. 9.

[248] *Ibid.* Art. 10.

[249] *Ibid.* Art. 10.

[250] *Ibid*. Art. 7(2).

[251] *Ibid.* Art. 6(1) & (2).

[252] Ruth McKenzie & Barbara Eckers, "The Cartagena Protocol on Biosafety" (2000) 3 J. Int'l Econ. L. 525 at 530.

[253] *The Protocol*, *supra* note 20, Art. 11(1).

[254] *Ibid*. Art. 20.

LMOs. The logic behind setting up Clearing-House is to make informed choices with respect to LMOs. The parties may also decide to prohibit the import of FFP-LMOs under its "domestic framework" provided that "decision is consistent with the objective of the Protocol."[255] Field trials involving FFP-LMOs are exempted from this procedure[256] which again shows an element of compromise in the Protocol, and reiterates that the Protocol does not restrict the spread of new technology, if it is proven safe. A special clause exists for developing countries or economies in transition that lack a domestic framework to make decisions according to relevant risk assessment procedures and within the time limit of 270 days.[257] However, any decision made under the AIA or the Biosafety Clearing house mechanism shall be made in accordance to the risk assessment procedures mandated under the Protocol.

Risk assessment:

Under several Articles (10 (1), 11(6)(a), and 15(2)), members must undertake a risk assessment prior to taking a decision on an import of LMOs. The risk assessment should be carried out in a "scientifically sound manner" and "taking into account recognized risk assessment techniques"[258] The guiding principles for a risk assessment, required by various provisions of the Protocol, along with its methodology are set out in Annex III

[255] *Ibid.* Art. 11(4).

[256] *Ibid*. Art. 11(1).

[257] *Ibid.* Art. 11(6).

[258] *Ibid.* Art 10(1) & Art. 15 read with Annex III.

of the Protocol.[259] The objective of risk assessment is to "identify" and assess the impact of LMOs on the "likely potential receiving environment, taking also into account risks to human health."[260] Section 8 deals with the methodology of carrying out a risk assessment, and offers recommendations for fulfilling its objective:

> (a) An identification of any novel genotypic and phenotypic characteristics associated with the [LMOs] that may have adverse effects on biological diversity in the likely potential receiving environment…;
> (b) An evaluation of the likelihood of these adverse effects being realized… [in] likely potential receiving environment…;
> (c) An evaluation of the consequences should these adverse effects be realized…;
> (d) An estimation of the overall risk posed by the living modified organism…;
> (e) A recommendation as to whether or not the risks are acceptable or manageable, including, where necessary, identification of strategies to manage these risks…;
> (f) Where there is uncertainty regarding the level of risk, It may be addressed by requesting further information on the specific issues of concern.[261]

The signal characteristic of the risk assessment under the protocol is its continuous reference to the words "likely potential receiving environment" showing significant concern toward the environment of the importing party. For example, an LMO may remain harmless in a cold climate, but may have unforeseen adverse effects in a tropical atmosphere. Another major success of the Protocol are the provisions of Article 15 (2) and (3) which require the exporter to carry out the risk assessment, and the party of

[259] *Ibid*., Art 10, 11, 15 read with Annex III.

[260] *Ibid.,* Annex III Section 1.

[261] *Ibid.,* Annex III Section 8 (a)-(f).

import may require "the cost of risk assessment shall be borne by the notifier."[262] This entails that, if a developing country lacks the infrastructure to undertake risk assessment, then it may ask the exporter to bear the costs for a risk assessment.

The most critical issue is the application of the precautionary approach under the Protocol. The precautionary approach is not only mentioned in the preamble and in the objective of the Protocol, it is also fine tuned into the key decision-making provisions, such as general decision procedures. In its operative provisions for AIA procedures and FFP-LMOs, the Protocol allows parties to adopt precautionary measures:

> Lack of scientific certainty due to insufficient relevant scientific information and knowledge regarding the extent of the potential adverse effects of a living modified organism […] shall not prevent that Party from taking a decision, as appropriate, with regard to the import of the living modified organism […] in order to avoid or minimize such potential adverse effects.[263]

This expression of the precautionary approach appears stronger than the version laid down in the Rio declaration, which has been criticised for its threshold requirements of "threats of serious irreversible damage" and "cost-effective measures."[264] Annex III section 8 (f) of the risk assessment, required under Article 10, 11 and 15, also provides for the precautionary approach:

> Where there is uncertainty regarding the level of risk, it may be addressed by requesting further information on the specific issues of concern or by implementing appropriate risk management strategies and/or monitoring the living modified organisms in the receiving environment.[265]

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[262] *Ibid.* Art 15 (2) & (3).

[263] *Ibid*. Art 10 (6) & 11(8).

[264] Ruth McKenzie & Barbara Eckers, "The Cartagena Protocol on Biosafety" (2000) 3 J. Int'l Econ. L. 525 at 532.

[265] *The Protocol*, *supra* note 20, Annex III section 8 (f).

The inclusion of the precautionary principle in the core provisions of the Protocol is an "important and genuine achievement."[266] The strong application of the precautionary approach under the Protocol empowers an importing party to say "no" to a transfer in cases where there is lack of scientific certainty.

Another significant achievement of the Protocol is in the labelling of LMOs. It sets out the documentation requirements for handling, packaging, transport and identification for the transboundary movement of LMOs,[267] and the requirements for intentional transboundary movement of LMOs. The documentation for FFP-LMOs shall clearly identify that, "they "may contain" living modified organisms and are not intended for intentional introduction into the environment, as well as a contact point for further information."[268] The Protocol's labelling requirements are only for shipping purposes, and do not address any domestic food labelling requirements for consumer information. However, these labelling requirements are in direct conflict with the measures of Technical Barriers to Trade agreement under the WTO.[269] The Protocol also refers to emergency provisions in the event of any unintentional transboundary movement of LMOs.[270] In such emergency situations, the Biosafety Clearing-House would serve as an

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[266] Peter-Tobias Stoll, "Controlling the Risk of Genetically Modified Organisms: The Cartagena Protocol on Biosafety and the SPS Agreement" in Jutta Brunnée & Ellen Hey, eds., *Yearbook of International Environmental Law* Vol. 10 (Oxford: Oxford University Press, 1999) 82 at 97.

[267] *The Protocol*, *supra* note 20, Art. 18. The Protocol also imposes documentation requirements on LMOs destined for contained use under Art 18(2)(b).

[268] *Ibid*. Art. 18(2)(a).

[269] Preamble of the TBT agreement states: *Desiring* however to ensure that technical regulations and standards, including packaging, marking and labelling requirements, and procedures for assessment of conformity with technical regulations and standards do not create unnecessary obstacles to international trade.

[270] *The Protocol*, *supra* note 20, Art. 17.

important resource to assist parties in adopting adequate counter measures (against further spread).

The issue of transboundary movement of LMOs, between parties and non-parties to the Protocol, should be "consistent with the objectives of the Protocol."[271] Article 26 mentions socio-economic considerations for decision-making, especially keeping in mind the effect of such decisions on local and indigenous communities.[272] The parties couldn't reach an agreement on the structure of a liability regime (liability arising out of transboundary movement of LMOs) and "included article 27 as an enabling provision for subsequent discussions."[273] Article 27 urges the parties to "adopt a process with respect to the appropriate elaboration of international rules and procedures in the field of liability and redress for damage resulting from transboundary movements of [LMOs]"[274] and the clause sets a four-year goal for the completion of this process.[275] Thus, the Protocol appears to be inclined toward protecting the environment over economic interests. Such stand is in stark contrast to the SPS agreement which is committed to minimizing any barriers to international trade. Even with all the limitations and compromises, the Protocol is the only international legal instrument that expresses strong precautionary language.

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[271] *Ibid*,. Art. 24.

[272] *Ibid.,* Art. 26; Discussed in the next section.

[273] See Elizabeth Duall, "A Liability and Redress regime for Genetically Modified Organisms under the Cartagena Protocol" (2004) 36 Geo. Wash. Int'l L. Rev. 173 at 188.

[274] *The Protocol*, *supra* note 20, Art 27.

[275] *Ibid.*

4.3 Comparative Analysis

Much has been written about the existence (or non-existence) of potential conflicts between the Protocol and the SPS agreement. Many have argued that there are conflicts between these agreements which can and should be harmonized.[276] Some have suggested that WTO's dispute settlement mechanism be adopted to resolve disputes regarding conflicts between the Protocol and SPS agreement;[277] while still others have claimed that there is no substantial conflict between these instruments.[278] The primary purpose of this analysis is not to assess the potential conflicts between the SPS agreement and the Protocol. Rather, I argue that these instruments take radically different stances on the role of science in governing GMO's. Therefore, I will focus my discussion upon the differences between the risk assessment provisions in the SPS agreement and the Protocol, and their differing interpretations of the precautionary approach, as these differences are particularly relevant to my main argument.

The most obvious distinction between the Protocol and the SPS Agreement concerns their subject matter: one is a trade agreement and the other one is an environmental agreement. The SPS agreement is committed to "least" trade restrictive measures

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[276] See Brett Grosko, "Genetic Engineering and International Law: Conflict or Harmony? An Analysis of the Biosafety Protocol, GATT, and The WTO Sanitary and Phytosanitary Agreement" (2001) 20 Va. Envtl.L.J 295.

[277] See Elizabeth Duall, "A Liability and Redress regime for Genetically Modified Organisms under the Cartagena Protocol" (2004) 36 Geo. Wash. Intl. L Rev.; Robert Howse & Joshua Meltzer, "The Significance of the Protocol for WTO Dispute Settlement" in Christoph Bail et al, eds., *The Cartagena Protocol on Biosafety: Reconciling Trade in Biotechnology with Environment & Development?* (London: Earthscan Publications, 2002) 482.

[278] For example, see Sabrina Safrin, "The Relationship With Other Agreement: Much Ado About Savings Clause" in Christoph Bail et al, eds., *The Cartagena Protocol on Biosafety: Reconciling Trade in Biotechnology with Environment & Development?* (London: Earthscan Publications, 2002) 438.

(negative effects on trade), whereas the Protocol is an addendum (in effect) to the Convention the purpose of which is to protect biodiversity. This difference moves the issue beyond a technical one of the application of SPS agreement or the Protocol to the deeper themes that have been explored in this paper concerning the nature of development, and how it might be pursued in the future.

A key issue of contention between the SPS agreement and the Protocol is the approach to scientific knowledge in these two instruments, which can be seen in their risk assessment provisions and their approach to the precautionary principle. Articles 2(2) and 5(1) of the SPS agreement state that the measures adopted by a state must be based on a risk assessment, unless they are in consonance with international standards. Article 5(2) further outlines the factors (relevant production and process methods, and available scientific evidence) that should be taken into consideration for a risk assessment.[279] The reliance of the SPS agreement on science and available scientific evidence shows its reliance upon an approach to development that must be able to predict *with certainty* the level of harm associated with particular activities.

The Protocol also relies on science to carrying out risk assessment; however, it also contains recognition of the science's limitations. Annex III of the Protocol states that the "risk assessment should be carried out in a scientifically sound manner".[280] Yet it further states that "lack of scientific knowledge or consensus should not necessarily be interpreted as indicating a particular level of risk, an absence of risk, or an acceptable

[279] *SPS agreement*, *supra* note 23, Art. 5(2).

[280] *The Protocol*, *supra* note 20, Annex III.

risk".[281] Such language reaffirms that the measures taken by governments, to protect public health and environment, are to be made on the basis of many considerations, including, but not limited to, science.[282] The approach adopted under Annex III again reiterates the "uncertainty" of biotechnology, and the science associated with its development. It makes it clear a lack of scientific consensus or the existence of conflicting scientific results (regarding the effects of GMOs) should not be the basis of a decision or indecision.[283]

The Protocol specifically contemplates situations where there is a lack of scientific consensus *and* situations where there is a lack of scientific knowledge or consensus. In contrast, WTO jurisprudence on the SPS agreement only mentions situations where there is a "lack of scientific consensus."[284] The WTO jurisprudence remains deeply entrenched in the historic quest for a "right" answer, and ignores the evidence that this may not exist. It is unwilling to acknowledge the possibility that scientific knowledge has limits, and that there are times when the conclusions it reaches should be treated with caution. This issue will become more important in the event of disputes between the members and non-members of the Protocol.

The risk assessment provisions under the SPS agreement focus on the protection of "human, animal or plant life or health", although this also consider the "associated

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[281] *Ibid.*

[282] Robert Howse & Joshua Meltzer, "The Significance of the Protocol for WTO Dispute Settlement" in Christoph Bail et al, eds., *The Cartagena Protocol on Biosafety: Reconciling Trade in Biotechnology with Environment & Development?* (London: Earthscan Publications, 2002) 482 at 486.

[283] *The Protocol*, *supra* note 20, Annex III.

[284] *Beef Hormones, supra* note 204 at para 194.

potential biological and economic consequences."[285] In keeping with its linkage to a major environmental convention, the main focus of the Protocol's risk assessment is on the "potential adverse effects of LMOs on the conservation of biological diversity."[286] As a result, the range of risks considered to be relevant to a legitimate decision will be significantly narrower under the SPS agreement. For example, where a state adopts a measure to protect against a threat of *genetic pollution* (including the possibility of an LMO becoming dominant over naturally occurring plant varieties) the state could be challenged under the SPS agreement, even though this measure would be acceptable under the Protocol. Consider the jurisprudence of the WTO regarding the SPS agreement. The appellate body in the Salmon case (Australia- Measures affecting the importation of Salmon) held that a risk assessment must evaluate the likelihood (i.e., the "probability") of entry, establishment or spread of diseases and associated biological, and economic consequences as well as the likelihood.[287] In Beef Hormones case the appellate body stated that the risk should be "ascertainable." The appellate body further explained, "[i]t is a substantive requirement that an SPS measure be based on a risk assessment" and there be a "rational relationship between the measure and the risk assessment."[288] The risk assessment under the SPS agreement must be based on the standards set one of three international organizations.

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[285] *SPS agreement*, *supra* note 23, Annex A.

[286] *The Protocol*, *supra* note 20, Annex III.

[287] WTO Appellate Body Report, Australia Measures Affecting Importation of Salmon, AB-1998-5, WT/DS18/AB/R (Oct. 20, 1998) at para 123 (Appellate Body Salmon Decision).

[288] WTO Appellate Body Report on EC Measures Concerning Meat and Meat Products (Hormones) WT/DS26/AB/R, WT/DS48/AB/R (Jan. 16, 1998), WL 1998 WTO 25520 at para 193.

In contrast, the Protocol refers to relevant international organizations in general, but refrains from privileging any specific organizations. Because the Protocol supports reliance on a wider range of expert advice and other relevant international organizations it has a higher degree of joint assessment procedures. Ellen Hey notes that such (joint) "assessment assists in institutionalizing caution…expert and peer consultations….[and] can generate the maximum amount of relevant information to serve as the basis for making decision."[289] It is very likely that the WTO dispute panel in the *Biotech Measures* will rely on the guidelines issued by the Codex commission which are based on strict scientific analysis. In that case, these guidelines will become a benchmark to which all countries will be required to adhere or face sanctions under WTO disputes. While commenting on the effect of the association between the Codex commission and the SPS agreement, Aaron Cosby notes:

> The WTO language in effect made Codex standards more like ceiling, beyond which onerous requirements are in effect. Such standards cannot be called fully voluntary, nor are they fully mandatory, falling into an area between which it looks voluntarism under duress. The instant effect of it is the transformation of standard setting in Codex in a highly charged political exercise; all countries knew that the standards they were debating might subsequently be the subject of WTO dispute settlement, and act accordingly.[290]

Codex commission's way of working reflects Enlightenment ideology because it relies on normal science to come up with all the answers. Moreover, it is a reflection of the structures of power that, for centuries, have privileged one model of development over all others, and over any other institutions that would act differently.

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[289] Ellen Hey, "The Precautionary Concept in Environmental Policy and Law: Institutionalizing Caution" 4 Geo. Int'l Envtl. L. Rev. (1991-1992) 303 at 315.

[290] Aaron Cosby, "The Codex Alimentarius Commission, Scientific Uncertainty and the Precautionary Principle" (Winnipeg: IISD, 2000) at 8, online: <http://www.iisd.org> (date accessed: 2 April 2006).

The complex issue of burden of proof is a significant area of contention between the SPS agreement and the Protocol. The WTO adopts the general principle of law, according to which the burden of proof is on the plaintiff (the government that complains) to "establish a *prima facie* presumption that different measures arbitrarily or unjustifiably discriminate."[291] After that onus is discharged, the burden of proof shifts and the defendant government that is applying the measures has the responsibility to bring forward the evidence that justifies its actions not being a violation of a WTO rule.[292] In contrast, the Protocol requires the exporter to show that the LMOs are safe for the environment. The importing party then makes the decision to import LMOs or not. This is a significant shift in the burden of proof, and the country taking measures is not required to qualify its measures.

Another difference between the SPS agreement and the Protocol lies in the factors that may be taken into account in decision-making. Under the Protocol, a member state may make a decision on the basis of the socio-economic considerations arising from a decision to import LMOs (for example, a member state may take into consideration potential impacts upon indigenous and local communities if consistent with members other international obligations).[293] Some have suggested that this article is weak particularly because of the inclusion of consistency clause with international obligations. However, it still empowers a member state to make decision to protect its local

[291] WTO Panel Report, Australia Measures Affecting Importation of Salmon- Recourse to Article 21.5 by Canada, WT/DS18/RW (Appellate Body Report) at para 4.348.

[292] *Ibid.* at para 7.37.

[293] *The Protocol, supra* note 20, Art 26.

communities.[294] The contents of the socio-economic consideration are even more relevant for developing countries that are more likely to rely on agriculture so that any effect on their biodiversity may have more severe consequences for them than for developed countries.[295] In India, there are many indigenous communities that are dependent on subsistence agriculture and on preserving their biodiversity. The Indian government cannot make a decision against the importation of LMOs under the current SPS regime by citing considerations to local and indigenous communities. However, the Protocol would support India in making a decision not to import on this basis, so long as it can be justified according to the broader, and more open, criteria of the Protocol.

As mentioned above, the precautionary language appears in the SPS agreement in Article 5.7. The provision further clarifies that the members "may apply provisional measures on the basis of available information" to restrict trade in some products.[296] Under the Protocol, a member state may make a decision to restrict permanently the import of LMOs in its territory. This is the crucial thrust of the Protocol: it allows a state to make a decision based on its own development needs taking into consideration its duty to protect its cultures and the environment rather than be forced to address trade considerations alone. The SPS agreement applies scientific analysis to determine

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[294] Tewolde Berhan Gebre Egziabher, "Balancing Biosafety, Trade and Economic Development Interests in the Cartagena Protocol" in CBD News Special Edition: Cartagena Protocol on Biosafety: From Negotiation to Implementation, Historical and New Perspectives as the World Marks the Entry-into-Force of the Protocol at 33.

[295] Robert Howse & Joshua Meltzer, "The Significance of the Protocol for WTO Dispute Settlement" in Christoph Bail et al, eds., *The Cartagena Protocol on Biosafety: Reconciling Trade in Biotechnology with Environment & Development?* (London: The Royal Institute of International Affairs & Earthscan, 2002) 482 at 491.

[296] *SPS agreement*, *supra* note 23, Art. 5.7.

uncertainty, which makes it more rigid than the Protocol in relation to the environment since, in some instances, normal science cannot even detect the uncertainty (as shown in the examples of Ozone depletion, DDT, and Beef Hormone). In contrast, the Protocol suggests that the party making a decision on the import of LMOs may review its decision upon the availability of new evidence, and may also require a new risk assessment for future imports.[297]

At the application level, the relationship between the SPS agreement and the Protocol may be deduced from the Protocol's preamble:

> *Recognizing* that trade and environment agreements should be mutually supportive with a view to achieving sustainable development;
>
> *Emphasizing* that this Protocol shall not be interpreted as implying a change in the rights and obligations of a Party under any existing international agreements;
>
> *Understanding* that the above recital is not intended to subordinate this Protocol to other international agreements.

This is known as the 'savings' clause. As noted, this clause was one of the contentious issues during the negotiation of the Protocol. While commenting on the issue of the savings clause, Cosby and Burgeil note:

> The Miami group got what it wanted. The text states that "this Protocol shall not be interpreted as implying a change in the rights and obligations of a party under any existing international agreement." The EU also got what it wanted. The next paragraph of the text states that, "the above recital is not intended to subordinate this Protocol to other international agreements." And the Like-minded Group got what is wanted: both statements appear in

[297] *The Protocol*, *supra* note 20, Art. 12.

> preamble, not in the main text. It is not clear where this compromise leaves the Protocol relative to the WTO.[298]

The conflict of the overlap between the Protocol and the SPS agreement may be resolved with the aid of the Vienna Convention on the Law of the Treaties.[299] In usual interpretation, Article 30 of the convention would apply, which recommends the "application of successive treaties relating to the same subject matter."[300] However, due to the preambular language of the Protocol, the two instruments are intended to be equal. In that case Article 31.3 of the convention states that, "there shall be taken into account together with the context: (a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions."[301] The interpretation according to this rule would mean that the precautionary measures stated under the Protocol must be taken into account for any SPS measures. Again, much of these contentions will depend on the outcome of the decision of the Biotech measure.

Conclusion

This paper began with a simple question: how did the green revolution, an endeavour that attempted to eliminate hunger in the third world, end up to be so fatal in its application? Rather than examining the Bhopal Disaster in detail, I have sought to

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[298] Cosby & Burgeil *supra* note at 231.

[299] U.N. Doc. A/Conf. 39/27 (1969), 8 I.L.M. 679 (1969). Done in Vienna on May 23, 1969, entered into force on January 27, 1980, online: United Nations Office at Geneva Homepage <http://untreaty.un.org/ilc/texts/instruments/english/conventions/1_1_1969.pdf > [hereinafter *Vienna Convention*].

[300] *Vienna Convention*, *ibid*. Art 30 (1).

[301] *Ibid*. Art 31 (3) (a).

understand the background conditions against which the disaster occurred. This approach, while it may not be capable of providing a definitive explanation of why the disaster occurred, has allowed me to examine the larger forces that were at play in Bhopal, and which persist in the world today. In particular, I have focused upon the idea of development, which has shaped our world and its, laws and which continues to wield considerable influence.

In Section Two, I explored the idea of development during the Age of Reason and the Enlightenment. The ideas developed during the Enlightenment created a general attitude of "victory through science". The project of science, developed during the Enlightenment, became a tool to dismantle nature. Characteristics of the Enlightenment emerged historically in the transformation of the economy which shifted from feudalism to mercantilism and finally to capitalism. With mercantilism, the ideas of the emerging Western world travelled across the oceans and became embedded in foreign cultures through colonization. The process of colonization, however, fuelled a particular kind of "development" that disproportionately benefited one part of the world (First World) at the cost of another part of the world (Third World). The dissemination of these (development) ideas in the third world is, as I have shown, attributable to the imbalance in power relations caused by colonization and decolonization. History shows that the idea of development has failed to achieve the desired results. The ideas, and science that we inherited during the Enlightenment period are inadequate for the future.

There have been many instances where economic objectives trumped environmental concerns, as in the case of Bhopal. The scientific principles established during the Enlightenment period, which are only progress-driven, hoped to create an ideal society.

There are some inherent problems with that idea, replicated within the Enlightenment approach to science, as I have shown through the Green Revolution. The most disturbing attribute of this type of science is its tendency to externalise the costs of development/experiments on to the environment. Such a tendency may well be connected to the colonization where the development of the mother country came at the cost of distant remote colonies. The resulting paradigm of these trends set the background conditions in Bhopal, and also manifested within today's Gene revolution. The science is still focussed on "perfection" through man's rational mastery over nature as discussed through the gene revolution. That paradigm is not only influential in the gene revolution but is also reproduced within the international regulatory regime under the SPS agreement.

The precautionary principle challenges the existing paradigm by recognising scientific uncertainty (i.e. the limits of existing science). Such recognition, in effect, creates a new paradigm that establishes a balanced (and more holistic) approach that attends to local communities, and empowers decision-makers acting on their behalf.

The SPS agreement represents an Enlightenment paradigm, while the Cartagena Protocol is part of a new precautionary approach. The Protocol is an instrument of compromise, as evident from the negotiations; however, it still incorporates many key elements of the new paradigm (risk reduction, the precautionary approach and enhanced participation). Right from the start of the negotiations there was extensive NGO participation, enhancing the representation of the (would be) affected communities. The SPS agreement (under the WTO) is still committed to the elusive concept of development which does not fully take into account of the local conditions of the

environment, and which seeks to establish homogeneity in a naturally diverse world. The precautionary principle, and the Cartagena Protocol, represents a real alternative for international trade regulation as it concerns bio-safety, particularly as it relates to the relationship between science and uncertainty. The most powerful aspect of the precautionary principle is its ability to recognise our limits. Such recognition of boundaries need not be weakening, neither it is derogatory; rather it is an acknowledgment. That acknowledgment means an "appreciation for the naturally and socially constructed boundaries of our knowledge, and for our situation in, and our influence on, scientific research."[302]

I believe that it precisely the move away from holistic approaches towards the environment (which occurred as a result of the Enlightenment and Colonialism) that is responsible for our present day environmental problems such as the Bhopal Gas Disaster. Again, we are taking the same path, and pursuing the gene revolution by exploiting nature and by making regulations that would legitimize such exploitation. I have tried to show how the approach connected with precautionary science is better equipped to handle the uncertainty in an emerging technology (such as the gene revolution), and different from the approach coming from the Enlightenment ideas. The "laboratory science" needs to give way to the "precautionary science." We can no longer rely on the scientific assumptions that were used to justify the manipulation of nature during and after the Enlightenment. The precautionary approach is not a magic bullet with all answers to undo all the problems of today's world. It is a critical and indispensable way of thinking, which can change the way we are pursuing our economic

[302] *Protecting Public Health*, *supra* note 145 at 119.

objectives. The precautionary principle better equips us to deal with the complexity of issues with regard to scientific uncertainty, as it aptly takes a holistic approach rather than embracing routine science.

Bibliography

LEGISLATION

The Bhopal Gas Leak Disaster (Processing of Claims) Act (India), 1985, No. 21.

International Law

Cartagena Biosafety Protocol to the Convention on Biological Diversity, 29 January 2000, 39 I.L.M. 1027 (entered into force 11 September 2003).

UN Conference on Environment and Development: Convention on Biological Diversity, 5 June 1992, 31 I.L.M. 818 (entered into force Dec. 29, 1993).

General Agreement on Tariffs and Trade, 30 October 1947, 58 UNTS 188 (entered into force 1 January 1948), as a result of the Uruguay Round of trade negotiations, this was amended as 'GATT 1994'establishing the World Trade Organization.

The Agreement on the application of Sanitary and Phytosanitary Measures, WTO Agreement, Annex 1A, The Legal Texts at 59.

Agreement on Technical Barriers to Trade, Annex 1 A, Legal Instrument—Results of the Uruguay Round vol. 1 (1994), 18 I.L.M. 1079 (1979).

Vienna Convention on the Law of Treaties, U.N. Doc. A/Conf. 39/27 (1969), 8 I.L.M. 679 (1969). Done in Vienna on May 23, 1969, entered into force on January 27, 1980.

JURISPRUDENCE

United States

Dow Chemical Co. v. *Castro Alfaro*, 786 S.W. 2d 674, 681 (Texas 1990)

Sajida Bano, et al., Plaintiff, v. *Union Carbide Corp*. and *Warren Anderson*, No. 99 Civ.11329 (JFK). [2005] WL 2464589 (S.D.N.Y.)

India

Union Carbide Corp. v. *Union of India*, [1990] A.I.R. 273 (S.C.).

WTO

EC Measures Concerning Meat and Meat Products (Hormones) WT/DS26/AB/R, WT/DS48/AB/R, WL 1998 WTO 25520 (Appellate Body) (Jan. 16, 1998).

Japan-Measures Affecting Agricultural Products, WT/DS76/AB/R (Appellate Body) (February 22, 1999).

Australia Measures Affecting Importation of Salmon, AB-1998-5, WT/DS18/AB/R (Appellate Body) (Oct. 20, 1998)

SECONDARY MATERIALS: MONOGRAPHS

Alavi, H., et al, *Capitalism and Colonial Production* (London: Croom Helm, 1982).

Bakshi, P.M., selective comments, *The Constitution of India with Comments & Subject Index* (New Delhi: Universal Law Publishing, 1996).

Bello, W., *Brave New Third World: Strategies For Survival in the Global Economy* (London: Earthscan Publications, 1990)

Blaustein, A.P. & Flanz, G.H. eds., Constitutions of the Countries of the World (New York: Oceania Publications, 1974)

Cassels, J., *The Uncertain Promise of Law: Lessons from BHOPAL* (Toronto: University of Toronto Press, 1993)

Cassier, E., The Philosophy of the Enlightenment, Translated by Fritz C.A Koelln & James P Pettegrove (Boston: Beacon Press, 155)

Daintith, J., ed., *Oxford Dictionary of Chemistry*, 3d. (Oxford: Oxford University Press, 1995).

Hampshire, S., *The Age of Reason: The Seventeenth Century Philosophers* (Cambridge: Riverside Press, 1956).

Harremoës, P. et al eds., *The Precautionary Principle in the 20th Century: Late Lessons From Early Warnings* (London: European Environment Agency and Earthscan Publications, 2002).

Heilbroner, R. L., *Between Capitalism and Socialism*, (New York: Random House, 1970).

Heilbroner, R., & Milberg, W., *The Making of Economic Society*, 10th ed., (New Jersey: Prentice Hall, 1998).

Heinberg R., *Cloning the Buddha: The moral impact of biotechnology* (USA: The Theosophical Publishing House, 1999).

Holton, R.J., *The Transition from Feudalism to Capitalism* (Houndmills: Macmillan Press Ltd, 1985).

Honderich, T., ed., *The Oxford Companion to Philosophy*, (New York: Oxford University press, 1995).

Horkheimer, M., & Adorno, T. W., *Dialectic of Enlightenment*, Translated by John Cumming, (New York: Continuum, 1994).

Itoh, M., *The Basic Theory of Capitalism: The Forms and Substance of the Capitalist Economy* (Houndmills: Macmillan Press Ltd, 1988).

Kimbrell, A., ed., *Fatal Harvest: The Tragedy of Industrial Agriculture* (California: Foundation for Deep Ecology, 2002).

Koppe, J. G, & Keys, J., "PCBs and the Precautionary Principle" in Harremoës, P. et al eds., *The Precautionary Principle in the 20th Century: Late Lessons From Early Warnings* (London: European Environment Agency and Earthscan Publications, 2002).

Landes, D. S., *The Wealth and Poverty of Nations* (New York: WW Norton and Co, 1999)

Lapierre, D., & Moro, J., *Five Past Midnight In Bhopal*, Translated by Kathryn Spink, (London: Scribner, 2002).

Latouch, S., *In The Wake of The Affluent Society: An Exploration of Post-Development* (London: Zed Books, 1993)

Locke, J., *Second treatise of the Government* (Oxford: Oxford University Press, 1956)

Maddison, A., *Class structure and economic growth: India and Pakistan since the Moghuls* (London: George Allen & Unwin Ltd, 1971).

McGarvin, M., "Science, Precaution, Facts and Values" in Tim O' Riordan, James Cameron & Andrew Jordan eds., *Reinterpreting the Precautionary Principle* (Cameron May, 2001)

McGiffin, S. P., *Biotechnology: Corporate Power and Public Interest* (London: Pluto Press, 2005)

Mockyr, J., ed. in chief, *The Oxford Encyclopaedia of Economic History*, vol. 2, (Oxford: Oxford University Press, 2003)

Outram, D., *The Enlightenment*, (New York: Cambridge University Press, 1995).

Palmowski, J., ed., *A Dictionary of Twentieth Century World History*, (New York: Oxford University Press, 1997).

Pearse, A., *Seeds of Plenty, Seeds of Want, Social and Economic Implications of the Green Revolution* (Oxford: Oxford University Press, 1980).

Ponting, C., *A Green History of The World: The Environment and The Collapse of Great Civilizations* (New York: St. Martin's Press, 1991).

Raffensperger, C. & Tickner, J.eds., *Protecting Public Health & the Environment: Implementing the Precautionary Principle* (Washington D.C: Island press, 1999)

Ruggie, J. G., *Constructing the World Polity: Essays on International Institutionalization (*London: Routledge, 1998).

Salomon, J., & Sagasti, F. R., eds., *The Uncertain Quest: science, technology and development* (Tokyo: United Nations University, 1994).

Shiva, V., *The Violence of the Green Revolution: Third World Agriculture, Ecology and Politics* (London: Zed Books & Third World Network, 1991).

Shiva, V., *Stolen Harvest: The Global Hijacking of Global Food Supply* (Cambridge: South End Press, 2000).

Smith, A. K., *Creating a World Economy: Merchant Capital, Colonialism and World Trade, 1400-1825* (Boulder: Westview Press, 1991).

Stanislav, A. ed., *Max Weber On Capitalism, Bureaucracy and Religion* (London: George Allen & Unwin, 1983).

Tagliaferro, L., *Genetic Engineering: Progress or Peril* (USA: Lerner Publications Company, 1997).

Trebilcock, M. J., & Howse, R., *The Evolution of International Trade Theory, The Regulation of International Trade*, 2d. (London: Routledge, 2001).

Trouwborst, A., *Evolution and Status of Precautionary Principle in International Law*, (Hague: Kluwer Law International, 2001)

Weeramantry, C. G., ed., *The Impact of technology on Human Rights- Global Case Studies* (Tokyo: United Nations University press, 1993).

Worster, D., *Nature's Economy: A History of Ecological Ideas*, 2d. (New York: Cambridge University Press, 1994)

SECONDARY MATERIALS: ARTICLES

Adler, J. H, "More Sorry Than Safe: Assessing the Precautionary principle and the Proposed International Biosafety Protocol" (2000) Vol. 35, Texas International Law Journal

Boyd, W., "Wonderful potencies? Deep structure and the problem of monopoly in agricultural biotechnology," in *Engineering Trouble: Biotechnology and its Discontents*, R. A. Schurman & D. D. Takahashi Kelso eds. (California: University of California, 2003).

Cameron, J. & Aboucher, J., "The Precautionary Principle: A Fundamental Principle of Law and Policy for the Protection of the Global Environment" (1991) 14 B.C. Int'l & Comp. L. Rev. 1

Charnowitz, S., "The Supervision of Health and Biosafety Regulation by World Trade Rules" (1999-2000) 13 Tul. Envtl. L. J 271.

Clingingsmith, D., & Williamson J. G., "India's De-Industrialization Under British Rule: New Ideas, New Evidence" (June 2004) Discussion paper # 2039 Harvard University Cambridge, Massachusetts.

Coleman, W., "Providence, Capitalism, and Environmental Degradation: English Apologetics in an Era of Economic Revolution" (Jan. –Mar., 1976), Vol. 37, No. 1 Journal of the History of Ideas, 27.

Contreras, R., "How the Concept of Development Got Started" (1999) 9 Transnational Law & Contemporary Problems, 47.

Cosby, A., "The Codex Alimentarius Commission, Scientific Uncertainty and the Precautionary Principle" (Winnipeg, MB: IISD)

Cullather, N., "Miracles of Modernization: The Green Revolution and the Apotheosis of Technology" (April 2004), Vol. 28, Issue 2 Diplomatic History

Duall, E., "A Liability and Redress regime for Genetically Modified Organisms under the Cartagena Protocol" (2004) 36 George Washington International Law Review 188.

Earp, D. J, "Comment, The Regulation of Genetically Engineered Plants: Is Peter Rabbit Safe in Mr. McGregor's Transgenic Vegetable Patch?" (1994) 24 Envtl. Law 1650.

Gale, L., "Greenpeace International" in C. Bail et al eds., *The Cartagena Protocol on Biosafety: Reconciling Trade in Biotechnology with Environment & Development?* (London: Earthscan Publications, 2002) 251.

Gianessi, L. P. et al, “Plant Biotechnology: Current and Potential Impact for Improving Pest Management in US Agriculture-An Analysis of 40 Case Studies” (2002) Washington: National Centre for Food and agricultural Policy

Grosko, B., “Genetic Engineering and International Law: Conflict Or Harmony? An Analysis of the Biosafety Protocol, GATT, and the WTO Sanitary and Phytosanitary Agreement” (2001) 20 Va. Envtl. L.J. 295.

Grossman, M. R., “Biotechnology, Property Rights and the Environment” (2002) Vol. 50, The American Journal of Comparative Law, 215-248

Gupta, K. D., “Poverty amidst plenty” (Jan 2001), Vol. 54, Issue 1, UNESCO Courier

Haselberger, A. B., Commentary, “Codex Guidelines for GM Food Include the Analysis of Unintended Effects” vol. 21 no.7 (2003) Nature Biotechnology 739.

Hazell, P. B.R, “Green Revolution: Curse or Blessing?” (2002) International Food Policy Research Institute.

Hey, E., “The Precautionary Concept in environmental Policy and Law: Institutionalizing Caution” 4 Geo. Int’l L. Rev. 303 (1991-1992)

Howse, R., “From Politics to Technocracy – And Back Again: The Fate of the Multilateral Trading Regime: Symposium on the Boundaries of the WTO” (2002) Vol. 96 The American Journal of International Law

Howse, R. & Meltzer, J., “The Significance of the Protocol for WTO Dispute Settlement” in C. Bail et al eds., *The Cartagena Protocol on Biosafety: Reconciling Trade in Biotechnology with Environment & Development?* (London: Earthscan Publications, 2002) 482

Johri, D., & Miller, M., “Devaluation of the rupee: Tale of two years 1966 and 1991” (2002) Centre for civil society.

Jordan, A. & O’Riordan, T., “The Precautionary Principle in Contemporary environmental Policy and Politics” in C. Raffensperger & J. Tickner eds., *Protecting*

Public Health & the Environment: Implementing the Precautionary Principle (Washington D.C: Island press, 1999).

Kirschenmann. F., "Can We Say "Yes" To Agriculture Using The Precautionary Principle: A Farmer's Perspective" in C. Rafflsenperger & J. Tickner eds., *Protecting Public Health & the Environment: Implementing the Precautionary Principle* (Washington D.C: Island press, 1999)

Kunich, J. C., "Mother Frankenstein, Doctor Nature, And the Environmental Law of Genetic Engineering" (2000-2001) 74 Southern California Law Rev

Losey, E. J. et al, "Transgenic Pollen Harm Monarch Larvae" 399 (20th May 2000) Nature

McKenzie, R., & Eckers, B., "The Cartagena Protocol on Biosafety" (2000) 3 J. Int'l Econ. L. 525.

M'Gonigle, M. R., "Between Globalism and Territoriality: The emergence of an international constitution and the challenge of ecological legitimacy" (July 2002) Vol. XV, Number 2, The Canadian Journal of Law & Jurisprudence

M'Gonigle, M. R. et al, "Taking Uncertainty seriously: From Permissive Regulation to Preventative Design in Environmental Decision Making" (Spring 1994) Osgood Hall Law Journal, Vol. 32, No 1

Nustad, K. G., "The Development Discourse in the Multilateral System" in M. Bøås and D. McNeill eds., *Global Institutions and Development: Framing the World* (London: Routledge, 2004).

Paul, D.W, "An Historical Perspective from the Green Revolution to the Gene Revolution" (Jun 2003) Part 2 of 2, Vol. 61, Issue 6, Nutrition Reviews.

Ragner et al, "Precautionary Principles: General Definitions and Specific Applications to Genetically Modified Organisms" Journal of Policy Analysis and Management, Vol. 21, No.3, 381-407 (2002)

Safrin, S., "The Relationship With Other Agreement: Much Ado About Savings Clause" in C. Bail et al eds., *The Cartagena Protocol on Biosafety: Reconciling Trade in*

Biotechnology with Environment & Development? (London: Earthscan Publications, 2002) 438

Sagoff, M., "Biotechnology and Agriculture: The Common Critics and Wisdom" (2001-2002) 9 Indiana Journal of Global Legal studies

Shelton, A.M., Zhao, J. Z. & Roush, R.T., "Economic, ecological, food safety and social consequences of the deployment of BT transgenic plants" (2002) vol. 47, Annual Review of Entomology.

Stoll, P., "Controlling the Risk of Genetically Modified Organisms: The Cartagena Protocol on Biosafety and the SPS Agreement" in J. Brunnée & E. Hey eds., *Yearbook of International Environmental Law* Vol. 10 (Oxford: Oxford University Press, 1999) 82.

Swaminathan, R., "From Green Revolution to Gene Revolution" (2004), Issue 2, PBI Bulletin

York G., "Global Foods, Local Tastes and Biotechnology: The New Architecture of International Agriculture Trade" (Fall 2001) Columbia Journal of European Law

OTHER MATERIAL

Amnesty International, "Accountability of Union Carbide in Clouds of Injustice: Bhopal Disaster 20 Years On", (United Kingdom: Amnesty International, 2004).

Cosby, A. & Burgeil, S., "The Cartagena Protocol on Biosafety: An Analysis of Results: An IISD Briefing note" (2000)

International Institute of Sustainable Development, "Report of the Sixth Session of the open-ended adhoc working group on Biosafety and the First Extraordinary Session of the CBD Conference of the Parties" (14-23 February 1999), Earth Negotiations Bulletin vol. 9, No 117

The World Bank: Questions and Answers Booklet, (Washington: The World Bank Group, March 1976).

Clive James, International Service For the Acquisitions of Agri-Biotech Applications (ISAAA), Executive Summary: Global Status of Commercialized Transgenic Crops 2004.

Egziabher T. B. G., "Balancing Biosafety, Trade and Economic Development Interests in the Cartagena Protocol" CBD News Special Edition: Cartagena Protocol on Biosafety: From Negotiation to Implementation, Historical and New Perspectives as the World Marks the Entry-into-Force of the Protocol 32.

Scoones. I., "Science, Policy and Regulation: Challenges for Agricultural Biotechnology in Developing Countries" (Sussex: January 2002) ISD Working Paper 147

Suppan, S., "Backgrounder on WTO Dispute: U.S. V EC Biotech Products Case" (Minnesota: Institute for Agriculture & Trade Policy, September 2005)

Internet Sources

Biotechnology Industry Organization http://www.bio.org

Centre for Civil Society http://www.ccsindia.org

Codex Alimentarius Commission http://www.codexalimentarius.net

Health Canada http://www.hc-sc.gc.ca

Institute of Development Studies http://www.ids.ac.uk

International Institute of Sustainable Development (IISD) http://iisd.ca

National Centre for Food Agriculture and Policy http://www.ncfap.org

Noble Prize Organization http://nobelprize.org

Oxford Reference Online http://www.oxfordreference.com

Science & Environmental Health Network http://www.sehn.org

The World Bank http://www.worldbank.org

The National Academic Press http://www.nap.edu

The Asian Development Bank http://www.adb.org

The Coalition Provisional Authority of Iraq http://www.cpa-iraq.org

The U.S. department of Commerce- Export Portal http://www.export.gov

The Monsanto Company http://www.monsanto.com

The International Service for the Acquisition of Agri-biotech Applications (ISAAA) http://www.isaaa.org/

The World Trade Organization http://www.wto.org

The Organization for Economic Co-operation and Development (OECD) http://www.oecd.org

The Convention on Biological Diversity http://www.biodiv.org