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Developing Social Responsibility: Biotechnology and the Case of DuPont in Brazil

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ABSTRACT. The development of genetically modified organisms (GMOs) has caused worldwide debate and has required us to reevaluate theories of social responsibility. This article, first, briefly discusses the progressive stages of social responsibility that scholars have outlined as they examine the history of businesses. Next an overview of the development of the DuPont corporation in the United States is presented, tracing DuPont's transformation from an explosives and chemicals company into a life-science corporation and demonstrating how outside factors influenced this change. The article then turns to the activities of the DuPont corporation in Brazil, a country with one of the world's largest agricultural economies – and examines how the debate on GMOs is unfolding within the Brazilian context. It discusses how differing interest groups have taken part in this debate, the limits of their arguments, and the need to develop means for providing open collaborative efforts in evaluating new technologies.

KEY WORDS: biotechnology, Brazil, DuPont, social responsibility

New biotechnologies and social responsibility

The introduction of new agricultural biotechnologies has raised a number of concerns regarding the safety of the product for human or animal consumption, the effects the product might have on the environment, the question of patenting living organisms, and the power large corporations have over cultivation and food supply. These questions have divided scientists over the direction of agricultural development and sparked debate over the best way to feed the growing world population. The emergence of these new technologies also requires us to reevaluate the theories on social responsibility. For instance, how should businesses proceed when laws or guidelines do not adequately address the issues or the new circumstances produced by these technologies? What procedures should governments, social movements, scientists, and businesses follow when developing and approving new technologies? Is there a difference in how developing countries might view and make use of these new technologies in comparison with Northern countries? What are the new issues that arise as these technologies develop?

Since the mid-1980s, E. I. du Pont de Nemours and Company (DuPont) has engaged in research and developed technology on genetically modified organisms (GMOs). The commercialization of this new technology by seed companies has caused considerable worldwide debate and has also become a hotly contested issue in Brazil. The discussion in Brazil is particularly interesting not only because it is one of the largest agricultural countries in the world, but also because of the complexity of the questions that have been raised. In this article, I will first briefly discuss some theories related to the development of social responsibility, especially in chemical companies such as DuPont. Then I will trace the history of the DuPont corporation in the United States, before I focus on its activities in the emerging country of Brazil. I will examine how the debate on GMOs is unfolding in the Brazilian context and how DuPont has chosen to deal with the issue. Finally, I will discuss how differing organizations have taken part

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in this debate and the importance of developing means for evaluating new technologies.

Developing social responsibility

The 200-year history of the DuPont Company shows that it has gone through a number of stages in its relationship with the general public and its perception of responsibility. Like many companies in the chemical industry, DuPont has progressively incorporated a number of social and environmental concerns into its business policies.

In recent years, companies such as DuPont have become progressively more attuned to their responsibilities and have introduced practices that recognize these responsibilities. The history and development of this change in corporate attitudes have not escaped the notice of scholars, consultants, and business people. For example, in a good-humored lecture, Peter Sandman (1990) admits that he would have been very cynical if someone had told him in the mid-1980s that the chemical industry would be actively involved in providing information about its emissions and emergency responses, that it would have local and national advisory councils, and that it would be promoting public accountability and environmental responsibility; yet a growing number of companies now regard these policies as being necessary for their survival. To explain this transformation, Sandman outlines three historical stages: first, the ''stonewall stage,'' in which the industry simply denies any responsibility; next, the ''missionary period,'' in which the industry attempts to win over the public and prove the social and human benefits of its products; and finally the ''dialogue stage,'' in which the industry realizes the need to listen to the public, recognizes the ways in which it has failed, and responds so as to remove real hazards as well as to mollify public fear and outrage.

Swift and Zadek (2002) define three generations of corporate business responsibility based on their study of companies in western Europe. The starting point is a basic stage in which corporate social responsibility (CSR) is simply interpreted as compliance with pre-existing laws. From this stage the industry develops the *first generation* of CSR, defined as the ''low-level business case'' or risk-management phase, in which social responsibility is seen as a way to avoid risks or crises. In the *second generation*, the ''business case'' for social responsibility is incorporated as an overall strategy to add value to the product or services of the industry, to improve its image and relationship with the community, and to increase its ability to attract and maintain talented employees. According to this line of argument, there is a positive correlation between social and environmental performance and financial gain. The attempt is made systematically to incorporate questions of ethics and responsibility in all areas of the business. The *third and final generation* involves partnerships, dialogue, and communication between various sectors, and between international organizations as well. Social responsibility is seen as part of the very fabric of the economy, in which non-governmental organizations (NGOs), unions, different levels of government, community organizations, industry, and businesses form a system that strengthens the country's competitive edge. In a larger sense, this third-generation CSR is seen not as a purely corporate dimension, but rather as the ability of differing sectors to make agreements that would benefit the common good and overall global development.

Both these perspectives, though different in approach and style, adopt the idea of an evolutionary awareness by business and industry of its need to dialogue with the public. Swift and Zadek include an additional phase in which other sectors are also required to enter into dialogue and make alliances. This awareness within the industry, however, comes reluctantly and as the result of outside pressure by social movements, labor, government, and so on. Thus CSR is not achieved in isolation but rather is the result of continued dialogue and communication (often confrontational) between industry and other sectors of society.

As modern social concerns arose, the meaning of what could be considered responsible corporate behavior also changed and new demands were made of industry. Political and social scientists have studied the development of social movements: how they organize so as to influence both public opinion and social policy. Nancy Fraser (1989) borrows from discourse theorists such as Jürgen Habermas (1981, 1989) to show how social groups, through the use of various discursive means, form an identity around particular issues, and seek to bring such issues to the public sphere, where they can be debated openly.

Fraser defines these discursive means as the "historically and culturally specific ensemble of discursive resources available to members of a given social collectivity in pressing claims against one another" (Fraser, 1989, p. 164). For unions, social action groups, and environmental groups struggling to raise concern among the public and to pressure industry to become more socially responsible and responsive, the discursive means available include strikes, activist manifestations, civil disobedience, slogans, scientific reports, and lawsuits. However, in recent years some businesses have experimented with NGO alliances to achieve common environmental and social goals (Bendell, 2000; Sagawa and Segal, 2000); other businesses have acknowledged the need to work on global governance issues (Bendell and Shah, 2002) along lines similar to what Swift and Zadek (2002) have envisioned.

These developments are not limited to North America and Europe. The advent of the Internet and other means of advanced communications have made it possible for activist groups to disseminate their ideas concerning environmental and social issues to other countries and forge alliances with local organizations that are also developing local popular support. In criticizing industry, international groups have had the resources to publish on-line studies, set up Web sites, and instigate lawsuits. However, international NGOs have also been criticized for not perceiving the full complexity of local situations, for putting their cause before concern for the local people involved, and, in some cases, for usurping local power (Khan, 2005; Peel, 2004). Thus, particularly in developing countries, one must take into account not only the local context, but also the international influences under which public debate and policy are often developed.

Like most international companies, DuPont has come to realize the importance of its relationship with the public. In dealing with continued criticism DuPont has had to redirect its product line and implement new strategies in order to meet both the commercial and social demands imposed by changing contexts. The theories cited above can guide our understanding of how and why DuPont developed its socially responsible efforts. The current debate on biotechnologies provides new questions and calls for analyses that go beyond the "business case" for social responsibility and touch on Swift and Zadek's call for alliances between business, civil society organizations, and government.

DuPont's historical development

DuPont was founded as a gunpowder manufacturer in 1802 in Wilmington, Delaware by the French immigrant Eleuthère Irénée du Pont de Nemours (1771–1834), who had studied advanced explosives production techniques with the pioneering French chemist, Antoine Lavoisier. DuPont became the leading supplier of black powder to the U.S. government by the beginning of the War of 1812. During the Civil War, it supplied almost 40% of all powder to the armed forces of the Union. In 1880, Dupont began experimenting with other types of explosives, and by 1920 it was the world's leading producer of dynamite and the largest supplier for World War I (WWI). In addition to military purposes, DuPont explosives were used by the mining and railway industries during the westward expansion of the United States (DuPont, 2003).

In 1912, an antitrust suit against DuPont's monopoly on explosives pushed the company to turn increasingly from explosives to chemicals, with a variety of products such as synthetic textile fibers, paints, varnishes, plastics, and heavy chemicals. DuPont's lacquers and coated upholstery fabrics were used in the emerging automobile industry. Between 1914 and 1920 DuPont acquired one-third of all the shares of the General Motors Corporation, which in turn used DuPont's products in its automobile production. The companies also worked together on refrigerants and gasoline additives (ibid.). In 1924, the DuPont-controlled General Motors joined Standard Oil of New Jersey to form the Ethyl Corporation. Despite reports of nerve damage among workers in the production of this lead additive and criticism by scientists, DuPont succeeded in convincing the public and health officials of the safety and utility of leaded gasoline (Moore, 1990).

Despite this new product line, DuPont was still known primarily as a "powder company." A series of explosions in January 1916 that were negatively reported in the news spurred DuPont to launch an organized public relations effort. In addition to advertising, DuPont began to submit articles to the

press concerning the activities of the company in an effort to control negative publicity. In the mid-1930s, controversy concerning DuPont's profits during WWI coupled with general public distrust of big business forced DuPont's directors to seriously reconsider their relations with the public. In 1935, the DuPont company sought to change its image from that of a powder or wartime industry to that of a peacetime manufacturer.

The corporation launched an advertising campaign to promote DuPont's contribution to daily life with the slogan ''Better Things for Better Living...Through Chemistry.'' In 1946, DuPont implemented a ''precinct system'' of public relations. Dupont executives explained to employees and local communities the benefits of DuPont's products for society. According to DuPont, this system worked effectively in managing DuPont's activities during World War II and their work on atomic explosives. DuPont's continued heavy investments in public relations produced radio shows, publications, news articles, films, and videos as well as the 1964 World's Fair exhibit to present a positive account of DuPont activities and to promote DuPont's products (ibid.).

The DuPont slogan certainly caught the essence of postwar optimism and consumerism in the United States. Many DuPont synthetic materials such as neoprene, nylon, and rayon, originally developed for wartime purposes, were converted to the peacetime market in the form of staple products found in most US homes. DuPont's research into polymers has produced patents in fibers, films, plastic resins and finishes. Dupont became known as the world's most proficient producer of synthetic fibers with the commercialization of Lycra, Tyvek, and Nomex during the 1960s. In 1981, DuPont bought Conoco, Inc. in order to supply petroleum for its fiber and plastics operations. Since the early 1900s, DuPont had been working on agrochemicals, but after World War II it markedly increased its production and marketing of numerous fungicides, insecticides and herbicides (ibid.).

Despite DuPont's successful fiber production during the 1960s, public sentiment began to turn against chemical companies. In 1949, anti-trust prosecutors had filed a suit against DuPont and GM. In 1962, DuPont's relations with General Motors came to an end with a court-ordered divestiture of General Motors stock. That same year, Rachel Carson's *Silent Spring* shocked the world with its revelations about the chemical contamination of the planet – notably the harmful effects of herbicides and insecticides, many of which were DuPont products. Later in the 1960s, protests against the use of herbicides in the Vietnam War targeted the United States government and the big chemical companies. Gerald Colby Zilg's *DuPont: Behind the Nylon Curtain*, published in 1974, gave a critical account of the power and influence exercised by the DuPont family in the United States.

The general public had become more concerned about environmental issues and corporate power and was demanding more rigid controls on chemical companies such as DuPont. In the United States, legislation requiring environmental safeguards was enacted: the National Environmental Policy Act (NEPA) of 1969 provided a basis for a series of laws in the 1970s regulating solid waste disposal, clean air, clean water, marine mammal protection, endangered species, and control of toxic substances (Munn, 2000).

Increasing public concern regarding the chemical industry resulted in the 1980 enactment in the United States of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), or ''Superfund,'' which gave the EPA the authority and resources (levied from a tax on chemical and petroleum producers) to identify and respond to potential and actual releases of hazardous waste and to clean up waste disposal sites. As hazardous waste sites were identified, the magnitude of industrial waste became evident to the public. Then in 1984, the disaster occurred in Bhopal, India when a Union Carbide Plant leaked MIC, a highly toxic cyanide compound, killing thousands of local residents (Munn, 2000).

The United States put added pressure on the chemical industry with the reauthorization of the Superfund in 1986 and the Emergency Planning and Community Right to Know Act (EPCRA), which required the chemical industry to provide detailed reports on emissions, chemical inventories, and the preparation of emergency plans (Munn, 2000).

The Canadian Chemical Producers' Association (CCPA) in 1984 created a model volunteer initiative for the role and responsibility of the chemical industry under the name ''Responsible Care.'' The program consists of a formal commitment to a set of

guiding principles to reduce negative impact on the environment, workers, and the general public. It also includes codes, implementation checklists, and performance indicators as well as the agreement to communicate to outside parties, share views and strategies with other industries, and encourage others to join. Since it was formally adopted in 1986, 40 companies have adopted the Responsible Care program (Munn, 2000). One of these companies is DuPont.

In an attempt to respond to the new demands, DuPont in 1987 worked on the Montreal Protocol to phase out chlorofluorocarbons (CFCs) for refrigerants by the end of the twentieth century. In 1991, it began marketing its first substitute for CFC-based refrigerants. It also began to adopt recycling technologies for plastics and organic polymers (DuPont, 2003). Through its Safety, Health and Environment Commitment (SHE), DuPont has promised to be environmentally responsible for each product through its life cycle, from extraction, production, handling and packaging, to transport, end-use, and disposal. It also promises to increase margins of safety and stewardship for its workers, suppliers, carriers, distributors, and customers (Dupont, 2006d). However, critics have noted that DuPont has been under attack for being one of the biggest producers of CFCs since 1974. DuPont's solution strategy had been the production of hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) as substitutes for CFCs. Neither of these chemicals was regulated by the Montreal Protocol nor by the US Environmental Protection Agency, although they have also been proven to be ozone depleters. DuPont has delayed shifting to safer alternatives by launching distant phase-outs. DuPont will continue to manufacture CFCs for export until 2010. While HCFC use will also be discontinued in industrialized countries by 2010, no deadline has been announced for discontinuation in less industrialized countries (Corporate Watch UK, 2002).

By the late 1990s, DuPont sought to reinvent itself once again by changing its focus from a chemical to a life-science company. DuPont's slogan was changed to ''Miracles of Science,'' which could incorporate a sustainable development message (DuPont, 2003). In 1999, in order to free up money for new investments it sold off its Conoco shares, which it had purchased in 1981 for US$4.4 billion. In 1999, after a joint venture with Pioneer Hi-Bred International, Inc., DuPont bought the company outright for US$7.7 billion, thereby acquiring the world's largest seed company, which produces hybrid corn, soybeans, alfalfa, canola, and wheat (DuPont, 2003; Guerrante, 2004). In 2003, DuPont and the Bunge Company entered upon a joint venture with the formation of the Solae Company. The new company specializes in nutritional products, particularly proteins in soybeans and lecithin. In 2005, DuPont and Tate & Lyle formed a joint venture to build a plant that would use a polymer made from GM corn in place of the petrochemical-based polymer used in clothing, carpeting, and plastics.

By adopting the idea of sustainable development and environmental stewardship, DuPont outlined an ambitious list of commitments including: high standards of business and performance; a goal of zero injuries, illnesses, and incidents; a goal of zero waste and emissions; conservation of energy and natural resources, as well as habitat enhancement; continuous improvement of processes, practices, and products; open and public discussions; and accountability (DuPont, 2006a).

DuPont reports that it has reduced its carcinogenic air emissions by 92% since 1987 and cut its hazardous waste in the United States by 43% from 1990 to 1999 while increasing production by 11%. It has reduced its greenhouse gas emissions by 72% since 1990. Its global energy consumption has decreased 6% despite a 41% increase in production. The company has already met its 2010 goal of reducing greenhouse gas emissions from its global operations by 65% from a base year of 1990. In terms of energy use, the company has a target goal for 2010 of deriving 25% of its revenue from non-depletable energy resources. It reports its total waste generated is down by more than half since 1991 (DuPont, 2006c).

DuPont is a founding member of the United Nations Global Compact and is moving to be in full accordance with the Global Reporting Initiative Guidelines and the Responsible Care Initiative. The Chief Executive Officer, Charles O. Holliday, is a founding member of the World Business Council for Sustainable Development (WBCSD) and co-author of the book, *Walking the Talk: The Business Case for Sustainable Development* (2002) which was presented at the World Summit on Sustainable

Development in Johannesburg, South Africa in 2002. Holliday has aggressively promoted the business case for sustainable development and encouraged other companies to do the same. He emphasizes that business results can be met while meeting environmental and social needs. He sees environmental improvements as means to lower costs and increase capacity, and meeting societal needs as a source of market development (Holliday, 2003). This is the philosophy that DuPont seeks to reflect.

DuPont has received recognition for its policies towards sustainable development. It was rated by *Fortune* magazine in 2000 as one of the most admired companies in the world and first in Social Responsibility. In the United States, the National Association for Female Executives recognized the company for its commitment to women. The company was ranked Number One in its sector on the Innovest 2002 survey and on the 2003 and 2004 Dow Jones Sustainability Index. And in 2005 DuPont was named as one of the ''100 Best Companies for Working Mothers'' in *Working Mother* magazine.

However, despite these attempts at transparency, public engagement, and social and environmental responsibility, criticism and cynicism continue. For instance, positive perceptions of DuPont's recent environmental record are believed to be due primarily to its phase-outs of lead gasoline additives and CFCs; but these came about through government action and DuPont's sale of Conoco (Brubaker, 2001). Critics also question if the Global Compact, WBCSD, and other business initiatives are not just marketing attempts by industry so that stricter regulations will not be put in place (Bruno and Karliner, 2002).

In addition, several ongoing protests against DuPont seem to contradict the sincerity of its safety and environmental commitments. In December 2005, DuPont agreed to pay a $16.5 million penalty to the EPA for allegedly withholding information about the potential health and environmental risks of PFOA, a Teflon chemical, in a plant in West Virginia (Blackwell, 2006). Investigations are continuing in New Jersey, Ohio, North Carolina and Mississippi on the human costs of high exposure to perfluorinated chemicals released into the air and water by DuPont plants (Common Dreams, 2006; United Steel Workers, 2006).

While DuPont's trajectory shows the ability of a large company to respond to new demands and new contexts, it also shows the importance of government and civil society associations in shaping the development of the company. Public opinion, associating DuPont with war production as ''merchants of death'' (DuPont, 2003), pushed the company to change its image to that of a chemical company developing innovative and convenient consumer products for use in everyday life. Later criticism of DuPont's environmental record as a chemical company caused it to delete the tag in its slogan ''through chemistry'' and reconsider its environmental precautions as well as its products (DuPont, 2003). Accusations of ''green washing'' (Bruno, 1997) and other chemical disasters spurred DuPont to adopt the Responsible Care initiative. Although DuPont admits it must dialogue about its mistakes (DuPont, 2003), communication has often been initiated through bad publicity, lawsuits, and activist finger pointing; in other words, corporate social responsibility did not initially emerge from within the company but due to pressure from outside.

DuPont in Brazil

In 1937, DuPont set up Industrias Quimicas ''Duperial'' SA Industrial y Comercial (usually known simply as ''Duperial'') in association with the British ICI to import and distribute its products. In 1949, it set up its first explosives factory at Barra Mansa in the state of Rio de Janeiro; the plant was later converted for producing fungicides and herbicides. In 1953, the association with ICI was broken off and DuPont began to operate under its international name independently in Brazil. Subsequently DuPont expanded its activities in 1974 to Paulinia, Sao Paulo where it produces textiles, films, does testing for fungicides and herbicides, and provides technical assistance for its clients. The administrative office for Latin America has been located in Alphaville, São Paulo since 1981. In the 1990s, DuPont inaugurated a pigment plant in Uberaba in Minas Gerais and an industrial nylon plant in Camaçari, Bahia. It also has an industrial unit in Guarulhos, São Paulo. In 2005, Dupont employed approximately 3,200 employees in its plants and offices in Brazil (Dupont, 2001a).

DuPont's agricultural products have followed the agricultural development of Brazil. Initially developing products for coffee plantations and horticulture, it now produces fertilizers for citrus, sugar cane, soybeans, rice, etc. More recently, DuPont Brasil installed a research station in the city of Planaltina in Central West Brazil to focus on developments primarily in soybeans and corn (*Gazeta Mercantil*, 2005a).

Pioneer, DuPont's agricultural seed subsidiary, has five offices throughout Brazil, in the South and Central West agricultural regions. The Solae Company of Brazil, a joint venture of DuPont and Bunge, will invest in research related to soybeans. Together the companies have invested US$100 million in the plant in Rio Grande do Sul which isolates proteins from soybeans (*Universia*, 2003).

DuPont's CSR efforts in Brazil

DuPont in Brazil has attempted to reflect a policy consistent with its worldwide commitments to CSR. Perhaps the most apparent and important for the company has been the SHE program. Long before Brazilian regulations were introduced, DuPont drivers and transporters were required to use seat belts, to drive only during the day, and not to mix drinking with driving.[1]

Currently, DuPont's goals in Brazil have attempted to follow the international commitments, particularly those of Responsible Care. Through continuous meetings and internal safety contests, DuPont in Brazil has attempted to create a "culture of safety." One of DuPont's stated goals is not only to teach its employees good safety measures at work, but that this knowledge be transferred to their homes and families. Once again, such issues are of particular importance in any country where a major segment of the population lives in precarious conditions, and where disposal of waste and use of toxic chemicals at home may be done without even a basic understanding of safety. DuPont has also entered the business of teaching its safety measures to other industries (DuPont, 2002a).

Another issue regarding social responsibility is DuPont's principle of respect for people.[2] In Brazil, this has meant, in part, a striving towards diversity and inclusion. But what can be done in a country like Brazil where particularly the African-Brazilian population has been marginalized and largely kept out of good schools and work opportunities, and still is highly represented in the poorest sectors of the population? In order to make diversity within the company a reality, DuPont Brasil has begun a small program that offers college scholarships and internships to students of African descent. Since the state educational system has not provided adequate education to most African-Brazilians, DuPont has taken upon itself not only to actively recruit, but also to prepare students so that they are qualified to work for the company. DuPont also is the major contributor to Integrare, a non-governmental agency based in São Paulo, which acts as mediator between industry and African-Brazilians, Amerindian peoples, or people with disabilities who are potential suppliers, in order to open business opportunities for these groups (DuPont, 2001b).

DuPont also defines respect in terms of formal employment. Brazil was recently rated by the World Bank as having some of the most rigid regulations with regard to hiring, maintaining, and firing workers, which entails considerable costs for a company (World Bank, 2004). This is one of the reasons why the informal market, made up of unregulated and undocumented income-generating activities, has become so strong in Brazil. However, DuPont, among other international companies, has been able to withstand these costs and prefers to follow existing labor laws and formalize work agreements. For workers, this includes labor protections, fixed salaries, and benefits beyond the national standard.[3]

Areas of social action include:

- promoting science for elementary school children;
- providing microcredit to small farmers through the "Cultivating Citizens" (*Cultivando Cidadãos*) program;
- supporting the Bio Atlantic Institute (established by Conservation International, DuPont and other industries to defend, recuperate, and encourage sustainable development with local groups, government, NGOs, the private sector, and the scientific community);
- encouraging voluntary efforts by DuPont staff;

- supporting the United Way agency of Brazil (*Caminhando Juntos*); and
- supporting Global Vision efforts in poverty stricken northeastern Brazil through the production and sale of fruits based on the Fair Trade concept.[4]

In 2001, DuPont was elected for the fifth time by two Brazilian magazines, *Carta Capital* and *Interscience*, as the most admired company in Brazil in its sector, i.e., chemistry (DuPont, n.d.).

Thus, DuPont has adapted its CSR programs to the Brazilian context, while maintaining its core principles related to worker safety and sustainable development. However, the controversy around GM seeds has provided yet another challenge for the company. DuPont has had to incorporate new strategies to defend its development and sale of GM seeds. While GM seeds have been widely accepted in the United States, the Brazilian context produced a number of hurdles for the company to negotiate.

In Brazil, the issue of size and control has become a continued critique of the new life-science companies, which no list of commitments to social and environmental responsibility is likely to reduce. The ''gene giants'' are considered to be simply too large and powerful to trust (Clarke and Inouye, 2002; Guerrante, 2004). Can a multinational company that has invested billions and has a large share of the market be expected to act responsibly in evaluating the pros and cons of a new controversial technology?

GM seeds in Brazil

Agriculture is responsible for 33% of the Brazilian GNP, 42% of total exports, and 37% of all jobs. Brazil is the world's primary producer and exporter of coffee, sugar, alcohol, and fruit juices. It is second only to the United States in soybean production. Unlike the United States and Europe, Brazil has high potential for growth in agriculture. Projection indicates that it will become a primary producer of cotton and biofuels made from sugar cane and vegetable oil. Other agricultural products include corn, rice, fresh fruits, cocoa, and nuts (Ministério da Agricultura, 2004). Thus agribusiness plays a pivotal role in the Brazilian economy.

In addition to its agricultural potential, Brazil is believed to contain the richest sources of genetic and biological diversity in the world. Estimates indicate that the Brazilian territory holds 10–20% of the world's total plant and animal species (Mittermeier et al., 1997). Despite these numbers, this diversity is largely untapped, while agriculture is primarily done with non-native species.

While GM seeds were introduced into the United States in 1995, Brazil only voted in legislation for their commercialization in 2005. The judicial context regarding GMOs in Brazil is complex. Article 225 of the Federal Constitution of 1988 requires the State to ''preserve the diversity and the integrity of the genetic patrimony of the country'' and ''control the production, commercialization and use of techniques, methods and substances that pose a risk to life, the quality of life and the environment.''[5] Also, there are a number of laws on the books that could be interpreted as referring to GMOs: laws regarding the National Environmental Policy, regulating plant security, agricultural policies, rights and obligations of industry, crop protection, exotic species importation prohibitions, protection of the forests and fauna, crimes against the environment, etc. In addition, individual states have also enacted laws regarding biosecurity (Medina, 2002).

Brazil is also part of the Convention on Biological Diversity and signed the Cartagena Protocol on Biotechnological Security, which was ratified in 1994. The Protocol calls for the creation of a national strategic plan on biodiversity (ibid.). To deal with the specific issue of genetic engineering, in 1995 Brazil enacted the Law of Biosecurity 8.974/95 (Jurisdoctor, 2006), which was based on norms established by the European Union, specifically the precautionary principle, which requires that a product be proven to be risk-free. Among other things, the law authorized the creation of the National Technical Commission on Biosecurity (CTNBio) to provide normative instructions on biosecurity for the utilization of GMOs and present technical opinions on their experimental or commercial use. The CTNBio was made up of experts from an wide range of disciplines including specialists in biotechnology, representatives from such ministries as Science and Technology, Foreign Relations, Health, Agriculture, Environment, and Education, as well as representatives from health,

consumer, industrial, and biotechnological organizations (Leite, 1999; Medina, 2002). Information regarding solicitations from the CTNBio can be found on their Web page, making this information publicly accessible (Ministério de Ciência e Tecnologia, 2006).

The first opinion given for the commercialization of GMOs was in 1998 when the commission acted in favor of the request of the Monsanto company for the commercialization of its GM seed ''Roundup Ready,'' which is resistant to its herbicide Roundup. No environmental impact statement or labeling of the commercialized product was required (Leite, 1999). This action began a series of legal battles and public debates around GM seeds in Brazil.

The *Instituto Brasileiro de Defesa do Consumidor* (IDEC), Brazilian Institute in Defense of the Consumer, together with Greenpeace, filed a suit against the release of this product, citing that the Federal Constitution required an environmental impact study for potentially polluting agents and that all commercial GM products should be labeled as such. In a decision handed down by the federal judge in 1999, the CNTBio decision was reversed and an impact study was required of Monsanto (Transgênicos, 1999). However, the wording of the decision caused outcry among businesses and scientists supporting GM seeds, especially the reference made by the judge to the possibility of generating ''alien hosts'' when referring to GMOs. This terminology appeared to be construed more from science fiction than from scientific study. Discussion over the release of GM seeds includes debate on the role of the CNTBio. Should it be consultative or executive? Should it be the only instance of approval or should other ministries also provide approval? Should an environmental impact study be required of each request (Leite, 1999)?

The opposition Workers' Party at this time came out strongly against the commercial use of GM seeds. In the southern state of Rio Grande do Sul, the Workers' Party governor, Olívio Dutra, in 1999 declared the state free of transgenics (as GM seeds are commonly known in Brazil). This position spurred public debate and that same year 25 non-governmental agencies formed the group, ''For a Brazil Free of Transgenics'' (Weid, 2004). The group's primary objectives were to lobby against the commercial use of GM seeds on the judicial, parliamentary, and executive levels, to define rules for environmental impact studies on transgenics, to demand the proper control of illegal cultivation and commercialization, and to systematically provide information to the public about transgenics. These, among other efforts, resulted in legislation prohibiting the cultivation of transgenics in the states of Santa Catarina, Mato Grosso do Sul, Pará, and Rio de Janeiro (Weid, 2004). The debate divided different sectors of the government, with the Ministry of Agriculture and *Empresa Brasileira de Pesquisa Agropecuária* (EMBRAPA, Brazil's agricultural research corporation), favoring the commercialization of GM seeds, while the Ministry of the Environment was staunchly against their cultivation (Leite, 1999).

However, by 2003, farmers in the south of Brazil were smuggling Monsanto's Roundup Ready seeds into Brazil from Argentina. Through Provisional Measure Number 131, (PRFB, 2003) the Workers' Party president, Lula Inácio Lula da Silva, who had won the elections in 2002, agreed to allow the cultivation of the seeds that farmers had already smuggled into the country provided that these seeds were not commercialized and were harvested by the end of 2004. Remaining seeds would have to be destroyed. In addition, the seeds could only be planted in the state where they originated, so that they would not contaminate cultivation in other parts of the country. Products, whether for human or animal consumption, containing more than 1% GMOs have to be labeled as such (Greenpeace, 2004). However, the fight for and against the commercialization and cultivation of GM seeds continued to be debated at different levels in Brazil.

Groups fighting against the commercialization and cultivation of GM seeds have come from differing perspectives and have developed a long list of arguments countering the use of GM seeds. The campaign ''For a Brazil Free of Transgenics'' has argued that transgenics could pose health risks that have not been adequately studied and they charge that transnational organizations have not given consumers sufficient information concerning their product. They also argue that there is no technical regulation for the secure use of these products. Transgenics are said to provoke a loss in the genetic diversity in agriculture, putting crops more at risk since single characteristic crops will be unable to withstand differing pests and conditions. Transgenics

can genetically pollute other organisms and lead to the generation of ''superpests,'' as well as killing off insects that are beneficial to agriculture and affecting microorganisms in the soil. Such changes in nature may be irreversible. In a country that boasts the richest biodiversity in the world, the introduction of GM crops could reduce these biological resources (Greenpeace, 2004).

Those against transgenics also argue that farmers will become more dependent on large transnational corporations because they will be induced to continually buy the seeds and corresponding agrochemicals from the corporation. Along with this, farmers are required to pay royalties on the intellectual property rights of the seed. This technological package may be too expensive for small farmers who would be forced to leave their farms causing increased rural exodus, unemployment, and social exclusion. Along with this, farmers who replant seeds without paying royalties are subject to fines (Guerrante, 2004). In order to control the cultivation of their seeds, companies have experimented with technologies such as ''terminator'' (which produces sterile seeds) and ''traitor'' (which requires a chemical substance to activate or deactivate specific characteristics). Critics argue that only a few multinationals have monopolized the ownership of agricultural seeds and will have tight control not only over farmers but also over agricultural production in general. Furthermore, as the seed companies acquire other companies through mergers, a few companies would come to control not only the genetic information, but also the production and distribution of crop protections, the processing of grains and the final distribution of the food product. Such tendencies would give oligarchic control to the companies, limiting competition and democratic decision-making channels (Guerrante, 2004).

At the same time, it appears that no one has agreed to assume responsibility for the risks that are being imposed. Critics cite the StarLink fiasco (2000–2001) in the United States, where Aventis' StarLink corn, a GM strain that is not intended for human consumption, was found in hundreds of food products and contaminated over 140 million tons of grain. This is an example of a case, like those of BSE (''mad cow'' disease) and dioxin-infested chickens in Europe, in which neither agro-industry nor government regulations managed to guarantee consumer safety. Finally, critics have argued that GM seeds are not just new and improved versions of conventional seeds, they represent a new form of technology that could have unknown consequences, thus the need for precaution and exhaustive studies (Clarke and Inouye, 2002; Greenpeace, 2004; Inouye, 2003; Shiva, 2004).

Those in favor of the commercialization of GM seeds have argued, first, that the discussion on transgenics has taken a turn toward emotionalism and irrationality. Ecologists and activists have greatly exaggerated the risks of transgenics and not seriously considered the benefits. They have looked at isolated cases and generalized them for all of the varieties of GM seeds. Proponents argue that fewer toxic materials will be used on GM seed crops, thereby favoring the environment. GM crops will result in lower costs to farmers because they will not have to pay as much for agrochemicals. Higher production and the ability to cultivate land that was previously inadequate for agriculture are other potential benefits of GM seeds. Such benefits could provide food for the growing number of people on the planet without infringing on biodiverse forests. GM crops may also offer special dietary benefits such as higher quantities of vitamin A or proteins. They can be used in the production of plastics, thereby reducing the need to rely on petroleum.

In Brazil, scientists in favor of the commercial use of GM seeds have argued that agriculture continues to be of primary importance to the Brazilian economy and that encumbering the use of advanced technologies in agriculture, through overly cautious legislation and bureaucracy, will compromise Brazil's ability to compete within a globalized market and severely hinder economic development. They also argue that by properly regulating GM seeds and cultivation, the Brazilian government will have more control over any negative consequences such cultivation could have. As it is, without clear controls, clandestine cultivation goes on unrestricted. They argue that the discussion on GM seeds has become overtly ideological, particularly in Brazil, where anti-imperialist jargon has invaded talk on the particular qualities and benefits of a product. Such tendencies only work against the development of good science and good public policy. Finally they state that the precautionary principle is simply too rigid, that no commercialized product could ever be

considered totally risk-free, and that one must consider benefits that such a product could offer (Brazilian Association of Biotech Companies, 2006; CIB, 2004; DuPont, 2006b; Minas Faz Ciência, 2000; Monsanto, 2004).

In general, such arguments for and against have become extremely polarized. The scientific knowledge required to evaluate the technology of each seed and its environmental effects is extremely sophisticated, and is largely beyond the grasp of the general public. If scientists cannot agree, how can lay people make informed decisions? The credibility of scientists and activists has also been questioned by examining their funding sources. Industrially funded scientists are criticized for favoring GM seeds, while rumors circulate that activist organizations such as Greenpeace have received funding from agribusiness in the United States in order to de-accelerate production in Brazil. As one Brazilian agronomist says, ''Nobody knows who is who anymore,'' while suspicions abound and make it more difficult to come to negotiated agreements.[6]

In 2004, the executive branch of government provided yet another provisional measure to permit the planting of transgenic seeds while the legislature was left to hammer out the new biosecurity law. Those in favor of GM seed commercialization lobbied in favor of streamlining the regulatory process and allowing the CNTBio to approve seeds. They complained that congressional delays left farmers in a quandary as to what to plant. Those against insisted on the need for an environmental impact study for each seed and for the labeling of products. They also argued that CNTBio be a consulting rather than a decision-making organ and that other ministries be involved in the licensing process.

Finally, on March 25, 2005, the new Law of Biosecurity, number 11,105 was passed by both the House and the Senate. This law revoked the previous Biosecurity Act and provisional measures (Informe Legislativa, 2005). Originally the House of Representatives approved a law that created a council, made up of members from various ministries, responsible for releasing transgenics, while the CTNBio would regulate research and provide technical advice. However, the Senate passed another law in which the CTNBio was the responsible organ for the release of transgenics. Returned to Congress it was passed but with an inclusion for the removal of restrictions on stem-cell research, further complicating discussion. President Luis Inácio Lula da Silva sanctioned the law vetoing seven of its points. Two of the vetoes allowed for the national Council on Biosecurity (CNBS) to question decisions of CTNBio.

Greenpeace filed against the law, calling it unconstitutional and arguing that it violates the precautionary principle, democratic procedures, and the independence and harmony between governmental powers. The petition questions the competence of the CTNBio to make decisions related to environmental impact. Such questions according to Greenpeace should be the responsibility of the Environment and Health ministries (Greenpeace, 2005). The Brazilian Institute in Defense of the Consumer continues to critically observe the regulatory process, insisting on adequate tests before approval of any product and the appropriate labeling and storage of GM products (*Tribuna do Povo*, 2005). Businesses have already complained about the lack of legislation that would properly regulate the bill. Also, producing the mechanisms to separate GM seed products from conventional products and organic products has become a logistical nightmare (*Gazeta Mercantil*, 2005b).

DuPont's strategies in favor of GM seeds

What has DuPont been doing while this discussion has been going on? First of all, the name of DuPont or Pioneer has not entered much into public discussion except when a listing of the major seed companies is made. For the most part, Monsanto has been the forerunner in the battle for commercialization and the company that has attracted the most attention. Why is this? First, Monsanto, through an aggressive marketing and price-cutting campaign, was able to commercialize an inexpensive agrochemical based on glyphosate and market a resistant strain of soybeans, thereby linking the sale of Roundup with its GM seed, Roundup Ready. By reducing the price of Roundup, Monsanto was able to lock out competitors and increase its market share, making up for the price reduction by increasing sales. DuPont responded by filing two lawsuits in the US federal courts, accusing Monsanto of violating antitrust laws (Barboza, 2001). But

accusations have also been made that DuPont's Pioneer subsidiary and Monsanto colluded to fix prices in the 1990s. In the 1980s, Monsanto had sold the license for some of its seeds to Pioneer for what would be considered today a very low price. Both companies state that they were discussing these licensing agreements and not deciding to raise the price of seeds as some allege (Barboza, 2004). In any case, the relationship between Monsanto and Pioneer appears to be both adversarial and collaborative. Nonetheless, there are differences in how the companies initially proceeded with the commercialization of their products.

While Monsanto has certainly gained the lead in making profits from this technology, it has also been the first to expose itself to critics. It has also aggressively commercialized the product, often without taking into account public reactions. Roundup Ready and Roundup are basically uninteresting products for consumers, because they offer no direct consumer benefit. Advantages are largely monetary, benefiting Monsanto and farmers who pay less for agrochemicals. When questions were raised concerning the potential risks involved in GM seeds, few arguments could be made to attract consumers. When Monsanto began to sue farmers for not paying royalties or for storing seeds clandestinely, public opinion once again went sour on Monsanto. The use of terminator technology or sterile seeds, to induce farmers to continually buy their seeds, also caused criticism (Bridgland, 2000; ETC Group, 2003).

DuPont has picked up on these issues and developed policies that could respond to them. First, it saw that biotechnology had become an ethical issue and second it did not assume that merely a series of company-run tests would be enough to convince the public of the safety and benefits of GM seeds. In order to reduce public resistance to GM seeds, DuPont took on a number of initiatives. In September 1999, DuPont set up a Biotechnology Advisory Panel made up of a group of independent consultants from universities, NGOs, and the government sector of various countries. The purpose of the panel is to evaluate DuPont's social and environmental commitment and provide advice on the various phases of product development, including testing, commercialization, and marketing. For instance, the panel has helped DuPont to see that biotechnology needs to offer benefits to consumers. In December 2001, DuPont announced a project to develop healthier foods such as soybeans that would combat osteoporosis, and has entered into cooperative efforts with universities to develop corn and sugar cane seeds from which polymers, resins, and oils could be extracted. DuPont has also pledged not to use terminator seeds (although it has patents on the traitor technology).

Most recently, the panel has advised DuPont to:

- make responsible responses when accidents and genetic transfer to wild plants occur (as has happened with maize in Mexico);
- share plant genetic resources, especially in developing countries;
- develop biotechnology in developing countries that would benefit the poor;
- increase transparency and seek outside perspectives;
- use its influence to increase transparency and include external perspectives in other industries;
- provide access to scientific knowledge assessment;
- exercise the precautionary principle;
- examine how lessons learned can be applied to emerging issues; and
- continually work to identify new issues. (DuPont, 2002a).

With this advice, DuPont has reported that it will adjust its policies to reflect these concerns. For instance DuPont has made a list of bioethics-guiding principles which include: commitment to food/feed safety; environmental focus, conserving biodiversity, transparency of information, engaging stakeholders, advocating independent research, contributing to developing economies by sharing knowledge and technologies that would alleviate hunger, and formalizing access to genetic resources (DuPont, 2002a)

In 2001, DuPont joined the major food and seed companies in forming the *Conselho de Informações de Biotecnologia* (CIB), the Biotechnology Information Council. The Brazilian CIB is part of an international network of councils that have formed in Argentina, the United States, and Mexico. The primary objectives of the group are to diffuse scientific information on biotechnologies that would

promote the advantages of GM technologies and lobby the government for the release of GM seeds (Guerrante, 2004).

The lesson that communicating to the public can make good business sense has been implemented by DuPont in the case of GM seeds. By inviting independent outside consultants to evaluate their activities and report them on their Web page, DuPont has in effect admitted that there might be issues of concern regarding their products and activities that the company simply has not been able to perceive. The advice given by these consultants also offers an invaluable tool for planning future strategies, particularly in product development and marketing. Also, the collaboration of industries in the CIB has created a powerful force in favor of GM seeds in Brazil. With all companies offering scientific data in favor of GM seeds, they hope to sway public opinion in their favor. Overall, DuPont has had a more sophisticated strategy in developing its products, compared to Monsanto. It has realized that the public identifies the issue as an ethical one and that information and safety are key issues in the debate.

Will DuPont act responsibly?

The issue of GM seeds has raised new questions beyond safety, transparency, and environmental and social stewardship. Or rather, it has brought to the surface old questions that have to be asked all over again. Beyond the issue of whether a particular technology can benefit society or not, we could ask: What should our priorities be? What are our needs? How should we respond to these needs and priorities? How much power should any one organization, corporation, or industry have? Who should decide these questions?

While DuPont might insist that it is finally up to the government and the public to decide about their products, in developing countries like Brazil, structures for public discussion are not always in place and governments are often seen as overly bureaucratic, corrupt, and inefficient at regulating. Also, we might ask whether consumers are prepared to make a decision on the safety of such products – especially consumers in developing countries who might not have access to information, lack the educational background to understand the scientific aspects of the discussion, or are inclined to simply buy the cheapest product.

Furthermore, the global market is a major influence. As long as other countries are importing GM-free products, there will continue to be a market for traditional cultivation. But should the market for GM products increase, economic contingencies could be the most decisive factor in the release of GM crops onto the market. Unlike European countries, Brazil depends on its agricultural exports and is not in a position to neglect a technology that would offer it a more productive advantage. Should the decision be left up to market demands?

Other issues such as biodiversity must also be fitted into the formula. Are scientists prepared to consider all aspects of the product's impact beyond the technical know-how and make a balanced judgment on the product? Are activist organizations prepared to negotiate? Do international organizations really understand the importance – or the potential dangers – of new technologies in developing countries? Finally, can a multinational company that has invested billions and has a large share of the market be expected to act responsibly in evaluating the pros and cons of a new controversial technology? We must conclude that neither corporations, nor governments, nor civil organizations alone are equipped to answer these questions.

A company such as DuPont, which must survive within a very competitive and globalized world, cannot be expected to go beyond the business-case argument for social responsibility or respond to the issues of new biotechnologies on its own. This means that DuPont needs outside pressures and partnerships that will push it on to the next step of ethical development as outlined by Swift and Zadek. In the case of Brazil, the pressure by multinational companies to liberate GM seeds was offset in part by another international organization, Greenpeace. Organizations such as Greenpeace and Corpwatch are considered to be the foes of companies such as DuPont, but they have also functioned to make the company incorporate such concerns as safety, diversity, the environmental, and social development into their agenda, providing the company with justifications for responsible policies that could provide added value.

To its credit, DuPont has perceived the need to dialogue and has engaged outside perspectives. For instance in its Social Responsibility programs in

Brazil, it has developed alliances with World Vision, United Way, Conservation International, and Integrare. The outside Advisory Panel has provided it with perspectives that are external to the company and helped it to better manage the issue of GM seeds.

However, DuPont and other companies could go beyond this. Ideally they could engage more with governments, academic institutions, and civil societies as well as international organizations during the research phase so that product development is grounded more closely to needs. A superfund could be developed by industry to provide independent research on new technologies. By forming associations with other organizations, government, and industries they could attempt to foresee parallel problems of logistics, segregation of products, and labeling and storage before these problems become urgent. Educational programs for users of their products and prevention of potential dangers could be more strictly enforced. Through more cooperative efforts in the development of technologies, new products would be discussed in their inception and development rather than their commercialization. These strategies require not only cooperation from industry but also from governments and civil organizations.

In the present context of frustration, bureaucracy, suspicion, and confrontation surrounding this issue in Brazil, the development of meaningful partnerships and cluster development with state, public, and private collaboration, working as a unified group toward national development seems highly unlikely. For the time being, what we find in Brazil is the participation of various interest groups, each with an ethical position limited by its own particular agenda in the arguments they bring to the public sphere. Those with the strongest voice will likely win. However, we may also hope that during this process each interest group will force the others to reconsider, negotiate, and become more sophisticated in their approach, so that an adequate solution might yet be found to the question of GM seeds and its corollary issues.

Notes

Interviews for this study were conducted between June 2003 and August 2004. Two interviews with two DuPont executives took place in the DuPont administrative offices in Alphaville, in the state of São Paulo. One interview with a former DuPont executive took place in Piracicaba, SP. Two interviews were conducted with separate researchers at the Luis de Queroz Agricultural School of the University of São Paulo in Piracicaba. One visit was made to the Paulinha plant in São Paulo state. Permission was not granted to use names of the persons interviewed.

[1] Interview with a former DuPont employee, Piracicaba, April 13, 2003.
[2] Personal interview with DuPont executive, Alphaville, SP, March 13, 2003.
[3] Ibid.
[4] Personal interview with DuPont executive, Alphaville, March 13, 2003. See also DuPont, n.d.; DuPont, 2001b.
[5] Translation by M. Griesse.
[6] Personal interview with professor at Escola Superior de Agricultura ''Luiz de Queiroz'' (ESALQ), Piracicaba, August 13, 2004.

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