2003

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Strategic Implications of Technological Innovation That is Hard to Sell

Stephen R. Luxmore
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EXECUTIVE SUMMARY

During the last decade the biotechnology industry has made remarkable scientific advancement. It is reasonable to surmise that in addition to corporate and personal goals, an intended outcome of biotechnological research is to benefit society. Yet, how should companies react in the face of public scrutiny and often-resulting mistrust for technological innovation? This paper examines the strategic implications of researching, developing and bringing to market technology that is hard to sell. Specifically, we explore the application of technology to genetically modified crops in the agricultural industry.

INTRODUCTION

The business of agriculture, as old as mankind, and modern agriculture of the last two thousand years is essential for the continuation of life. For various reasons the world currently cannot adequately nourish its populace. Traditionally the agrochemical industry has responded with hybrid crops, new fertilizers, herbicides, pesticides, and improved farm management techniques. Significant innovations on the scientific front has researchers addressing foodstuff demands by engineering crops that will be suited to specific environments, including poor growing conditions. These crops are also expected to deliver higher yields, be lower cost, of improved quality, and provide nutritional benefits currently lacking in diets.
Historically, new and/or improved varieties of crops were the result of natural processes such as evolution or man induced cross-pollination to create hybrids, both of which are relatively slow and imprecise (Saigo, 2000). All this changed dramatically in the 1980s with the application of recombinant DNA technology to the agriculture industry. This technology allows specific genes to be modified or inserted into plant (or animal) matter to engineer new, and most likely otherwise unattainable, crop characteristics. The rate of scientific advancement has been astonishing: the first transgenic or genetically modified crop, an antibiotic resistant tobacco plant, was developed in 1983 (Monsanto, 2001a). By the mid-1990s, the FDA approved commercial plantings of some GM crops (Monsanto, 2001a). Today GM crops exist that are insecticide and herbicide resistant, create toxins to kill insects, and resist disease (Pew Initiative, 2001). Future transgenic crops will directly benefit consumers through the addition of nutrients such as vitamin A to rice and vitamin E to cooking oils (Pew Initiative, 2001). The extension of this technology to other sectors of agriculture includes turf and forestry, and to other industries including pharmaceuticals, industrial products, and environmental cleanup (Pew Initiative, 2001). Clearly the potential benefit of transgenic crops is enormous.

However, transgenic crops have not been universally embraced. Total GM crop acreage reached 109.3 million acres, or 44.2 million hectares by the year 2000, a more than twenty-five fold increase over the five-year introduction of commercial GM crops (James, 2000). While this figure is impressive, GM crops only account for approximately 16 percent of total world acreage of corn, soybean, canola and cotton, the four most planted GM crops (James, 2000). Of the 13 nations that allowed planting of GM crops in 2000, four accounted for 99 percent of the global total, with the United States leading at 30.3 million hectares, the equivalent of 68 percent of global GM crop acreage (James, 2000). Canada recorded a net decrease in GM crop acreage, Portugal withdrew registration of *Bt* (*Bacillus thuringiensis*) corn, and the U.S. reported a decrease in transgenic corn acreage in 2000 (James, 2000).

While the net benefit of transgenic crops are questioned, even more so are the processed foods using GM crop yields as ingredients. Many nations disallow or place restrictions on the importation and/or marketing of foodstuffs made from GM crop (Barboza, 2001). Additionally, consumers and processors are rejecting GM crops (Dutton, 1999; McGowan, 2001). The Pew study (2001) indicates more than half of the Americans polled are in favor of GM food research, but are against genetically modified foods in the marketplace. Shanahan, Dietram, and Lee (2001) provide a review of trends inferred from different polls and note inconsistencies across polls as well as ambiguities in questions posed by the different research groups. They find that public awareness of the negative aspects of transgenic crops has increased since 1998 corresponding with increased coverage by the media.

If industry competitors are to continue investment into the development of GM
crops, more widespread acceptance of transgenic crops by governments, special interest groups, food processors, and the end use consumer is of critical importance. The top three GM crop competitors, Aventis, Monsanto, and Syngenta, invested more than 1.5 billion dollars, or ten percent of sales to research and development in 2000 (estimates from annual reports, Aventis, 2001a; Monsanto, 2001b; Syngenta, 2000). These R&D expenditures fund more than transgenic research, but transgenic research remains a significant factor in the industry. Harvey and Schaefer (2001) state the importance of stakeholder perspectives in strategic planning, and in some instances, notably government and regulators, 'green' stakeholders are extremely important. As we demonstrate in this paper, we agree with this position and propose that the government stakeholders are greatly influenced by other stakeholders in this industry.

This is the basis for our study, which can be phrased 'what if you build a better mouse trap, but no one wants it?' or at least many are currently wary of acceptance. Our discussion begins with the disruptive technology phenomena of biotechnology (Christensen, 1997) and then details the perceptions of industry stakeholders: proponents and opponents. A conceptual framework of strategic choices is presented and demonstrated using case analysis followed by the concluding section.

**DISRUPTIVE TECHNOLOGIES**

In addition to the strong opposition to GM crops, another significant risk exits for the industry incumbents. Christensen, Craig and Hart (2001) identify disruptive technologies as those that “create major new growth in the industries they penetrate.” The larger competitors are participating in the application of biotechnology to the agriculture industry, but many smaller companies are investing in biotechnology as well, albeit on a smaller scale. Thus the other real risk: a significant alteration of industry dynamics created by technological advances of new or smaller industry participants (Christensen, 1997; Christensen and Overdorf, 2000).

For the incumbents, a decrease of research allocation toward transgenic crops could be warranted should the acceptance of GM crops and foods continue to be limited. Christensen (1997) and Christensen and Overdorf (2000) discuss the folly of this tactic to incumbent competitors who listen to the current needs of their customers, rather than focusing on the future needs should the new technology improve and gain wide acceptance. This analysis is relevant to the incumbents: they should continue to invest resources in the development of transgenic crops, a potentially disruptive technology. This leads us to the primary topic of how to gain acceptance of a technology that is difficult to sell.
STAKEHOLDER PERSPECTIVES

Stakeholders completely at odds with each other characterize this industry. At one end of the spectrum are proponents of GM crops, ranging from industry competitors, scientists, farmers, consumers, and global agencies. All of these stakeholders are included under market forces as defined by Porter’s (1980) five forces model. At the other end of the spectrum we find the opponents consisting of the same group categories, save most industry participants, and including organizations such as Greenpeace and Friends of the Earth, religious groups, and radical organizations which we define as consisting the quasi-market forces. We expand this concept later in the paper. Lastly are the non-market stakeholders, the governments that regulate the transgenic crop technology. All of these groups have legitimate concerns and stakeholder theory suggests firms should take these issues into consideration when conducting strategic planning (Harvey and Schaefer, 2001).

Market Stakeholders

Proponents identify the major benefit of GM crops as the ability to safely feed and improve nutrition benefits to an expanding population during a period of decreasing arable land. World population is forecast to increase to 7.5 billion by 2020 (Legg and Viatte, 2001), of whom more than 80 percent will reside in developing nations and more than 50 percent will be in urban areas (Food and Agriculture Organization of the United Nations, 2001). The UN Human Development report suggests that technological advances are critical to the development of poorer nations (“Let Them Eat,” 2001). Following criticism of the report by Greenpeace, an open letter clarifying the position taken in the Human Development Report 2001, states “investing in more research and development of GM crops is a promising avenue for accelerating progress in tackling global poverty and hunger challenges” (Fukuda-Parr, 2001). For example, GM crops that grow in arid conditions or poor soil conditions, and with increased yields have been or are being developed (Pew Initiative, 2001).

In many developing nations concerns over the nutritional value of foodsuffs rank only slightly below the ability to feed its populous, and in developed nations physical well being likewise is an issue. GM crops present an opportunity to address these issues with products that may contain vitamins otherwise absent from the local diet, such as golden rice containing vitamin A (“Golden Rice,” 2001; Pew Initiative, 2001) or fruits and vegetables delivering vaccines against viruses or genes to help fight cancer (Gwin, 2001; Pew Initiative, 2001).

A reduction in the use of pesticides and herbicides is another significant benefit of GM crops. Estimates place the use of these treatments in excess of 970 million tons per year in the United States alone (PBS, 2001). Crops that have an
internal gene mechanism to fight insects or to resist herbicides require fewer applications of chemical treatments. With fewer chemical residuals entering the environment, this should result in a reduction of harmful effects on wildlife, water, and humans.

Quasi-market Stakeholders

The potential harm to the environment is one of many factors documented by the detractors of GM crops (Saigo, 2000; PBS, 2001). Herbicide resistant crops could cross-pollinate with weeds, creating ‘superweeds’ or the crop itself could become a weed, spreading uncontrolled over other fields or natural enviros. Insecticide resistant ‘superbugs’ could result, or the pesticide producing GM crop could harm insects or other wildlife not targeted. Lastly, new viruses may evolve resistant to current treatments or harmful to other previously unaffected organisms. Without full knowledge of the potential consequences of GM crops to the ecosystem, some opponents recommend a moratorium of this technology.

Health risks are argued to exist on two levels. The interjection of genes from one organism to another can create transgenic crops with allergens that previously were not present in the non-GMO crop (Saigo, 2000). Similarly, as antibiotic resistant genes from GM crops enter the human body, bacterium resistant to antibiotics could develop (PBS, 2001).

The profitability of the industry depends upon intellectual property rights that opponents argue could lead to small farmers becoming indebted to the patent holders of GM crops (PBS, 2001). Farmers will not be able to save seed for next year’s crop or will be required to make payment to the patent holder for the saved seed. In poorer nations, farmers may not be able to afford GM crop seed negating the potential benefit of feeding the masses as discussed previously (“Agriculture and Technology,” 2000): This technology could alter the relative efficiencies of growing crops in different regions of the world leading to a reallocation of resources. While economic theory would argue for resources going to the relatively most efficient producer, opponents believe farmers in poorer nations, not able to purchase GM crop technology, will suffer creating further hardship and reducing food self-sufficiency in developing nations. Lastly, the profit orientation of the industry will cause firms to allocate their R&D expenditures to the most promising financial GM crop prospects that could be different from the crops needed by the poorer nations of the world (PBS, 2001).

Opponents state that diversity of flora is insurance against drought, insects, and disease (PBS, 2001). GM crops can lead to less diversity, known as genetic erosion (Saigo, 2000) and the resulting monocultures are more susceptible to such factors. Additionally, weeds and insects may evolve that are resistant to the protection designed into GM crops. The ethical and moral implications of transgenic crops are vast. Should a company be allowed to patent genetic
material, or even create GM crops through the introduction of genes from one plant to another, or genes from animals into plants? Opponents state that this science violates moral considerations, including many religious principles (PBS, 2001).

Lastly the opponents argue that regulation of the science of GM crops is poor at best. In the United States regulation of transgenic crops falls to three agencies, the Environmental Protection Agency (EPA); the Food and Drug Administration (FDA), and the U.S. Department of Agriculture (USDA), that have overlapping responsibilities and little experience in this area (Saigo, 2000). Thus opponents state that GM crops are introduced without sufficient testing, and debate is quashed (PBS, 2001). Additionally in some nations, notably the United States, regulations do not require labeling of GM foodstuffs leaving consumers without adequate knowledge and choice. The Pew Initiative (2001) study found that only twenty percent of Americans realize they consume GM foods.

**Non-market Stakeholders**

The above arguments underpin the high degree of uncertainty in this industry. Governments differ on regulations regarding the testing, planting, harvesting and use of GM crops. The level of regulation occurs at domestic and international levels.

On the domestic front, the United States is characterized as having relatively few restrictions regarding transgenic crops and foodstuffs. McGowan (2001) notes “Approximately two-thirds of all processed food now on U.S. supermarket shelves has ingredients that have been genetically rearranged through biotechnology.” However, this does not mean that the regulatory environment in the U.S. is unambiguous: under the Coordinated Framework for Regulation of Biotechnology, three government agencies, the FDA, the EPA, and the USDA share regulatory authority, which has created uncertainty (Saigo, 2000). Additionally the U.S. has not signed the Cartagena Protocol on Biosafety adopted in 2000 (Saigo, 2000). Still at the domestic level, other nations or regions have greater and lesser restrictions concerning GM crops. These regulations range from no restrictions such as Argentina (Saigo, 2000), to planting bans in Brazil (although this may change) to labeling restrictions in Europe (ICTSD, 2001). Saigo (2000) states the Germany has some of the most stringent regulations of all nations that have a strong presence in biotechnology.

At the international level, the Cartagena Protocol on Biosafety includes regulations regarding biodiversity, the introduction of new GM organisms (or living modified organisms (LMOs)) into the environment, including notification thereof, labeling requirements, exchange of information, and consideration of socioeconomic factors defined by importing countries (Saigo, 2000). In her concluding comments, Saigo (2000) states “questions remain as to whether the Protocol will provide sufficient guidance to individual countries as well as the
international community" regarding transgenic organisms.

Summary

Based upon the above discussion we believe the industry is in a quandary. Is the current and continuing level of investment justified given: the current level of acceptance of GM crops by consumers; the disruptive technology factor; inconsistent government policies and; other potential negative factors created by special interest groups; and if future investment is appropriate, what strategies would be suitable? Christensen's (1997) research supports continued investment into GM crops, despite the present level of uncertainty. In response to the latter question, we develop in the next section a conceptual framework to address strategic responses to technology that is difficult to sell.

MODEL OF TECHNOLOGICAL IMPACTS ON FIRM STRATEGY

As demonstrated, the transgenic crop industry operates in an environment of high uncertainty created principally by special interest groups, government regulators, consumers, and disruptive technologies. The significance of stakeholders to corporate decision-making is well defined (Harvey and Schaefer, 2001). The dynamic interaction of the above-mentioned stakeholders, along with corporate decisions will determine the evolution of this industry. Szajkowski (2000) supports this perspective stating the level of product acceptance is determined by the "aggregate of stakeholders" and that this is not static.

Following Rugman and Verbeke (2000), we believe the government, defined as a non-market environment, has a major impact on firm strategy, beyond its affect on Porter's five forces model. While Rugman and Verbeke studied the realized strategic reaction of firms to changes in environmental regulations, our study differs in that we are examining potential strategic responses to industry uncertainty. Given this fact, we modify their model of government regulation on firm strategy.

We know governments have begun regulating the GM crop industry, but the regulations vary widely across governments and are continuously evolving as the technology advances. As a result, we believe the technology itself, as a driver of change amongst all constituencies, is the most important factor. That is government regulations will result and continue to change, as does the rate of innovation. Indeed biotechnology will alter the dynamics of Porter's five conventional forces, the sixth force of non-market factors (government regulation) as presented by Rugman and Verbeke (2000), firm strategy, and a new seventh force, quasi-market forces that includes all other stakeholders, but in particular special interest groups.
Innovation has the potential to alter the dynamics of the industry, as represented by Porter's five forces, which will directly alter firm strategy, and indirectly impact through government regulation. The disruptive characteristic of this technology follows Christensen's (1997) analysis. Further, there can be a direct shift in corporate strategy brought about by biotechnology, similar to changes in environmental regulation directly influencing strategy presented by Rugman and Verbeke (2000).

Government regulations will be partially driven by the rate of innovation of transgenic crops; a more rapid rate of change creates greater pressure on the government to develop regulations regarding the scientific and commercial advancement of the technology. This sixth force, as discussed by Rugman and Verbeke (2000) then directly affects corporate strategy.

Lastly, we introduce a new force, quasi-market factors, that recognize the influence of stakeholders, predominantly special interest groups and individuals in this case. While some of the individuals who make up special interest groups may also be part of conventional market forces (buyers for instance), we believe they behave in a different manner when aligned with other similar minded people. In this industry, special interest groups would include institutes such as Greenpeace, Friends of the Earth, religious groups, the scientific community, radical organizations; and so forth. Of all such groups, those opposed to biotechnology tend to be more vocal in their cause, and pose the greatest challenge to corporate strategy, through direct means and indirectly through government policy. This is due to the fact that the interests of groups opposing transgenic crops diverge from the interests of corporations investing and commercializing this new technology. Conceptually, we map the impact of biotechnology to the agrochemical industry in Figure 1.

The strategic prescriptions to manage the external forces, market, non-market, and quasi-market, are presented in Figure 2, in which consideration of potential social costs and benefits determine choice. It is our belief that as social benefits increase society will be more receptive of the new technology, all other factors equal. Conversely, as social costs increase society will be less receptive to new technology, all other factors equal. We present our analysis under the assumption that investing R&D monies and commercializing the technology will yield positive economic rents, should the market accept the product.

We begin our analysis with high potential social benefits and low potential social costs found in quadrant one. The industry competitors possess significant evidence of the value of the new technology to society while the opponents of the quasi-market encounter challenges to substantiate their position. We believe the strategic implication in this case to be a public relations approach as suggested by Zeithaml and Zeithaml (1984). The primary result is to discredit the quasi-market forces, create or reinforce support for the adoption of the technology, and influence regulators to the advantage of the industry. The firms
may also engage lobbying, defined as a political action strategy, and use a coalition strategy through industry associations (Zeithaml and Zeithaml, 1984) as a secondary strategic approach.

FIGURE 1

Impact Of Biotechnology Innovation In Agrochemical Industry

Relatively low social costs and benefits characterizes quadrant two. Industry proponents and opponents confront similarly weak positioning to justify support of their cause on the basis of social welfare. Thus the ability of either stakeholder group to influence the non-market regulators is relatively minimal. As a result, firms should engage in minimal intervention to influence quasi-market participants. Voluntary action, defined by Zeithaml and Zeithaml (1984) as management of interest groups, is an appropriate strategic response. This approach recognizes the concerns of the quasi-market stakeholders at a relatively low cost and perhaps leads to a mutually acceptable outcome. It also allows for the outcome that the two stakeholder groups agree to continue to disagree, which while being less preferable, is not detrimental since in this case quasi-market stakeholders, similar to market stakeholders, have low ability to influence regulators on the basis of social welfare. Additionally, it is our expectation that as social costs decrease, regulations tend to be more favorable from an industry perspective. A secondary strategic initiative is political action to influence non-market regulators, although not based upon a social benefit argument.
Quadrant three presents the scenario of high potential social benefits and costs, the firm confronts significant opposition to the technology, but convincing evidence exists to support adopting the technology. This is the segment in which the transgenic crop industry finds itself. To reduce or eliminate the strongest opposition to adoption of new technology, we believe the firm needs to create partnerships with all the stakeholders: market, non-market, and quasi-market alike. Through cooperation, industry competitors can amalgamate resources and present a united approach to help determine as favorable industry regulations as possible. Included in the market partnership will be buyers and suppliers, both of which should be positively disposed to the new technology. The arrangement
provides quasi-market partners with a legitimate avenue to engage in dialogue with the proponents and ensure that their concerns are recognized and potentially part of the new regulations. Ideally the firm would move to dependence development, whereby the quasi-market stakeholders become dependent on the organization (Zeithaml and Zeithaml, 1984). Such an arrangement should work smoothly to create a mutually acceptable outcome to minimize or eliminate further and/or continued strong opposition. Should the arrangement fail to placate quasi-market partners, the industry participants still have created ammunition to use in a secondary strategic approach of political action and public relations campaigns in a coalition (Zeithaml and Zeithaml, 1984). The purpose being to convince the public of their willingness to cooperate and the quasi-market forces unwillingness to negotiate mutually acceptable outcomes. The non-market player, the government(s), set the regulation in partnership with market and possibly quasi-market forces.

The fourth quadrant contains the least tenable scenario from an industry perspective. Market stakeholders need to convince non-market and quasi-market stakeholders to accept and/or reasonably regulate the new technology. From the social welfare perspective quasi-market stakeholders hold the advantage to support their opposition to the new technology, while market participants are weakly positioned. Thus the market stakeholders confront their greatest challenge to successfully commercialize the new technology. Our recommended strategic response is co-optation. Zeithaml and Zeithaml (1984) characterize this strategy as incorporating external elements into the internal decision-making process with the intended outcome of "alarming threats to its stability or existence." The inclusion of quasi-market forces in the firm's internal decision-making process allows their concerns to be voiced and debated in private, yet the process can be promoted publicly to reduce negative perceptions about the new technology. Additionally, non-market regulators cognizant of the process may be more favorably disposed to market stakeholder influence. A secondary strategy is partnership with non-market stakeholders through a joint industry-government task force to be part of the decision-making process. If this is not possible, the firm has the option of political action.

CASES OF CORPORATE STRATEGIC APPROACHES

In this section we discuss three case studies on corporate responses to develop markets for transgenic crops. None of the three firms has been able to create a dependence development of the quasi-market forces and find their strategies to be located outside of quadrant 3. As a result, all have experienced some difficulty in creating and accessing global markets for GM crops. The three firms for the case studies are Monsanto, Syngenta, and Aventis CropScience.
Monsanto

Monsanto has had limited success globally commercializing their transgenic seeds as the U.S. market remains the mainstay consuming community. Monsanto (2001c) recognizes the challenges of marketing GM seeds stating in their 2001 10K report:

The development and sales of our products have been, and may in the future be, delayed or impaired because of adverse public perception or regulatory concerns about the safety of our products and the potential effects of these products on other plants, animals, human health and the environment.

Clearly the firm acknowledges the ability of quasi-market and non-market forces to strongly influence the acceptance of transgenic crops. The firm has adopted an approach to work more closely with governments in the development of regulations and uses public relations efforts to inform the public and consumers of the benefits of transgenic production. However, Monsanto has not been able to create successful partnerships with all non-market forces and appears to have zero partnerships with quasi-market forces.

In terms of nomenclature the firm has implemented public relations, political action, coalition, and voluntary action strategies. These are evident in Monsanto's new pledge that the firm adopted in 2000 to address many of the quasi-market, as well as non-market, concerns. Specifically in response to ongoing opposition Monsanto has pledged to respect all such concerns, provide accessibility to published scientific study, create dialogue with all parties, and generally act in a socially responsible manner (Monsanto 2001d).

The firm's primary strategies encompass quadrants 1 and 2, and its secondary strategies are found in quadrants 1, 2, and 4. We believe the firm will continue to confront challenges in globally commercializing the transgenic seeds until it engages the prescribed primary strategies of quadrant 3.

Syngenta

The result of a merger and subsequent spin-off of Novartis Agribusiness and Zeneca Agrochemicals businesses, Syngenta became an independent competitor in 2000. Hoovers (2001) reports this transaction as a function of "poor agrobusiness sales that stem, in part, from the controversy surrounding genetically modified seeds." Similar to Monsanto, this company also confronts challenges to commercialize transgenic seeds and views the acceptance of biotechnology as a long-term process (Syngenta, 2000, 2001).

The strategies engaged by Syngenta are political action, voluntary action, coalition, and public relations, the latter of which might be a strength for the firm as an employee was recently awarded the NAMA Award of Excellence for
Public Relations (“Awards of Excellence,” 2001). This primary strategic choice set positions the firm in quadrants 1 and 2 of Figure 2, and as a secondary strategy in quadrant 3. The challenge for the firm is to develop a primary strategy for quadrant 3, where the industry is positioned. This strategic shift will hasten the acceptance of GM seeds by non-market and quasi-market forces.

Aventis CropScience

As an entity, Aventis CropScience had a relatively short life span. In 1999 as a result of the merger between Hoechst and Rhône-Poulaune, the companies’ crop sciences businesses were combined to create Aventis CropScience. Shortly thereafter Aventis, the parent company, decided to divest the crop science business for competitive reasons, including a realization that expected benefits of synergies between pharmaceuticals and plant biotechnology would take longer than expected (Aventis, 2001a,b). In 2001, with just two years of operations as a major competitor in the agrochemical industry, Aventis CropScience was taken over by Bayer in 2001.

Aventis CropScience has dealt with adversity regarding transgenic crops. StarLink, a GM corn crop approved for use as animal feed found its way into the human food chain in a variety of products. This led to a public relations nightmare for the firm, resulted in the ban of U.S. grow corn imports by Japan, and added fuel to the quasi-market stakeholder claims of the dangers of transgenic crops. Internally, Aventis responded by implementing policies to consider the ethical and cultural concerns expressed by relevant stakeholders in their new product research and development, a voluntary action strategy. Additionally, the firm engages strategies of political action, public relations, and coalition. Similar to the previous two competitors, Aventis CropSciences has not implemented a primary strategy as found in quadrant 3. Likewise, the failure to develop such an initiative will continue to hinder the firm’s ability to globally commercialize transgenic crops.

CONCLUSION

We developed a conceptual framework to assess the impact of agricultural biotechnology on market, non-market, and quasi-market forces as well as corporate strategies. Our case studies demonstrate that corporate strategies do reflect transgenic crop technology directly through corporate investment in research and development and commercialization efforts and indirectly through responses to non-market and quasi-market forces. It is the latter force, quasi-market that is of particular interest since this stakeholder group has sustained a formidable effort to slow and/or halt the acceptance of GM crops.

The industry participants toil to globally commercialize transgenic crops.
principally through strategies of public relations, voluntary action, political action, and coalition. All of these strategies have yielded minor success on a global basis. Consistent with our framework this outcome is a result of the failure of the studied firms to develop the primary strategies as presented in quadrant 3, Figure 2. The industry confronts high potential social costs, yet enjoys high potential social benefits: the critical factor is to implement strategies that will negate the quasi-market forces opposition and positively influence the development of non-market regulation.

REFERENCES


Monsanto. (2001c, March 25). Monsanto 10K. http://ezproxy.oswego.edu:2077/universe/document?_m=081b5bce497814e298c3051d0cc7cfa&_docnum=13&wchp=dGLSsiS-1SrzV&md5=2d8161445150575d26981d539cc68a06


