Biodiversity, Labelling and Other Issues in the Marketing of GM Products

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ABSTRACT

The marketing of genetically modified (GM) products, especially those derived from transgenic crop plants, has been plagued by regulatory and consumer perception issues. Concerns involving the effect of GM crop cultivation on biodiversity and the environment have been addressed by the Convention on Biological Diversity (CBD) under the UNEP. These concerns led to the development of guidelines which became known as the Cartagena Protocol on Biosafety. The issue of the safety of foods derived from genetically modified organisms (GMOs) has been taken up by the Codex Alimentaris which has provided guidelines for risk assessment and management. Consumer sentiments have led to regulations on the labelling of GM foods and there are provisions for this in several agreements under the World Trade Organization. Economic analysis showed that currently the farmers and technology suppliers are the gainers in this business. Whether consumers will see any benefit in future depends on the type, regulation and perception of GM products.

INTRODUCTION

Concerns with genetic engineering were first raised by a group of scientists at the Asilomar Conference in 1975 who called for measures to prevent the accidental release and proliferation of genetically modified bacteria outside the laboratory (Berg *et al*., 1975). This occurred soon after the technique of gene splicing or *recombinant DNA* was discovered by scientists working at Stanford University in the USA. The power of this technique lies in its ability to enable deoxyribonucleic acid (DNA), the chemical component of genes, from different sources to be combined to give rise to new forms of biologically functional entities. From this technique came *modern biotechnology*. The recombinant DNA technique has been variously termed *genetic engineering*, *gene manipulation* and *genetic modification* (GM). Ever since the first recombinant DNA

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experiments were carried out at Stanford in 1973, the technique has been applied to viruses, plants and animals. The organisms created through the use of this technique became known as *genetically modified organisms*, or GMOs. They are also said to be *transgenic*. The foreign gene incorporated into the GMO is called a *transgene*.

The Codex Committee on Food Labelling (CCFL) defines genetically modified/engineered organism as an organism in which the genetic material has been changed through modern biotechnology in a way that does not occur naturally by multiplication and/or natural recombination. According to the Cartagena Protocol on Biosafety, the term *modern biotechnology* is defined as the application of:

- *in vitro* nucleic acid techniques, including recombinant DNA and direct injection of nucleic acid into cells or organelles, or
- fusion of cells beyond the taxonomic family that overcome natural physiological, reproductive or recombination barriers and are not techniques used in traditional breeding and selection.

It is anticipated that the effects of GM technology will bring about revolutionary changes in healthcare, agriculture and industrial manufacturing. It is thus no surprise that issues pertaining to GM technology are today high on the agenda of several world fora. Among the issues discussed are concerns on the environmental effect of GMOs, economic repercussions and ethical considerations. Issues arising from trade in GMOs and their products have been implicated in the implementation of several agreements under the World Trade Organization (WTO).

This paper will discuss some of these issues in the marketing of products derived from GM crops and examine their potential effects on the oils and fats market.

THE LIFE SCIENCE INDUSTRY

Modern biotechnology has spawned a new industry which is known as the *life science industry* in Wall Street. The industry, made up of 416 public-listed companies worldwide, generated over US$ 41 billion in revenues in the year 2002 (Lähteenmäki and DeFrancesco, 2003). About 70% of these companies are in the USA, with the European Union (EU) having the second largest number. In the EU, 45% of the companies are in the United Kingdom.

The life science industry currently comprises the pharmaceutical, agricultural and chemical manufacturing sectors, but it is predicted that others such as environmental, mining, energy and robotics will become involved (Enriquez and Goldberg, 2000). In fact, information and communication technology (ICT) and nanotechnology are now part and parcel of biotechnology.

Agribiotechnology

The agribiotechnology (or agbiotech) business, a sector of the life science industry, is today dominated by a handful of multinational companies (MNCs) whose core businesses were originally in agricultural chemicals. In recent years, some of these have acquired seed companies in the effort to complement their chemical sales with the production of herbicide-tolerant GM crops (King, 2001). In 1997, five of the largest firms in the agrochemical and seed business accounted for nearly 60% of the pesticide market, over 21% of global seed sales and 100% of the GM seed market (OECD, 2000a).

In 2002, it was estimated that 58.7 million hectares of land in the world were under transgenic crops (James, 2003). For that year, the most dominant crop grown was herbicide-tolerant soyabean covering an area of 36.5 million hectares, that is, 62% of the total area of GM planting. Most of the GM crops grown were herbicide-tolerant (glyphosate-resistant) or insect-resistant (conferred by transfer of the *Bt* gene). For canola, herbicide-tolerant varieties covered 3.0 million hectares (5% of the global transgenic area), mainly in Canada and the USA. A total of 14 countries had transgenic plantings in 2002, with USA leading in area, followed by Argentina, Canada and China.

In 1998, the International Service for the Acquisition of Agribiotech Applications (ISAAA) predicted that the world market for GM crops would be US$ 3 billion in 2000 (James, 1998). However, in that year, Monsanto itself had revenues of US$ 5.5 billion. The industry has indeed grown at a surprisingly rapid rate. By the year 2010, it could be worth as much as US$ 25 billion (James, 1998). More optimistic estimates put the value of GM crops at US$ 75 billion by the year 2020 (Josling and Babinard, 1999).

ISSUES IN MARKETING GENETICALLY MODIFIED (GM) PRODUCTS

The introduction of genetic engineering in agriculture has been met with much debate and scepticism. Although higher yields and better quality foods and feeds from GM crops have been identified as potentially useful for alleviating world hunger and

ensuring better health, especially in the less developed countries (Kendall *et al*., 1997), the controversies and debates continue unabated. However, it is undeniable that the technology is far from being proven, given that it has been used commercially for less than a decade. In these early days, several controversial issues surround the application of the technology. Chief among these is the perceived hazards GMOs may have on the environment. The economic issues of production and marketing of GM products are also of concern. Globalisation of trade and other aspects of the WTO agreements could impact trade in GMOs and their products with uncertain consequences.

Biodiversity and the Environment

The effect of field release of GM crops on the environment has been one of the earliest concerns raised. The issue at hand is whether transgenes present in GM crop plants can be transferred to other organisms (horizontal gene transfer) thereby changing the profile of biodiversity or contaminating established varieties. Critics of the GM technology were concerned that herbicide resistance genes could be transferred to the wild relatives of GM crops thereby making these wild plants resistant to herbicides and becoming uncontrollable weeds. The advocates, however, claimed that the risks are small or non-existent. Although instances of gene flow from crop plants to wild relatives have been documented, there is still insufficient data to support the concerns and claims of either the critics or the advocates (National Academy of Sciences USA, 2000).

The effect of pesticide-producing transgenic crops on non-target organisms in the ecosystem is another point of concern. These non-target organisms include beneficial insects and insects of aesthetic value. The report on the effect of ingestion of pollens from *Bt* corn by Monarch butterflies reared in the laboratory has been much publicised by the press (Losey *et al*., 1999). *Bt* is the gene for the endotoxin produced by the bacteria, *Bacillus thuringiensis*, which kills the larvae of certain insects when ingested.

In addition, there is concern that the target insects may develop resistance to the *Bt* endotoxin, with devastating consequences. In order to delay this process, attempts have been made to introduce more than one form of the *Bt* gene into a crop plant (Moellenbeck *et al*., 2001), the rationale being that it would take a longer time to develop resistance to both types of endotoxin.

Although there is yet to be substantiable evidence that the release of GM crops can cause environmental damage (Conner *et al*., 2003), several countries already have in place biosafety guidelines or regulations for risk assessment of GM crop field releases. Risk assessment entails consideration of the host organism and the transgene and their effects on the environment. It also requires the identification and quantification of potential hazards, and how these hazards should be handled should they occur (Williamson, 1996). Data on which such an assessment of risk can be based are, however, difficult to come by, but efforts are currently underway (Dale *et al*., 2002).

Transgenic organisms are used not only within the boundaries of their country of origin. There is an increasing trade in these organisms and their products. For this reason, Article 19.3 of the Convention on Biological Diversity (CBD) called for an international protocol to safeguard natural biological diversity against any adverse effects GMOs may have by regulating the transboundary movement, handling and use of *living modified organisms* or LMOs. For this purpose, more than 130 countries negotiated for over five years for a set of guidelines which were adopted on 29 January 2000. These guidelines, developed on a precautionary approach, became known as the Cartagena Protocol on Biosafety. Under this protocol, Advanced Informed Agreement (AIA) procedure will apply to the introduction of GM seeds, living fish and other LMOs into the environment (Secretariat of the Convention on Biological Diversity, 2000). A much-debated issue during the negotiation of this protocol is whether the products of LMOs should also be subjected to the AIA procedure. The developing countries also called for the inclusion of mechanisms for liability and redress for environmental damage caused by the release of LMOs. In the final version of the protocol, products of LMOs (products thereof) were not included, and the issue of liability and redress will be taken up at a later date.

Consumer Concerns

Compared with environmental issues, the issue of public acceptance is more difficult to resolve. The response of consumers to GM products, especially foods, varies from country to country. At the extreme, consumers in the EU are averse to GM crops and their products. Consumers in the USA are seemingly untroubled by the technology. The survey reported by Gaskell *et al.* (1999) indicated that the reasons for this discrepancy lay in three factors. First, there was greater media coverage on GMOs in the EU than the US, and it was found that public

concern is proportional to media coverage. The second factor is trust in the regulatory procedures. In the USA, as far as possible, regulation of GMOs and their products were put under existing laws. In contrast, the EU looked upon GM products as novel requiring novel regulatory provisions. The public in the USA had more trust in their national regulatory authorities than the Europeans. The last factor was textbook knowledge. It appears that there was no correlation between knowledge and the attitudes of people. It is thus doubtful whether efforts to educate the public in GM technology will make a difference. However, it was evident that recent food safety scares, notably the occurrence of bovine spongiform encephalopathy (BSE) has put the European public on the alert.

Two issues emerge when consumer concern on GM foods is discussed. First is the safety of the food, and second, whether GM foods should be labelled.

Food safety. The safety aspects of GM foods have been addressed by several eminent organizations. A recent report by the United Kingdom's GM Science Review Panel concluded that available research shows that the risk of GM crops to human health was very low but cautioned that there could be adverse environmental effects (King, 2003). In the report of the Joint FAO/WHO Expert Consultation on foods derived from biotechnology (FAO/WHO, 2000), it was acknowledged that safety assessment of GM foods should be conducted on a case-by-case basis. The Consultation advocated the use of the concept of *substantial equivalence* in providing assurance of the safety of GM foods. On the issue of allergenicity, it was recommended that if the GM food contains the product of a gene from a source that has known allergenic effects, then the gene product should be assumed to be allergenic, unless proven otherwise. The expert panel convened by the Royal Society of Canada (2001), however, did not advocate the use of the concept of substantial equivalence in assessing food safety. The panel also called for application of the *precautionary principle* as the framework for assessing new technologies, including GM foods. A report prepared by the Royal Society of London (2000) and six other Academies of Sciences called for the long-term monitoring of the effects of GMOs and their products on human health. This view was echoed by the OECD Conference held in Edinburgh on 28 February to 1 March 2000 (OECD, 2000b).

In comparison to the other reports on GM food safety, the report of the National Academy of Sciences USA (2000) was the most optimistic. The report stated that there was no evidence that foods on the market are unsafe to eat as a result of genetic modification. It is obvious from the differences in opinion of these expert groups that the jury is still out with respect to whether GM foods are safe or not.

Of pertinence to the issue on the safety of GM foods, the Codex Alimentaris Commission (CAC) adopted a landmark agreement on 9 July 2003 which provided standards for risk analysis and safety guidelines for assessing both direct and indirect risks of foods derived from biotechnology (Haslberger, 2003). These guidelines are applicable for the scientific assessment of GM plants and microorganisms. They are applicable to pre-market safety evaluations, product tracing for recall purposes and post-market monitoring. They do not address issues related to environmental, ethical, moral or socio-economic issues. The document recognizes the concept of *substantial equivalence*. The adoption of these guidelines by the CAC has important implications as the WTO is looking to Codex in the settlement of disputes.

Food labelling. The issue of the safety of GMOs and their products when used as food and feed is often clouded by religious, cultural and ethical considerations. More often than not, human perception rather than science prevails in these discussions. For this reason, the consumers' right to know is the predominant factor behind the decision to label GM foods. Thus, for transparency, mandatory labelling of GM foods has been implemented in the member states of the EU. On 2 July 2003, the European Parliament passed laws which brought down the level of measurable GM DNA or protein in foods which required labelling from 1% to 0.9% (Pomeroy, 2003). Several other countries, including Australia/New Zealand and Japan also have mandatory labelling requirements. China introduced mandatory labelling and certification on 6 June 2001. India has indicated support for mandatory labelling. The USA and Canada require labelling only in cases where there is health or nutritional concern.

Trade-Related Issues

As GM crops emerge from the laboratories into the marketplace, they will become subjected to trade regulations. The GM crops commercialized to date are commodity crops which are traded internationally. As such, it is pertinent to examine how the regulations under the WTO will impact trade in GMOs and their products.

Effect of World Trade Organization (WTO) agreements on genetically modified organisms (GMO) regulations. The WTO was established on 1 January 1995 with the conclusion of the Uruguay Round of trade negotiations on 15 April 1994. The WTO succeeded the General Agreement on Tariffs and Trade (GATT) as the multilateral institution which deals with international trade issues. In principle, the WTO is not involved with GMO regulations. Each member country is free to implement its own domestic rules governing GMO and their products. There are, however, three areas in the use of GMOs that could implicate WTO agreements. The first of these involves the constraints on national import regulations for GMOs as embodied in the WTO's core principle of non-discrimination. In the second area, there is the issue of harmonization of the Cartagena Protocol on Biosafety with the Sanitary and Phytosanitary (SPS) Agreement and the Technical Barriers to Trade (TBT) Agreement under the WTO. The third area involves repercussions of implementation of the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement which require member countries to provide intellectual property (IP) protection to biotechnological processes and transgenic organisms.

Non-discrimination rule. The non-discrimination clause of the WTO, referred to as the *Most Favoured Nation (MFN) principle*, prohibits member countries from discriminating between imports from a WTO member country and the *like* products of another WTO member country. In the context of GM products, there is the issue of whether a country has the right to prohibit the import of a GM product based on its GM status, if that country allows the import of an equivalent non-GM version of that product. In addition, the MFN principle also requires member countries to provide equal treatment of imported products and the *like* domestic products. In this instance, once imported goods cross borders, the importing country has to treat these no differently from the domestically produced variety. Therefore, in the case of GM testing, it is not possible to impose additional tests on imported food ingredients if these same requirements are not imposed on the domestic products. However, in practice, most countries require GM testing for both imported and domestic *like* products, thus eliminating any violation of the *national treatment* principle (Josling, 1999).

The controversy surrounding the trade in GM products with respect to the non-discriminatory obligations of the WTO lies mainly in the interpretation of the term *like product*. At the centre of this issue is the argument whether the process used to develop a product matters. For example, can soyabean oil from GM and non-GM plants be regarded as *like* if the composition of the oil is not changed? This *process-versus-product* debate is still very much alive (Saner, 2001). This debate is important because if one takes the *process view*, then GM imports cannot be discriminated against if there is a *like* non-GM product produced domestically.

Protection of human, animal and plant health. The SPS Agreement provides the ground for justification of trade barriers that are deemed necessary for the protection of human, animal, plant life and health. When adopting measures aimed at protecting life and health, SPS member countries are required to base their standards on risk assessment in two steps (Caswell, 2000). First, risk assessment should be based on scientific principles. In the event that scientific evidence is not available or insufficient, then SPS members are obliged to take into account available pertinent information, including that from the relevant international organizations as well as sanitary or phytosanitary measures applied by other members (Eggers, 1997). In the second step, a measure has to be proven to be necessary (policy level). The measure, however, should not be more trade restrictive than required to achieve the appropriate level of sanitary or phytosanitary protection, taking into account technical and economic feasibility, giving the connotation that there is to be a balance between trade and safety measures. However, the WTO clearly states that the SPS Agreement allows countries to give priority to food safety, animal and plant health over trade, provided there is scientific basis for the safety requirements (Eggers, 1997). SPS measures, therefore, do not appear to contradict the requirement for risk assessment under the Cartagena Protocol on Biosafety. It, however, does not appear to be in line with the precautionary principle which is invoked in Article 10(6) of the protocol.

The difference between the TBT Agreement and the SPS Agreement is relevant in the issue of food safety. This distinction is important as it determines how standards should be developed. In the event the measure is to be adopted to safeguard human, animal and plant health, then it falls under the SPS Agreement. Food safety regulations to ensure compositional integrity of a product come under the TBT Agreement. The labelling of GM foods is thus a TBT matter.

A major unresolved issue with respect to how far the SPS and TBT Agreements cover GM products is

the case of consumer concerns. Without scientific justification of risk, a ban on GM products cannot be defended under SPS rules. However, under TBT regulations, there is no requirement that domestic standards be based on science. It is therefore allowed that imported GM products be labelled but not those produced domestically (Josling, 1999).

The SPS Agreement will adopt the standards set by three organizations, namely, the International Plant Protection Convention (IPPC), the International Office of Epizootics (French acronym, OIE) and the Codex Alimentarius Commission (CAC, or Codex). The IPPC takes care of plant pests and diseases, while the OIE is involved in disease control in animals. The function of Codex, a subsidiary of the World Health Organization (WHO) and the Food and Agricultural Organization (FAO), is the establishment of standards and codes of practices for food and other substances affecting human health. Codex has initiated negotiations on GM food labelling (CAC, 2001).

Intellectual property protection. The TRIPS Agreement requires that all WTO member countries have in place at least minimal intellectual property (IP) protection on goods traded. Currently, most chemical industrial processes are covered by patents. The TRIPS Agreement is advocating that biotechnological processes be also brought under patent protection. The contentious issue in the TRIPS Agreement, however, is the obligation of member countries to provide IP rights (IPR) to plant and animals. This has stirred debate on the morality of patenting life.

Article 27.3(b) of the TRIPS Agreement, however, allows member countries to exclude plant varieties from being patentable. But these countries will be required to use other forms of IPR and this can be done through a *sui generis* system (a system of its own kind) (Seiler, 1998). One such means of protection, termed Plant Breeders' Rights (PBR), has been practiced in Europe for more than 60 years (Berland and Lewontin, 1986). PBR are accorded to members of the International Union for the Protection of New Varieties of Plants (UPOV). For countries which are not part of the UPOV Convention, a comparable system called Plant Variety Protection (PVP) can be used as an IPR instrument.

In the agbiotech sector, the obligation of member countries to implement IPR to plant and animal varieties has caused some debate. Much of the controversy stems from the fact that the developing and less developed countries lack the capacity and resource to implement IP protection. The least developed nations have been given till 1 January 2005 to fulfil this obligation.

Another contentious issue is the fact that if plant varieties are protected under patent, farmers will have to pay a technology fee and will not be allowed to use saved seeds for the next season's planting. This issue has been played out in the courts in Canada recently in which Monsanto successfully sued a Canadian farmer for using the company's patented *Roundup Ready* canola without signing the *technology use agreement* (Fox, 2001).

On the other side of the coin, IP protection is the life-blood of the agbiotech business. With availability protection of IP, companies are assured that they can recoup their investment. This generates more investment in R&D which in turn generates new knowledge. However, for the common good, there has been a call for the life science companies to share some of this new knowledge with the less developed world (Conway, 1999). Instead of patents, seed companies are encouraged to use instruments such as the PVP system in developing countries in cooperation with public breeding agencies so that farmers are allowed to save seeds for the following season's planting. Such a system will also allow further improvement of the varieties by traditional breeding, a process that could allow the introduction of the desirable traits into local varieties. In this win-win situation, the seed companies could continue selling their patented varieties in the countries which can afford and desire them, while providing poor countries access to the technology for improving local varieties.

Economic Considerations

Regulatory requirements, trade issues and public perception have introduced special considerations in the marketing of GM products. In the present scenario, customer preference for non-GM foods in some countries has put the non-GM counterpart at a premium to the GM version. Who among the players here gain from GM technology is another interesting question that will determine the future of the GM market.

GM crop adoption. Despite the controversies, the adoption rate of GM crops by farmers has been surprisingly rapid. On the global level, the area of transgenic crops has been growing at a rate of more than 10% per year since 1996 (James, 2003). In 2002, 22% of the global cultivated area was under transgenic crops, as compared to 19% in 2001. Planting of transgenic soyabean increased from 46% of the total area in 2001 to 51% in 2002. Transgenic canola

plantings increased from 11% in 2001 to 12% in 2002.

Studies carried out at the University of Missouri-Columbia in the US showed that the rate of adoption of GM soyabean, corn and cotton surpassed that of hybrid corn (Kalaitzandonakes, 1999). In the Agricultural Resources Management Study (ARMS) survey carried out by the USDA's Economic Research Service (ERS) and the National Agricultural Statistical Service (NASS) on the adoption of GM cotton, corn and soyabean, comparisons were made on yield and pesticide use (USDA, 2001). This study also showed dramatic increases in the adoption of these GM crops in the mid 1990s. Yield increase, pesticide use and net returns varied with the crop and the transgene used. Adoption of herbicide-tolerant soyabean resulted in a small but significant yield increase and reduction in herbicide utilization. However, there was no reduction of herbicide use in the adoption of herbicide-tolerant cotton. For *Bt* cotton, significant increases in yield were observed with decrease in insecticide utilization.

Studies carried out in herbicide-tolerant soyabean (Roundup Ready™) or RR soyabean (Gianessi and Carpenter, 2000) and canola (Roundup Ready™ and Liberty Link™) (Canola Council of Canada, 2001) point to almost the same factors responsible for the rapid adoption of transgenic varieties. Farmers cited efficient weed control and reduction in tillage and herbicide usage as the main reasons for adopting the herbicide-tolerant crops. In the case of RR soyabean, farmers had to apply the herbicide only once as compared to the three to four applications required by the non-GM varieties. Recent estimates made in a study carried out by the National Centre for Food and Agricultural Policy in the USA put the average saving in weed control through the adoption of RR soyabean at US$ 15 per acre (Anon, 2001).

In terms of net return, although seed cost is higher for the GM varieties due to the charge for technology use, the reduction in pesticide use and the lower cultivation costs appear to offset the higher outlay for GM seeds (McBride and Books, 2000). It is thus not surprising that adoption of herbicide-resistant soyabean has been on the increase globally (James, 2003).

Market differentiation and segmentation. With the implementation of labelling, differentiated GM and non-GM products are likely to emerge. Labelling would require that testing for GM content be made at every step of production and it has been estimated that such testing will add 30% to the cost of the final product (Anon, 1999). However, as customers are willing to pay higher prices for differentiated products, the business will still be profitable to the producer.

The issue of *identity preservation*, that is, keeping GM and non-GM food components separate from *farm to fork* has been proposed as a possible solution to avoid labelling. However, in a segmented market, the question of who should bear the cost of segregating GM from non-GM products emerges. Generally, the cost is spread through the supply chain, but if the industry is vertically integrated, it is more likely that farmers will bear the largest portion of the cost (OECD, 2000a). In the long run, it is predicted that if anti-GM sentiments persists, the prices of GM products will be lower than those of their non-GM counterparts (Unnevehr *et al*., 2003). These factors could discourage the growing of GM crops.

QUO VADIS?

The United Nations Development Programme (UNDP) recognized GM technology as a plausible means for creating huge breakthroughs in medicine and agriculture (UNDP, 2001). This technology is much needed for increasing food production in the developing countries which are experiencing high rates of population growth. In the year 2050, it is predicted that the world population will be 9 to 10 billion (Federoff and Cohen, 1998). Of these, nine in 10 will live in the developing countries. Attaining acceptable qualities of life in these circumstances requires that food production in these countries will have to increase at unprecedented rates. This can only happen with technology intervention.

The widely held view that food insecurity exists in the world because of unequal distribution is true to a certain extent. However, failure to develop agriculture and increase food production locally is often the real reason behind food insecurity in the developing and underdeveloped countries (Alexandratos, 1998). It is in such countries that biotechnology could make the difference. In a World Bank report, Kendall *et al.* (1997) estimated that transgenic crops could help improve food yields by up to 25% in developing countries. But such technology is presently not within the reach of most underdeveloped countries.

Developments by corporations such as the *terminator* gene technique (US Patent No. 5 723 765), a means to render seeds sterile, have met with much criticism. On the one hand, this technique can be used to reduce environmental hazards of

accidental dispersal of transgenic seeds, and therefore, preserve the integrity of biodiversity, but on the other hand, it is also a means by which farmers can be made dependent on the agbiotech companies for their seed supplies.

Issues on the morality of the introduction of new technology are not easy to resolve. With new technology comes change, and when there is change, there will be winners and losers. But is there a compromise for a win-win situation? There should be one, or else the promise of the technology will come to nought. As stated by Polkinghorne (2000):

"If these problems are to be solved, there must be recognition of the common good, understood on a worldwide basis and calling for fairness in the policies of the big corporations and in the international regulation of biotechnological trading."

For the oils and fats industry, GM technology has slowly but surely crept in with the commercialization of herbicide-resistant transgenic seed oils and the production of GM oils of novel compositions (Murphy, 2003). The implementation of the WTO agreements as well as regional trade policies, such as those of the ASEAN Free Trade Area (AFTA) and the North American Free Trade Agreement (NAFTA), will inevitably lead to the liberalization of trade worldwide. This will be a challenge for producers of oils and fats (Commandeur *et al*., 1994). The ability to change storage oil composition in plants is of particular relevance, given the interchangeability in the usage of oils and fats. With reduced restrictions on trade, there would be much more competition among the producing countries, more so with the availability of the technology to change the composition of oils at will, as made possible through GM technology.

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