THE PUBLIC POLICY DISCOURSES ON GENETICALLY MODIFIED CROPS (I)

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Abstract

The introduction of genetically modified (GM) crops has been a subject of national as well as international discourse. The technology has been hailed by many as an extra-ordinary scientific revelation that could bring about enhanced food production and feed the ever-increasing population of the world. The technology has successfully produced improved quality crops with a better production capacity and an enhanced nutrient content. However, many people have voiced concerns on the potential risks of the technology on health, biodiversity, and the environment. Moreover, the commercialization, globalization, and monopolization of the technology remain to be a serious concern for the public. Public reaction on the GM crops is mixed and range from doubt and caution to outright hostility and total rejection. The deep division among the public in general and the scientific community in particular has brought about a range of broader public policy issues which have continued to be globally debated. This is the first part of the article, which is meant to briefly present and critically evaluate the major public policy issues surrounding the global GM debate.

Keywords : genetic modification, monopolization, commercialization, plant varieties, WTO, TRIPS, biodiversity, biosafety, terminator technology.

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1. Introduction

The discovery of the structure of the Deoxyribonucleic Acid (DNA) was a breakthrough in understanding cells, molecules, and proteins, which are the basis of all living matter. This great scientific discovery has allowed scientists to make genetically modified organisms by manipulating cells and transferring the genetic material, which govern a specific character from one organism to another in a laboratory. This process of genetic manipulation and transfer from one organism to another is called genetic modification or genetic engineering and the organism invented in this way is commonly known as genetically modified organism. In conventional breeding traits can only be transferred from a plant or animal to another plant or animal of the same or similar species. Genes from unrelated species do not naturally mix. But in GM technology, traits could be transferred between different species and even between plants and animals. For example, scientists have created a GM frost-resistant tomato by inserting in to it an anti-freeze gene from the flounder fish.[1)]

Commercial cultivation of genetically modified (GM) crops started in the United States (US) in 1996 and has now expanded through out the world. Until 2002 only four countries account for 99% of the GM cultivation and the number of major GM crop growing countries has increased to six in 2003. In addition to the major GM crop growing countries (the US, Canada, Argentina, China, Australia and South Africa), field trials of GM crops of one kind or another are taking place in countries such as Thailand, India, Indonesia, Colombia, Argentina, Mexico, Kenya, Zambia and South Africa, while research in GM crops continues in Egypt, Ethiopia, Nigeria, Uganda, and Zimbabwe.[2)] In 2002 commercially grown GM crops covered 58million hectares, equivalent to two and a half times the land area of the UK and an estimated 5.5 million farmers around the world are now growing GM crops on a commercial scale.[3)]

1) "GM Science", the BBC (http://www.bbc.co.uk/science/genes/gm.genie).
2) Pardey PG & Nienke MB "Slow magic: agricultural research and development after Mendel", International Food Policy Research Institute (IFPRI) 2001. Also Kuyek D "GM crops in Africa: implications for small scale farmers." GRAIN, 2002.
3) James C "Global status of commercialized transgenic crops" ISAA Briefs, 2002.

The principal GM crops grown commercially in 2003 are soybean, maize (corn), cotton, and canola.

This extraordinary scientific revelation has been hailed by many as a critical tool to bring about food security to the ever-increasing population of the world while others call it unwarranted interference in nature, which may bring about complicated problems to humanity.

There is a great deal of controversy about the introduction of GM crops. Many are concerned with its impact on health, biodiversity, and the environment. Others argue that GM crops have been rigorously tested and offer many benefits. The reaction of the public to the GM technology has been mixed and ranges from doubt and caution to suspicion and from skepticism to outright hostility and rejection.

A lack of consensus, and even the deep division, among the scientific community and the public at large on the GM has brought about a range of broader public policy issues on the technology, which still continue to be part of a major global discourse.

2. Potential benefits of GM Crops

GM technology claims to offer opportunities to accelerate the efficiency and extent of further crop improvement by the transfer of genes with traits of resistance to pests, diseases, herbicides, and harsh environmental conditions as well as with quality traits such as improved flavor and enhanced nutritional content.

This way, it is said, GM could be used as a tool to fight hunger and food insecurity. The GM industry alleges that the technology has the potential to develop crops which resist harsh environmental conditions such as drought; which grow in soils with high level of acid or salt; which are resistant to viruses, pests and bacteria and crops with an enhanced nutritional content.

The GM industry has already developed crops with the characteristics or traits

of herbicide tolerance and insecticide resistance.[4] Accordingly, crops like soya, canola, cotton, and maize have been engineered to tolerate certain herbicides.[5] The benefit of this is that herbicides could be used to kill weeds without at the same time damaging the crop itself.

Similarly, crops like maize and cotton are engineered to have insecticidal properties so that they would express a toxic to kill certain target pests resulting in less and less insecticide being applied in the farm.[6]

Hence given its promising potential, the GM industry argues, that the technology is a key tool for better production and future food security in the world.

3. Concerns on GM crops

Despite the potential benefits of GM technology to improve the reliability and quality of the world food supply, public and scientific concerns have been raised about the food safety, the environmental effects and the socio-economic implications of the technology. In addition to the potential risks inherent in the technology itself, several public policy issues have been raised and are being globally debated on the way the technology is owned and managed.

3.1. Concerns on risks inherent in the GM technology

The technology has different limitations and potential risks.

Firstly, in some situations the technology has not been able to bring about the result it promised to. Research findings on the capacity of GM technology to improve agricultural production tend to be divergent. While in some cases GM crops have allowed increased yields in some other cases they were not able to bring about increased crop production. For example, there have been reported increases in yields of Bt cotton in the US, Australia, South Africa and India.[7] On the

4) *Ibid.*
5) *Ibid.*
6) *Ibid.*
7) Mayer S "Genetically modified cotton: implications for small-scale farmers". *Action Network UK* 2002.

other hand, a study has showed that yields of GM cotton and GM maize did not change in most locations compared to non-GM varieties.[8] Similarly, studies in the US and Canada found that yields from GM soybeans are not higher than conventional high-yield varieties.[9]

These mixed results of the technology have brought about the contention that its claims and promises are just unreliable and unpredictable.

Secondly, although the findings on the long-term effects of GM crops on health tend to be inconsistent, it could at least be said that they remain unknown. Scientists advise that it is not possible to predict the long-term effects of GM crops on health and that continuous research and trials should be conducted in order to have a better understanding of their impact on health.

Thirdly, there is the concern on the impact of GM crops on biodiversity. Crop diversity is an important element for food security. Local farmers often cultivate large numbers of different plant species in the same field that are of considerable genetic diversity. These practices help farmers meet their livelihood needs as well as sustain local ecosystems.[10] This is how the farmers have been able to maintain varieties and preserve biodiversity for generations. It has been argued on the other hand that the commercial seed sector in general and the GM industry in particular is interested in cultivation of relatively few commercial crop varieties in monocultures. This would lead to genetic erosion as local varieties are replaced by high yielding varieties. For example in the Philippines, high yielding varieties displaced more than 300 traditional rice varieties that were the principal source of food for generations.[11] In the long run this genetic erosion could have an irreversible impact on the biodiversity, which may in turn seriously affect the whole environment.

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8) Pretty J "The rapid emergence of genetic modification in world agriculture: contested risks and benefits" *Environmental Conservation* Vol.28, 2001 (3).

9) Warwick H& Meziani G "Seeds of doubt: North America Farmer's experience of GM crops". *Soil Association* 2002.

10) Cromwell E. et.al "Agriculture, biodiversity and livelihood", *International Institute for Environment and Development*, 2001

11) "Crop varieties threatened by pressure on Seed banks", *International Herald Tribune*, 26 August, 2002

Fourthly, there is a concern on the environmental impact of GM crops. GM crops may pose threats on other plants, insects and in general the environment. Some of these risks stem from weeds and insects developing resistance to the chemicals applied to or expressed by the GM crops themselves and other occur when GM crops cross-pollinate with non-GM plants (genetic contamination). The US Environmental Protection Agency estimates that insects develop resistance to a chemical within three to five years of being constantly sprayed.[12] When insects become insecticide tolerant farmers need to apply more frequent and larger doses of pesticides to kill insects, which may have a serious consequence on the environment in addition to increasing the farm cost. There is already a proof in the US and Canada of gene contamination in which genes move from a GM crop to wild relatives, non-GM crops or other organisms.[13] Reports also show of the evolution of superweeds as result of gene transfer between GM crops and wild relatives where the latter acquired an insect-resistant character.[14] In connection to this, GM varieties of oil-seed rape and sugar beet faced a European-wide ban after field trials showed that the crops damaged wildlife and would have a long-term effect on bee and butterfly population.[15]

3.2. Concerns on access to the GM technology and related public policy issues

One of the strongest criticisms being echoed against the GM industry is that a few Transnational Corporations (TNCs) monopolize it. GM research and development requires a huge investment and the TNCs have the financial capacity as well as technological capability to invest a huge amount of money on GM research and development with a view to make profits. It can cost from $50 to $300 million to develop a GM crop from the laboratory to the market.[16] Owing to the huge investment the technology requires, most research and development in GM agriculture is conducted by the rich private, for-profit sector. For example, six TNCs controlled 98%of the market for GM crops and 91% of all GM crops grown world-

12) *Groundwork and Biowatch South Africa*, 2002.
13) Coghalan A. "Keep your distance" *New Scientist* Vol. 172, Nov 2001
14) "Genetic technologies: a review of development in 2002", *Genewatch UK*, February 2003.
15) *The Guardian*, (2003). Available at http://www.politics.guardian.co.uk.
16) Graff GD and Newcomb J, "Agricultural biotechnology at the crossroads", *Bioeconomics Research Associates*, 2003

wide in 2001 were from Monsanto Seeds.[17] These TNCs invest a huge amount of resources on GM research and development and heavily rely on Intellectual Property (IP) protection for the return of their investment and also for their profit. Many countries have already recognized GM products as inventions and hence qualify for patent protection. In fact the patenting and commercialization of GM crops has crossed domestic boundaries and has already become part of an international trade agenda. The agreement on the Trade Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO) has made IP an aspect of trade and set a minimum standard of IP protection at the international level to be applied at the domestic level.[18] Accordingly, member states of the WTO are obliged to provide IP or similar protection for new plant varieties including GM crops.[19]

The commercialization and the internationalization of IP protection on plant varieties has been a subject of a host of controversy.

The first is purely of an ethical concern. It is argued that man cannot create or invent living things and that claiming patent on life is claiming to be the Creator. The argument went on to say that patents on living things reflect human arrogance by treating scientists as Creator of living organisms.[20] According to this view, what GM technology does is just rearrange the existing genetic makeup of the plant, which is not invention of a new thing to qualify for patents and if the justification on patenting of plants is to encourage scientists, then the purpose could be served by different incentive measures and not by granting ownership over living things-which is not in the hands of man.[21]

The second concern is a concern on the global trend of monopoly of GM seed

17) "Crops and robbers: how patents jeopardize global food security", *ActionAid*, 2001
18) The World Trade Organization was established in 1994 replacing the General Agreement on Trade and Tariff (GATT). The 1994 Uruguay Round of Multilateral Trade Negotiations created the General Agreement on Trade in services and the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) under the umbrella of the WTO.
19) Article 27.3 (b) of the TRIPS requires member countries to provide protection of plant varieties through either patents, or a sui generis system or a combination of the two.
20) Shiva V, *Protect or Plunder? Understanding IP rights* (2001) 6.
21) Tewolde GE, "Patenting life is owning life" *Third World Resurgence*, No.106, June 1999.

production and sale. If the current trend of commercialization and internationalization of agriculture through IP continues, it may bring about monopoly of the seed industry in the hands of a few TNCs at the expense of traditional farmers. Farmers have been cultivating and innovating several plant varieties and supplying uninterrupted food supply freely for mankind from time immemorial. Monopoly right over seed will not only undermine the farmers invaluable contribution to the preservation and innovation of plant varieties but also denies them of their right to freely access the seeds for the production and preservation of which their contribution has been immense.

The third concern, which is related to the second, is that patent system of the WTO/TRIPS will allow the control of the biodiversity of the South by the North with out there being an adequate benefit-sharing scheme. The TNCs in the North have the technology and resources to engage in a vast GM research and development, which the South cannot afford. Hence, in the absence of a system of benefit sharing, the TNCs could easily take over the genetic resources of the South through patents. This may further aggravate the already wide gap in wealth between the North and the South. It is to be noted that the above concerns are not concerns over GM technology *per se*. They are rather on the way the technology is being handled and owned. There is no argument here that GM technology is bad or unnecessary; it is rather on the way protection is given to the technology.

4. Analysis of the current public policy discourse on GM crops

The international GM discourse has emerged in two polarized directions.

One totally rejects GM not only as futile and useless but also dangerous for human health, biodiversity the environment and future food security. Proponents of this view argue that organic and sustainable agriculture is the only way of insuring food security and preserving the environment and biodiversity.[22]

The second view alleges that future food security is in the hands of GM tech-

22) Mae-Wan Ho, "GM crops are neither needed nor beneficial" available at (http://www.i-sis.org.uk/jaguar.php).

nology. According to this view, the capacity of the organic and traditional agriculture is limited and will not be able to cop up with the ever-increasing population of the world. One proponent of this view says that 'organic agriculture and spreading around a bit of manure are not going to save the planet, feed the hungry or conserve wildlife and in a real hungry world there are no solutions other than technological ones'.[23]

These ideology-like and often polarized views seem to have seriously undermined the potential contribution of biotechnology as a science.

Total rejection of the GM as a worthless technology is simply contrary to scientific findings. It has now been proved, at least under some circumstances, that GM crops could result in higher yields, that they can reduce farm costs, that they could improve the nutrient value of crops, etc.[24] In a world of several millions of hungry and malnourished people, GM could offer crops which are rich in nutrients and minerals for those who need them most. Hence, it is not easy to reject as worthless the GM technology with an immense potential for improved crop production.

Similarly, the proponents of 'technology only' solution for food insecurity utterly failed to accept the limitations and potential risks of the technology. It is not difficult to imagine the potential risks of any new technology let alone the GM technology, which requires the manipulation of the sensitive and complex genetic materials of living things. In fact, it has been shown in different researches and field trials that the technology has indeed potential risks.[25] There is a potential risk of the transgenes from cultivated GM crops to wild relatives through pollination or through insects, pests to evolve resistance to the toxins produced by GM crops, and the risk of the toxins produced by GM crops affecting non-target pests.[26] By contaminating non-target plants or destroying the much needed and non-targeted pests, GM crops may affect the ecosystem and inflict serious damage

23) "Prince's war on GM condemns world to starve", *London Times*, 23 December (1999) 6.
24) Mayer (note 7 above).
25) Coghlam (note 13 above).
26) Genetic Technologies (note 14) above.

on the natural environment.

Above all, given the fact that the technology is relatively new and the alteration and manipulation of a living organism is very complex, it is difficult to fully consider the technology risk free with in a relatively short period of research and trials. The technology has to yet satisfactorily prove that it is fully risk free especially for food and human health.

The concern on the commercialization and monopolization of the GM technology and the consequent implication on farmers appears to be a valid concern. Indeed, the current trend of aggressive commercialization and corporate monopoly of the GM technology through patents should be a real source of concern. The commercialization and corporate monopolization of GM technology goes against the very livelihood of hundreds of millions of farmers who have been preserving and supplying seeds for mankind for generations and for free.

Apart from the ethical and moral concerns on patenting of life forms, the WTO/TRIPS approach on patenting of seeds will have a far-reaching consequence particularly to the third world subsistence farmers. It is unfair to give a monopoly rights to TNCs over seeds, which generations of farmers have been cultivating, preserving and supplying to mankind for free. Farmers in the developing countries who often practice a large measure of subsistence farming grow crops with local and domestic market focus. The crops are usually local food crops, which are not widely traded but saved from year to year and exchanged among farmers in the community. The WTO/TRIPS approach has failed to see this way of life of farmers. Hence, the fact that the WTO/TRIPS paradigm of IP protection has forgotten the contribution of farmers in preserving the same seeds the corporations claim monopoly rights is a miserable failure and should be a serious concern.

Apart from being unfair, the monopoly right will make the seeds inaccessible to the farmers. It will be a fatal blow to the subsistence farmers in the developing countries who have already been impoverished and marginalized by lack of investment, credit facilities (let alone government subsidies) and market access, if they

were to be required to buy the expensive patented seeds.

In general IP rights as recognized in the TRIPS do not recognize the crucial role traditional knowledge plays or the legitimate rights of farmers, indigenous people and local communities all of whom have been major contributors to knowledge and innovations in the sustainable use of biological resources in general and seeds in particular.

This doesn't mean that the biotechnology industry should not be rewarded for its contribution in the improvement of the seeds. The industry has been investing a huge resource on the development and marketing of GM crops and has developed improved quality seeds. To that extent it should be rewarded and encouraged. But this should not be made by excluding other contributors like local farmers. A mechanism has to be worked out where all contributors will be recognized for their contribution and share the benefit accordingly. All the contributors should be entitled to their fair share of the benefit. However, the monopolistic nature of IP rights does not give credit to those who deserve and allow benefit sharing among contributors.

Similarly, the biodiversity-rich South may wish to get technology transfer from the North in return for the exploitation of its resources. In view of the massive efforts of the North to protect its technology through IP systems, will it be out of logic and reason if the biodiversity-rich South wants to negotiate on its resourses, the available weapon at its disposal, so as to get in return technology transfer from the technology-rich North?

It could be interesting to raise some technical but still relevant issues in relation to the complaints raised by the South against WTO/TRIPS regime. Basically, WTO/TRIPS is a multilateral treaty where states willingly ratify or accede to. TRIPS, which commercialized and globalized intellectual property rights, came to force as a result of the Uruguay Round of Multilateral Trade Negotiations. The developing countries who are now crying loud against the TRIPS are part of the negotiation and most of them are party to the TRIPS agreement. Then why

didn't these developing countries raise the concerns they are raising now during the negotiations? And if they did (some did in fact presented their concerns) why did they accept the terms of TRIPS which they tell us now are unfair? In general, why did the South submitted to the TRIPS and make loud noise after the coming to force of the agreement, which it willingly entered into?

Well, there could be different possible reasons. The first could be lack of unity. It is true that in the history of the multilateral negotiations, the South had not been able to forge a common agenda and defend its common interests. Rather, it was always disunited and open to manipulation by the North. Lack of the necessary qualified and experienced negotiators could be another reason. Multilateral trade negotiations are highly technical processes, which require a high level of negotiation as well as technical skills in the area of international trade law. What is more, TRIPS is a very complex document, which may not submit itself for easy understanding and interpretation. The South generally lacks the necessary skilled and experienced trade negotiators who could easily understand the complex trade related documents and their implications as well. As a result, it could be said that the South was not able to foresee the implications of TRIPS during the negotiation and ratification time. The influence exerted and the diplomatic game played by the North during the negotiations could also have contributed to the South's easy surrender to the TRIPS.

TRIPS being an international agreement the parties are expected to implement it according to its terms. Hence, technically, the plausible solution available to the South is to forge unity within the WTO and initiate a strong and convincing proposal for the possible revision of the TRIPS agreement. To this end, Article 27.3(b) of the TRIPS agreement itself provides for the review of the provision on protection of new plant varieties after four years of the coming in to force of the agreement. Will the North accept the revision of the TRIPS in line with the demands of the South? That is yet to be seen but the indications are such that the North is unlikely to accept the demands of the South.

5. Will GM feed the hungry world?

One of the most attractive assertions of the GM industry is that the technology could offer an opportunity to feed the hungry. In view of the fact that hundreds of million of people are starved and that the number could increase with the increase of world population, the allegation indeed sounds very attractive.

But who are being starved? Why are they starved? Could the GM technology in its current position come to the rescue of the hungry? These are pertinent questions that have to be raised and answered in order to evaluate the opportunity of GM to feed the hungry.

Principally, people go hungry because of poverty. There is no doubt that poverty is the number one cause of hunger. Farmers in the developing countries, who are basically subsistence farmers, are so poor that they do not have the necessary resources at their disposal to invest in their farms. They do not have the means to buy the necessary fertilizers and chemicals. They cannot afford to get the necessary technology. They do not have credit facilities to buy their farming needs. The problem is further aggravated by structural problems like lack of access to and security on farming lands. The result of all this is a low level of production, shortage of food and finally famine. The contribution of GM technology to feed the hungry should be analyzed in light of these realities.

The truism, as things stand now, is that the GM technology is not only highly commercialized and globalized but also monopolized by a few TNCs. As stated earlier, the TNCs invest huge resources with a view to make profits. As a result of the high cost of production of the seeds and the desire to make profits the price of GM seeds are extremely expensive, at least for the subsistence farmers. What is more, the seeds are deliberately made to adapt to specific kinds of insecticides and herbicides, which are manufactured by these same corporations. Consequently, farmers are expected to buy the products in a package-both the seeds and the accompanying chemicals in a year-by-year basis. It is obvious that the poor farmers cannot simply afford to buy these products from the Corporations. The TNCs,

being motivated by profits, do not seem to have the interest to entertain the concerns of farmers. On the contrary, they went too far to realize their wishes for profits to the extent possible. The TNCs went as far as developing a technology that kills the reproductive capacity of the GM seeds in order to prevent farmers from using the seeds for plantation. The technology makes the seeds sterile so that farmers will not be able to save the seed for sowing in their farm. The famous (or more appropriately the infamous?) technology, which is commonly known as 'terminator technology', terminates the fertility of the seed so that it could no longer be used for plantation. This shows how far the TNCs could go in order to protect their monopolistic interests on the GM technology.

Hence, the GM technology in its commercialized and monopolized form is inaccessible to the poverty-stricken and the hunger-prone subsistence farmers and the high flying promotion of the GM as a means to feed the hungry remains a mere rhetoric. How could the technology claim that it solves the problem of food insecurity by adding one more burden on those who are prone to food insecurity?

Then how can the GM technology come to the rescue of those in need and feed the hungry stomaches? There could still be two possibilities, at least.

The first is by encouraging and supporting GM research and development by the public sector such as governments and NGOs. GM research and development by not-for-profit sector intended for the wider public interest could facilitate the easy access of the technology for the poor who are susceptible to hunger. China could be taken as a good example here. China invests heavily in GM research and development. The country is increasing its GM crops production from year to year and in 2003 grew 2.8 million hectares of GM crops. (James,C. Global Status of Commercialized Transgenic crops:2003). What is unique to China's GM technology is that it is entirely government funded. China has also put in place strict regulations to ensure the safety of imported GM crops as well as those locally produced. China's approach towards GM technology could be taken as a model by other developing countries who are facing actual or potential food insecurity for their growing population.

China's approach suggests that GM research and development by the public

sector is a possibility and that the corporate monopolization of the GM technology could effectively be checked and the technology could meaningfully assist feed the hungry.

The second possibility is by making reforms with in the WTO/TRIPS regimes and guaranteeing free access of the GM seeds to the poor farmers to sow, save and exchange among themselves. This is what is known as 'farmer's exception' to IP rights on GM seeds, which is being presented to the TRIPS review. As stated above, however, the North doesn't seem to be ready to accept such demands from the South.

In general, GM could potentially offer an opportunity to mitigate the problem of food insecurity but in the current state of monopoly of the technology, it is difficult to see its contribution to the problem.

6. Conclusion

GM technology as a science seems to offer several valuable potential benefits and it appears difficult to reject it altogether as worthless. However, its shortcomings and potential risks should be taken care of in an appropriate manner.

Both the 'organic agriculture only' and 'technology only' approaches to food security have their own limitations. The 'organic agriculture only' approach seems to have forgotten the immense potential of the GM technology in agriculture, which have scientifically been proved and tested.

Similarly, the 'technology only' approach seems to have overlooked the limitations and risks of the GM technology, which have also been shown and proved. Either approach has not been able to show that it is the only way for reliable future food security.

It seems that the better approach is to see the two approaches as complimentary to each other. The right perspective is not to consider the GM technology as worthless or as the only solution but as one potential solution for food insecurity complimenting the organic agriculture. GM technology has to be further

tested for its safety and used with the necessary caution. An open and honest debate should continue until such time that the public is fully convinced that GM crops are safe or unsafe.

The concerns over corporate monopoly of the technology and the related public policy issues should also be checked both at the national and international levels. However, these concerns, valid as they may, should not undermine the potential contribution of the technology. It is indeed unfortunate that this and other similar concerns are concealing the potential benefits of the GM technology. It is one thing to condemn how the technology is owned and administered and another to accept the potential benefit of the technology.