

# **Agricultural Biotechnology in Post Globalization Intellectual Property Rights Regime: An Impact Analysis in Southeast Asia Perspectives with Special Reference to India**

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## **A. Prologue:**

No country has achieved a mass dollar poverty reduction without prior investment in agriculture. Agriculture is important though it can contribute to development as an economic activity, as a livelihood, and as a provider of environmental services. This makes the sector a unique instrument tied to national food security issues and humanitarian concerns over hunger and malnutrition.

Agriculture has been impressive throughout the years. From 1980 and 2004, GDP of agriculture expanded globally by an average of 2 percent a year, more than the annual population growth of 1.6 percent. Seventy-nine percent of this growth was due to agricultural growth in developing countries. The agricultural growth of developing countries rose 2.6 percent a year in 1980-2004, and its share of world agricultural Gross Domestic Product (GDP) rose from 56 percent in 1980 to 65 percent in 2004.<sup>3</sup> The progress in agricultural growth in developing countries has been dominated by significant gains in Asia, especially China. Cereal yields in East Asia rose by an impressive 2.8 percent per year from 1961 to 2004. A major contributor to this growth has been investment in research and development (R&D) and technological improvements, with improved crop varieties contributing an estimated half of the agricultural productivity improvements. Other factors, such as increased adoption of new technologies, policies, institutional changes, and major investments in infrastructure and subsidized inputs and outputs have also been reported as contributing to this growth.<sup>4</sup>

Despite these major advances in agriculture and accelerated growth in food production in recent years, food insecurity is still common in many parts of the developing world. Food insecurity, exists when people lack sustainable physical

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3 World Bank. (2007). *Agriculture's Performance, Diversity, and Uncertainties*. Washington, DC: World Bank, P. 50

4 Ibid P. 51-53

or economic access to enough safe, nutritious, and socially acceptable food for a healthy and productive life. Many factors have been identified as root causes of food insecurity: poverty, war and civil conflict, corruption, national policies that do not promote equal access to food for all, environmental degradation, barriers to trade, insufficient agricultural development, population growth, low levels of education, social and gender inequality, poor health status, cultural insensitivity, natural disasters, and many others.<sup>5</sup>

The population has increased combined with moderately high income growth which result in a more than 70 percent increase in demand for food and other agricultural products and may result in up to 9.0 billion people suffering from malnutrition and hunger in 2050. A majority of these will come from the poorest socio-economic groups in developing countries. Thus, governments in agriculture dependent on developing economies thus, more challenged to look for new ways including technology development, research, growth policies, and distribution systems, among others and take actions, to renew focus, improve, and boost the agriculture sector in a sustainable manner, to help reduce this statistic and foster food security.

One of the major debates involving addressing food security focuses on how agricultural innovations in this age of the Gene Revolution (e.g. modern biotechnology) and their application might help to improve agricultural output and productivity and help to satisfy the food requirements in these countries. The advent of modern biotechnology and with agriculture becoming more of a technologically dynamic sector, agricultural industry especially in developed countries now increasingly relies on formal means of protecting new technologies through intellectual property rights (IPRs). The introduction and strengthening of IPRs in the agricultural sector has been and remains controversial. Developing countries and their public research institutions have evolved in a world without IPRs; hence, IPRs as a policy option can impact public agricultural research, the linchpin of agricultural development in these countries. The concept of protecting intellectual property, which originated from developed countries, are promoted to induce additional research spending especially from the private sector, technology acquisition and creation, encourage new business development, increase economic growth, and thereby improve development.<sup>6</sup> With the adoption of the TRIPS Agreement, which harmonizes and strengthens IPR rules worldwide, all agricultural innovations and inventions including those in agricultural biotechnology can be protected.

In 2011, almost half of the global biotech crop area is of 160 million hectares,

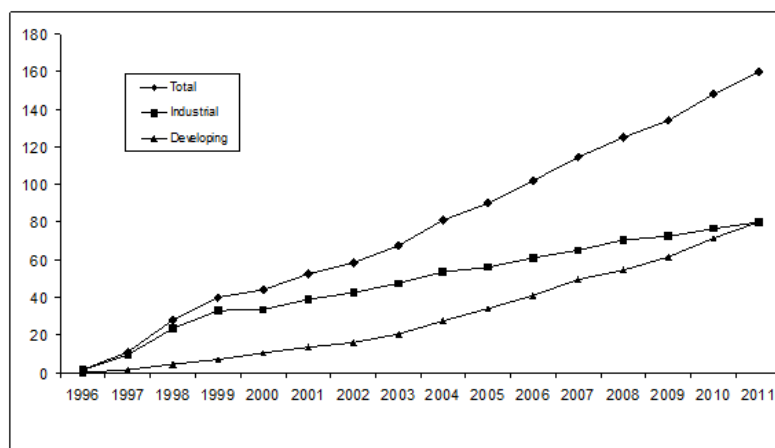
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5 Caldwell, J. (2011, March 7). *Time to Act on Food Insecurity*. assessed on 8.2.2013, from Climate Progress : <http://climateprogress.org>

6 Maskus, K. (2000). *Intellectual Property Rights in the Global Economy*. Washington, DC: Peter G. Peterson Institute for International Economics.

equivalent to 79.8 million hectares, was grown in 19 developing countries. It is noteworthy that in 2011, all four countries that exhibited proportional growth in biotech area of 10% or more were developing countries; they were in descending order of percentage growth: Mexico (146% increase), Brazil (19%), India (13%), and China (11%). As in the past, in 2011, percent growth in biotech crop area continued to be significantly stronger in the developing countries (11% and 8.2 million hectares) than industrial countries (5% and 3.8 million hectares). Thus, year-on-year growth measured either in absolute hectares or by percent, was higher in developing countries than industrial countries between 2010 and 2011 (Table1).

**Table 1: Global Area of Biotech Crops, 1996 to 2011 (Million Hectares)**



Source: Pocket K No. 16: Global Status of Commercialized Biotech/GM Crops in 2011 website: [Global%20Status%20of%20Commercialized%20Biotech%20GM%20Crops%20in%202011%20-%20Pocket%20K%20%20%20ISAAA.org.htm](http://www.isaaa.org/Global%20Status%20of%20Commercialized%20Biotech%20GM%20Crops%20in%202011%20-%20Pocket%20K%20%20%20ISAAA.org.htm) assessed on 7.2.2013

The science of biotechnology has been one of the emerging fields for the past two to three decades and is a rapidly growing research and intellectual property led sector. The Biotechnology Sector today largely uses cutting edge science based research and development techniques for isolation, modification and combination of genetic materials which in turn are used for invention of new combinations of genetically recombinant drugs and vaccines and other pharmaceutical products, genetically modified organisms/plants and foods, hybrid varieties of plants and seeds and other agricultural products. These products aim to provide better solutions in healthcare (diagnostics; prevention, treatment and management of disease) enhancement of agricultural yield and productivity (with a view to meet food security concerns) and other areas benefitting and contributing to the overall economy and at the same time affecting the market

mechanisms.<sup>7</sup>

### **B. Intellectual Property Rights and Agricultural Biotechnology:**

According to Black's Law Dictionary, (8th edition, by Bryan A. Garner) Agricultural Biotechnology means "A branch of molecular biology dealing with the use of biological process to produce useful medical and industrial materials."

Biotechnology as a means to benefit poor farmers and made available to the crop cultivators and to the public research institutions that will develop new varieties using biotechnology tools. modern biotechnology has enhanced the importance of IPRs, which not only stimulate protection for the genes, tools, and processes that are an increasingly common part of modern plant breeding, but has also spur the introduction of legal protection for plant varieties and hybrids in some countries.

#### *i) What are Intellectual Property Rights?*

IPRs are special kinds of property rights awarded by society to individuals or organizations principally over intangible assets associated with human ingenuity and creativity: inventions, literary and artistic works, and symbols, names, images, and designs used in commerce (Suri, 2007)<sup>8</sup>. The Universal Declaration of Human Rights provides a broader definition of this concept: "the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author," balanced by "the right [...] to share in scientific advancement and its benefits." Several distinct forms of IPRs exist, including copyright, patents, trademark, plant variety protection, and geographical indication. Those evolved over time to define and deal with various forms of property. These IPRs share the principle that innovators receive a high priority or exclusivity in the economic exploitation of the product of their work.

### **C. Implications Of IPRs On Agricultural Development:**

IPRs are reasonable from two distinct perspectives either as a personal right or as a form of economic incentive for investment in creative activities. The second perspective i.e., economic incentive role is predominant. IPRs provide economic incentives for research and development (R&D) activities by prohibiting direct copying without permission (e.g., the payment of a royalty). This prevents competition between the creator and the copier, who contributes nothing to the development costs. Thus, IPRs enable investment in R&D potentially to be more

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<sup>7</sup> Aprajita Sud, "Intellectual Property Rights in Biotechnology, Competition Policy and Regulation (An Agri-Biotech Perspective)", Competition Commission of India June-July 2010, P. 1

<sup>8</sup> Suri, G. (2007, December 19). Assessed on 8.2.2013, from Special Interest Group : <http://csi-sigegov.org/>

profitable.

IPRs are territorial in that they only apply to countries where it is available and granted. IPRs, hence, are important to access creations that are made in other countries. Otherwise, the creator, fearing loss of the work, will often prevent or at least delay transfer to countries where IPR protection is weak or unavailable. Technology transfer thus becomes part of the incentive for countries to protect IPRs and ratify WTO-TRIPS.

WTO-TRIPS are the most comprehensive international IP agreement contributed for strengthening and “harmonization” of IPR systems around the world.<sup>9</sup> Irrespective of development status, this minimum standards agreement sets benchmarks for most forms of IPRs, including copyright and related rights, patents, trademarks, geographical indications, including appellations of origin, industrial designs, integrated circuit layout-designs, protection of undisclosed information, and control of anti-competitive practices in contractual licenses, within 153 WTO member-countries.

In agriculture, the life patenting provisions of TRIPS have attracted more attention. TRIPS have increasingly becoming the basis for IP law in most countries of the world. Emergence of biotechnology which essentially deals with living matter complicates the debate further. The cornerstone of TRIPS for plant variety protection, Article 27.3(b) requires developing countries to provide either patents or an “effective sui-generis” protection for the ownership of plant varieties by the year 2000. For the least developed countries, the deadline is extended on till the year 2005.

One of the category of commercial marks more occasionally used in agriculture than industry is geographical indications, including appellations of origin. These marks associated with products originating from a country, region or locality where the quality, reputation or other characteristics of the product are essentially attributable to its geographical origin. Most geographical indications relate to agricultural products or those derived from them, as in the case of wines and spirits. Protection of such marks prevents third parties from passing off their products as those originating in the given region.

There are some of the examples related to TRIPS products like ‘Champagne’ for sparkling wine and ‘Roquefort’ for cheese from areas of these names in France or ‘Darjeeling’ for tea from this district in India. It is not necessary for these indications to be geographical names as in the case of ‘Feta’ for cheese from Greece or ‘Basmati’ for rice from India and Pakistan as there are no places, localities or regions with these names. Plant varieties developed with traditional knowledge and associated with a particular region

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9 Archibugi, D., & Filippetti, A. (2010). *The Globalization of Intellectual Property Rights: Four Learnt Lessons and Four Theses*. Journal of Global Policy, 1-20.

can also be protected as geographical indications. The advantage in such protection is that it is not time-limited, unlike the case of plant patents or plant breeders' rights. However, needless to say, commercial benefits can be derived from the protection of geographical indications only when the name becomes reasonably famous.<sup>10</sup>

#### **D. Current Status of Plant Biotechnology in Asia:**

Many Asian governments including China, India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam have given high priority to plant biotechnology research in the hope of addressing the pressing challenges related to improving productivity, farmers' livelihoods, driving rural development, and meeting food security demands.

##### ***i) China***

China in particular has invested heavily in agricultural biotech research, ranking second only to the United States in terms of public sector investment (approximately US\$112 million in 1999).

From 1996 to 2000, 141 genetically modified (GM) crops were developed, 45 of which were approved for field trials, 65 for environmental release, and 31 for commercialization (of which around 20 were various *Bacillus thuringiensis* (Bt) cotton varieties). Products already commercialized include Bt cotton, virus-resistant and altered-shelf-life tomato, color-altered petunia, and virus-resistant sweet pepper.

In 2002, Bt cotton was grown in 2.1 million hectares by around five million farmers. The average Bt cotton farmer has reduced pesticide sprayings for the Asian bollworm from 20 to 6 times per year and produces a kilogram of cotton for 28% less cost than the farmer using non-Bt varieties.

##### ***ii) India:***

The Government of India also recognized early on the importance and potential of biotechnology when it set up the National Biotechnology Board in 1982. About 50 public research units in India using tools of modern biotechnology for agriculture, especially techniques for cell and tissue culture. The Indian government allocates an estimated US\$15 million annually on plant biotechnology research, while the private sector contributes about US\$10 million.

The Indian plant biotechnology research agenda is dominated by tissue culture and micropropagation, exploitation of heterosis vigor, development of new hybrids and planting material with desirable traits, and the genetic enhancement

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<sup>10</sup> Jayashree Watal, "*Intellectual Property Rights In Indian Agriculture*", Indian Council For Research On International Economic Relations, July, 1998, P. 7

of important crops.<sup>11</sup> Considerable research progress has been made with cardamom and vanilla, both important crops. Cardamom yields have increased 40% using tissue culture plants.

**iii) Indonesia:**

In Indonesia's second long-term development plan (1994-2019), food security emerged as one of the most important issues in the national agricultural development framework. With an expected population growth rate of 1.4% per year between 2000 and 2010, rice consumption is expected to grow from 48.5-50 million tons in the year 2000 to 50-57.5 million tons in the year 2010.<sup>12</sup> Indonesia is thus looking to new and improved agricultural technologies to increase farm productivity and recognizes the role biotechnology must play in research.

Although no GM crops developed by the public sector have been commercialized yet, Indonesia earned the distinction of being the first Southeast Asian country that produced GM crops on a commercial scale. Monsanto's Bt cotton is now commercially grown in South Sulawesi province, covering over 4,000 ha. Multiple location field trials for both soybean and corn also developed by the private sector have been completed and are next in the pipeline for approval.

**iv) Philippines:**

The Philippine government recognized as early as the mid-1980s the potential role of biotechnology as a leading-edge technology for achieving sustained economic development. The plant biotechnology research agenda is currently dominated by tissue culture and micropropagation, biocontrol, diagnostics, molecular marker technologies, and genetic engineering. Current GM research programs focus on: developing transgenic banana with resistance to bunchy top virus and papaya resistant to ringspot virus; delayed ripening of papaya and mango; Bt corn; rice resistant to bacterial blight and tungro virus and rice with improved nutritional characteristics; and coconut with high lauric acid content. The performance of Bt corn is currently being assessed, although impact assessment results from nine field trials in 2001-2002 showed an average 40% yield advantage over non-Bt corn, producing 12,000 pesos/ha increased income.<sup>13</sup> Field trials for bacterial blight-resistant rice are currently being carried out by the

11 Sharma, M. (2001). India. In G.J. Persley & L.R. MacIntyre (Eds.), *Agricultural biotechnology: Country case studies* (p. 51). Wallingford, UK: CABI Publishing.

12 Moeljopawiro, S. (1999). Managing biotechnology in AARD, Indonesia: Priorities, funding, and implementation. In J.I. Cohen (Ed.), *Managing agricultural biotechnology: Addressing research program needs and policy implications*. Addis Ababa, Ethiopia: ISNAR; Wallingford, UK: CABI Publishing.

13 Gonzales, L. (2002). *Likely transcendental effects of agri-biotechnology: The case of Bt hybrid corn in the Philippines*. Los Banos, Laguna, Philippines: STRIVE Foundation.

Philippine Rice Research Institute.

**v) Malaysia:**

Biotechnology has been identified as one of the five strategic technologies expected to accelerate Malaysia's transformation into a highly industrialized nation by 2020.

Significant progress is being made in developing GM crops such as rice, papaya, pomelo, orchid, pineapple, oil palm, chili, and rubber. Although there is still no commercial release of GM crops, confined field trials are being conducted for delayed-ripening papaya.

**vi) Thailand:**

In 1983, the National Center for Genetic Engineering and Biotechnology (BIOTEC) was established to promote research and development in this strategic technology. Thailand has been very active in seeking and producing better varieties of plants using gene technology and other biotechnology applications.

GM crop seeds from foreign multinationals have already been introduced into Thailand. The first crop that was permitted for field trials and introduced in 1994 was Calgene's delayed-ripening Flavr Savr tomato. This was followed by Monsanto's Bt cotton and Novartis' Bt corn. The former had undergone the most extensive field trials in the country and have since been completed. However, due to strong opposition by several local NGOs, the product has been suspended at the political level for several years now.

**vii) Vietnam:**

The government of Vietnam has assigned the highest priority to biotechnology and views it as an essential and increasingly important prerequisite to achieve national goals and objectives for food, feed, and fiber production, healthcare, and environmental protection. Vietnamese plant biotechnology is largely at the stage of improving and adapting technology imported from advanced countries.<sup>14</sup> The use of conventional technologies such as in vitro micropropagation, virus elimination, somaclonal variation, another culture, and haploid lines effectively improved crop productivity over the past decade. As the second largest exporter of rice in the world, Vietnam is focusing much of its effort on improving its rice varieties. The Institute of Biotechnology, Hanoi, together with other institutions, is developing transgenic rice varieties tolerant to abiotic and biotic stresses and resistant to rice pests. It continues to build on its success

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<sup>14</sup> Tuong-Van Nguyen. (2000, June). Agricultural biotechnology in Vietnam. In E.M.T. Mendoza (Ed.), *Biotechnology research and policy: Needs and priorities in the context of Southeast Asia's agricultural objectives*. Proceedings of regional conference on biotechnology, Bangkok, Thailand.

in developing rice hybrids. Currently, hybrid rice occupies approximately 330,000 hectares giving the highest yields of 16 tons per hectare.<sup>15</sup>

Other target crops for improvement include maize, the second most important food crop in Vietnam; fruits such as citrus, mango, papaya; leafy vegetables; root and tuber crops including sweet potato and cassava; sugar cane; and soybean.

Thus the importance of the agricultural sector to economies in Asia cannot be overstated. Agriculture as a percentage of total GDP in Asia is approximately 20%. This percentage compares with less than 5% for the world, 2% for the United States, and 7% for Europe.<sup>16</sup> It is also the largest sector in some economies, despite the fact that economic statistics tend to understate agriculture's importance, because they only represent on-farm production and ignore post-harvest and value-added processing as well as agricultural input industries. The agricultural sector also employs more workers in Asia than any other region, 58%,<sup>17</sup> and a large percentage of the population depends directly or indirectly on agriculture (e.g., India, 67%; Indonesia, 55%; Philippines, 70%; China, 75%).

#### **E. Agriculture-Biotechnology - Key Elements :**

Agriculture-Biotechnology or Plant-Biotechnology, is the application of the science of biotechnology in agriculture and its related processes and products. Agri-Biotech focuses on one or all of the following:

##### **1. Crop yield:**

The using of techniques of conventional plant breeding or modern biotechnology, one or two genes may be transferred to a highly developed crop variety to impart a new character that would increase its yield. The current genetic engineering techniques work best for effects that are controlled by a single gene. Many of the genetic characteristics associated with yield (e.g., enhanced growth) are controlled by a large number of genes, each of which has a minimal effect on the overall yield.

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15 Bhumiratana, S. (2002). *Biosafety policy options and capacity building related to genetically modified organisms in the food processing industry of ASEAN*. Vienna: United Nations Industrial Development Organization.

16 World Bank. (2001). *World development report 2000/2001: Attacking poverty*. Washington, DC: The World Bank Group. Available on the World Wide Web: <http://poverty.worldbank.org/library/topic/3389/>.assessed on 10.2.2013

17 United States Agency for International Development. (2002). *Asia and the near east*. Available on the World Wide Web: [http://www.usaid.gov/locations/asia\\_near\\_east](http://www.usaid.gov/locations/asia_near_east). Assessed on 10.2.2013

**2. Increased nutritional qualities:**

Proteins in foods may be modified to increase their nutritional qualities. Proteins in legumes and cereals may be transformed to provide the amino acids needed by human beings for a balanced diet.

**3. Reduced vulnerability of crops to environmental stresses:**

Drought and excessively salty soil are two important limiting factors in crop productivity. Using Biotechnology, crops may be developed with genes that will enable them to withstand biotic and abiotic stresses and effectively meet such limiting factors.

**4. Improved taste, texture or appearance of food:**

Modern biotechnology can be used to slow down the process of spoilage so that fruit can ripen longer on the plant and then be transported to the consumer with a still reasonable shelf life. This alters the taste, texture and appearance of the fruit. Seriously it could expand the market for farmers in developing countries due to the reduction in spoilage with resultant avoidance of food wastage.

**5. Reduced dependence on fertilizers, pesticides and other agrochemicals:**

Most of the current commercial applications of modern biotechnology in agriculture are on reducing the dependence of farmers on agrochemicals such as fertilizers, pesticides, herbicides and insecticides. For example, *Bacillus thuringiensis* (Bt) is a soil bacterium that produces a protein with insecticidal qualities. A fermentation process has been used to produce an insecticidal spray from these bacteria. The Bt toxin occurs as an inactive protoxin, which requires digestion by an insect to be effective. Crops have also been genetically engineered to acquire tolerance to broad-spectrum herbicide. The lack of herbicides with broad-spectrum activity and no crop injury was a consistent limitation in crop weed management. Multiple applications of numerous herbicides were routinely used to control a wide range of weed species detrimental to agronomic crops. The introduction of herbicide-tolerant crops has the potential of reducing the number of herbicide active ingredients used for weed management, reducing the number of herbicide applications made during a season, and increasing yield due to improved weed management and less crop injury. In 2001, herbicide tolerance deployed in soybean, corn and cotton accounted for 77% of the 626,000 square kilometres planted to transgenic crops; Bt crops accounted for 15%; and “stacked genes” for herbicide tolerance and insect resistance used in both cotton and corn accounted for 8%.

**F. Strategic Policy Approaches:**

It is crystal clear that there can be no single policy blueprint for agricultural

biotechnology. Every country will need to formulate its own strategy or policy for the development of biotechnology for use in agriculture. However, if countries want to avoid the risks inherent in the science-driven, *ad hoc* approach and to ensure that biotechnology research is at the service of agriculture and agricultural producers, policy intervention will be required.

There are countries that permit GM technology and there are places where farmers are not allowed to even pilot-test GM crops because of serious concerns about, there are four potential national policy postures regarding GM crops based on intellectual property rights, biosafety, trade, food safety, and consumer choice and public research investment. These national postures may be (1) promotional, (2) permissive, (3) precautionary, and (4) preventive depending on the extent to which each nation is concerned with food insecurity, protection or expansion of export markets, and the opinions of consumers.

The policy formulation process in the Indian intellectual property regime for agricultural biotechnology is characterised by a lack of cohesion among policy objectives and the absence of a coordinated effort to facilitate the balancing of the interests involved in the process, which are varied and often conflicting. The Ministry of Agriculture has drafted the Protection of Plant Varieties and Farmers' Rights Bill; the Ministry of Environment, the Biodiversity Bill; the Ministry of Science and Technology, the Patents (Second Amendment) Act, and the Ministry of Human Resource Development has been attempting at formulation of the Traditional Knowledge Protection Bill.

The Protection of Plant Varieties Act emphasises the creation of property rights entitled the plant breeder's right aimed primarily at protecting commercial interests such as those of large seed companies and commercial cultivators. Innovations such as these would also form an integral component of India's biological diversity, a subject that is sought to be protected under the Biodiversity Bill.

This study also aims to determine the policy stances regarding GM of six Southeast Asian countries (Cambodia, Indonesia, Malaysia, Philippines, Thailand, and Vietnam) known as "the food baskets of Southeast Asia," and ascertain whether such policy statements have a bearing on the way GM crops or not.

It provide insights as to the potential impact of two socio cultural variables, (1) existing GM policy and (2) degree of press freedom, on press reports about GM crops. The findings are expected to help communication practitioners widen their perspectives on issues concerning risk reporting in Southeast Asian countries. Furthermore, the results are meant to assist policymakers in formulating and enhancing GM policies.

**G. Conclusion:**

The biotechnology and its applications for the benefit of the poor, however, will depend on a number of critical elements. As because a new agricultural technologies are increasingly complex, knowledge intensive, expensive, and location specific, clear priorities need to be established. The public sector should coordinate its efforts to take advantage of the willingness of the private sector to contribute to the search for new technologies and focus on those areas where companies are unwilling or unable to invest in. The problem with this approach, however, is the public's growing distrust of the private sector. Till now all GM crops that have been released commercially in Asia are products of foreign multinationals, adding subtlety to the issue. It is for this reason that these new technologies must be implemented under the auspices of regulatory frameworks that have the public's trust and confidence. Communication and education will play a key role in helping to achieve this. Last but not the least it can be said that, strong political will and commitment by governments, manifested by appropriate public policies and investments, will be crucial in the struggle to improve the livelihoods of millions of Asians.