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國際學碩士學位論文

**India's Food Security and Prospects for Future  
Regulatory Reforms: Unlocking Doha  
Development Round's Deadlock**

인도의 식량 안보와 미래 규제 개혁의 전망:  
도하개발라운드 교착 상태의 진전

2015年 2月

서울대학교 國際大學院

國際學科 國際通商專攻

韓 智 惠

**India's Food Security and Prospects for Future  
Regulatory Reforms: Unlocking Doha  
Development Round's Deadlock**

A thesis presented

by

**Joanne Jehae Han**

A dissertation submitted in partial fulfillment of the requirements for  
the degree of Master of International Studies in the subject of  
International Commerce

**Graduate School of International Studies  
Seoul National University  
Seoul, Korea**

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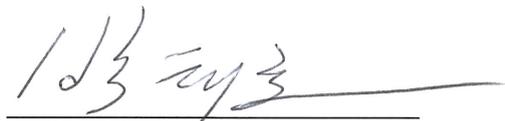
## India's Food Security and Prospects for Future Regulatory Reforms: Unlocking Doha Development Round's Deadlock

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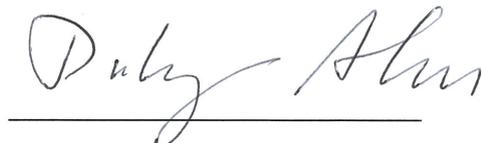
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## **Abstract**

# **India's Food Security and Prospects for Future Regulatory Reforms: Unlocking Doha Development Round's Deadlock**

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Currently, India is one of the forefront leaders in the developing world and its sphere of influence has grown rapidly granting them the position as one of the key dominant players in the international arena. The delay of Doha Development Rounds is a symptom of India's food insecurity and their reluctance to open agricultural markets. India claims that accepting the international subsidy levels for domestic farmers will jeopardize the protection of their agricultural industry. In order for the Doha Development Rounds to see any progression from its current standstill, one must get to the core of India's food security issues. Through the progression of laws, Genetically Modified Organisms (GMO) created a gateway for multinational corporations such as

Monsanto to introduce *Bacillus thuringiensis* (Bt) technology to produce greater quality and quantity yields. There is anticipation that this newly found technology can revert vital issues such as food deprivation and the costs of severe malnutrition by further commercializing Bt food crops. However, although Bt cotton is the only current commercialized GM crop, it has brought along controversies that have segregated two distinct positions regarding biotechnology's place within India's agricultural sector. By tackling the core problem, which is India's food deprivation from its very roots stemming from corruption, lack of irrigation systems, and ineffective distribution, it can mend such issues as GM crop failures, Bt moratorium, and farmer suicides. This eventually leads back to efforts towards forward movements in the Doha negotiation.

Therefore, based on the stagnancy in the Doha Rounds, this paper presents recommendations to India's food security plans and ways to counter the very central issues that is affecting all 160-member states in settling and mitigating an actual settlement towards world trade. Without tackling the inner layers of food insecurity, the outer outcomes will not foresee change. In other words, without accounting the causes, the consequences cannot be amended. Thus, issues in India's targeted public distribution system, irrigation system, farmer educational programs as well as Monsanto's customer perception must be resolved to see any formidable changes in tackling food insecurity and Doha's deadlock. India has come too far along in biotechnology and its involvement within the international community to go back. The only way is to utilize what they have and move forward towards achieving food

security once and for all, which will in effect progress decisions in the Doha Development Rounds to conclusively finalize unsettled international trade negotiations.

***Keywords:*** Doha Development Round, India, Biotechnology, Genetically Modified Organisms (GMO), Food Security

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# I. Introduction

In the midst of plenty, the developing world still faces the challenges of hunger and poverty. In regions such as Africa and Asia, nearly a billion people earn less than one dollar a day. Among them are 10 million orphans as well as 125 million children who are stunted and underweight. For years, agriculture, which includes forestry, fisheries, and livestock, is their way of life and only source of income (Lele pg1119). It is predicted that by 2015, 805 million people will still be chronically undernourished (Food and Agriculture Organization of the United Nations 2014). Food is a critical component to humanity, possessing biological, social, and cultural significance. It is vital not only for survival but also a way to communicate meanings and values both culturally and religiously. Furthermore, food directly affects the body and wellbeing, literally suggesting that, “we are what we eat.” In recent years biotechnology has revolutionized the agricultural industry by offering humanity the power to genetically alter microorganisms through the transfer of genetic information from one organism into another. Modern biotechnology is widely used in agriculture and genetically modified organisms known as GMOs are currently being used in the food production chain. Among GMOs many promises, higher crop yield is seen as a solution to the never-ending cycle of food deprivation. The case of India presents an interesting prism, in which the size and population of the country is ever so growing while facing the constant challenge of chronic food deficiency. India proves to carry a significant weight of influence, serving as a model to the rest of the developing world. However,

its strong stance on food security has led to halts and threats of derailing in solidifying multilateral trade agreements in the Doha Development Rounds. GMO was introduced to combat the growing issue of India's food insecurity. Yet to this day, although the technology has been active for four decades, GMO is still a controversial and divided issue between those who embrace and those who reject its technology. This paper explores the role of India's incorporation of biotechnology and the possibilities of integrating GM foods in a congenial manner. It investigates and suggests recommendations on the systematic inefficiencies that thwarts the government's efforts to not only achieve its food security goals but to furthermore promote negotiations to settle an agreement towards global trade in the Doha Development Agenda.

## **II. India**

### **2.1 Importance of India in Developing World**

India's sphere of influence has grown rapidly within the years that have given them a predominant voice in the international arena as well as in global affairs. Currently, it is the second most populous country in the world with over 1.23 billion people as of July 2014 (CIA Fact book 2014). Economically, India has grown to become the fourth largest in the world with regards to purchasing power parity (United Nations Stats 2012). As part of the BRICS, India also belongs to one of the five major emerging national economies and is considered one of the leaders of the developing world. Anand Sharma, India's Trade Minister states that India for years positioned itself as a representative for developing countries speaking for the vast majority of poor people. India participates actively in international organizations such as the United Nations, G20, World Trade Organization, Asian Development Bank and is also the founding member of the Non-Aligned Movement. Due to its rising economic importance, it has been successful in mobilizing the developing world into building coalitions and collective actions thus, making India an even more powerful player within global affairs.

### **2.2 Food Security Crises**

However, there is a juxtaposition that lies at the heart of India. Along with this growing empowerment through its population size, international involvement, and

economic boom they are still handicapped by severe challenges such as food insecurity, social deprivation, and the growing discrepancy between the classes, which ultimately leads to India's stunted growth from reaching their highest potential. "Food supply and food security have always figured prominently in the strength and stability of nation-state" and a country's internal stability is dependent on a steady food supply (Perkins 1997). Therefore, the rest of the world, in particular developing regions, look towards India and their actions in combatting these serious issues. India is a case that needs to be further examined and their domestic problems addressed and alleviated. As a key model in the developing region their domestic affairs spills over to the international, which affects significant trade negotiations as well as their involvement in foreign relations.

### **2.3 Doha Development Round Deadlock**

The Doha Development Agenda is an ongoing trade negotiation that is taking place under the umbrella of the World Trade Organization. There have been a total of eight previous rounds of multilateral trade talks between nations, Doha being the ninth. However, a marked difference in this round is the emphasis on developing nations in effort to help them emerge into the global marketplace. The agriculture negotiations began in 2000 from the 1986-1994 Uruguay Round to continue trade reforms and held its first meeting on November 2001 in Doha, Qatar (World Trade Organization 2014). All Member countries in the WTO are participants in this negotiation and developing nations represent two-thirds of the membership. However, there are polarized

differences between developed nations led by the United States and the European Union as well as the developing countries represented by India and China who have a tendency to dominate talks during the negotiation process. Gradually there has been a shift in power dynamics as developing nations have found a greater opportunity to bring forth their concerns to the table. Its aim is to increase trade flow centered on minimizing taxes and regulatory trade barriers that affect cross border trade as well as revise rules in trade policies. With regards to agriculture trade, Doha aims to create greater market access, eliminate export subsidies, reduce distorting domestic support, as well as nontrade concerns such as food security and rural development (World Trade Organization 2014). However, the main reason for the Doha Rounds deadlock is a result of the agricultural disputes over raising farming subsidies to protect poor, domestic farmers. 2008 was a devastating year for anticipating member states finally awaiting a common resolution and agreement in the trade talks. The disagreement primarily between India, China and the United States over measures to protect poor farmers and the right of developing nations to guard their domestic agricultural sectors from becoming less competitive, led to the collapse of world trade agreements. Unable to bridge the differences between world powers, member countries were left disappointed and frustrated about the long awaiting trade deal, questioning the credibility of the World Trade Organization and its effectiveness. Although India receives a surge of finger pointing and blame for the responsibility of the Doha Rounds deadlock, Kamal Nath, India's trade minister states, "The most important thing was the livelihood security, the vulnerability of poor farmers, which could not be traded off

against the commercial interests of the developed countries” (2008). China’s support for India reflects on the change of developing nations growing influence and the inability of industrialized powers to deal with the power dynamics in these negotiations. Ultimately, a consensus must be reached as Member countries look towards India to make that initial move. In an increasing globalized world countries form interrelationships and heavily relies on one another. However, the inability to form a consensus may slow or freeze worldwide trade completely that result in repercussions that could ripple throughout every nation. Therefore, there is fear that such strain will collapse the World Trade Organization as well as everything countries have negotiated and fought for so long. It is essential for the Doha Round to progress forward in global trade negotiations. In doing so, India must deliver in addressing their vulnerable food security concerns as the primary step towards building a stance in securing an agreement to reach a compromise on agricultural import rules. When there is harmony amongst governing bodies and the leading policymakers, states begin reaping positive outcomes and opportunities. With cohesive decision-making, there are greater chances for states to make revolutionary impacts that enact change rather than merely addressing it.

## **2.4 Green Revolution to Gene Revolution**

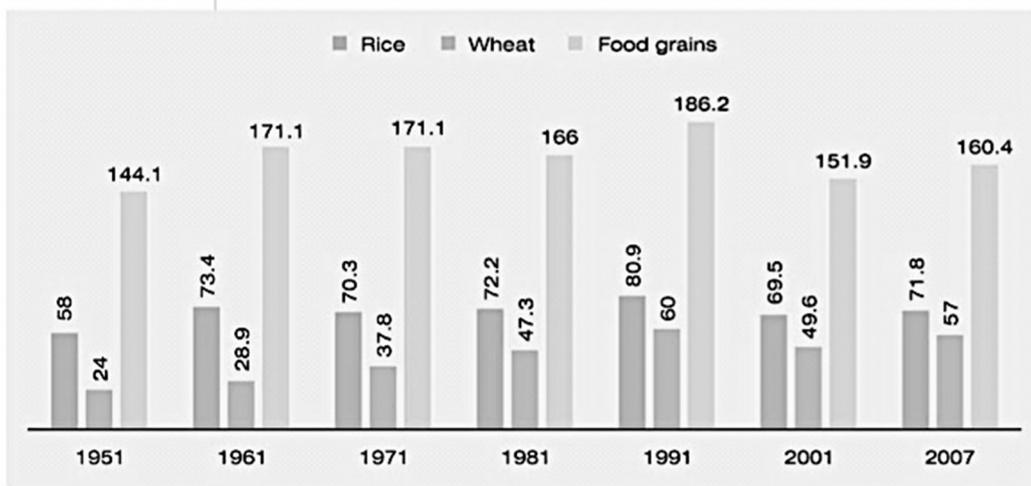
Over the past few decades, there have been spurring frenzies over the possible solutions to the world’s food security concerns that could change the course of humanity. The introduction to biotechnology has led many to believe that food deficient countries, like India, will finally be able to resolve huge developmental problems that have plagued

nations for so long. The beginning of the Green Revolution in the 1940s to 1960s marked the start of a global effort to combat world hunger and malnutrition in the poorest nations as a result of devastating periods of severe shortages, famines, and food crises. Ultimately, this would innovate biotechnology and the creation of genetically modified organisms (GMO) in an unprecedented manner. GMOs are organisms such as animals, plants, and microorganisms in which their DNAs have been altered to add a new property by transferring genes from different species that do not occur naturally or by traditional crossbreeding, thus creating a transgenic organism.

Green Revolution inspired by the developed nations spurred forth the initial spread of hybrid crops such as wheat and rice, two of the most important food crops to developing countries, who practice traditional agriculture. In the brink of famine, India in 1961 was suffering on the verge of starvation. The Indian Council of Agricultural Research secretary N.C. Mehta stated in 1951, “The country can rise as a whole only if our agriculture economy with its millions of farms and lakhs of villages is to revive with a new sense of energy and well-being” (Perkins, 1997). India tried several methods to combat food insecurities such as expanding farmland, creating development programs, as well as securing government grants, however they were all in vain. The government of India’s Minister of Agriculture, C. Subramanian invited wheat breeder, Norman Borlaug credited as “the father of the Green Revolution” for advice about new seeds. After initial hesitation, India embraced the Green Revolution and its technologies. Its main goal was to create an agriculture system which yielded more crops. In the state of Punjab, India soon adopted and pioneered semi-dwarf wheat and rice varieties, which

were soon planted. Fertilizers, pesticides, and herbicides were vastly distributed that resulted in higher yield increases. There was also a reduction of human labor as the newly altered crops were more efficient, hence requiring less manual work and increasing farmer's incomes. Grains showed steady increases in production, doubling from 1961 to the early 1990s. India began achieving self reliance in food production with agricultural GDP growing at 3.5 percent to 3.7 percent respectively between 1980s and 1990s, beginning a period which marked the start of national economic reforms (Choudhary and Guar 2008).

[Figure 1] India's per capita availability of food grains from 1951 to 2001 in kg per capita per annum.



Source: International Service for the Acquisition of Agri-biotech Applications (ISAAA)

The Green Revolution pioneered a new system in which seeds slowly transitioned from the public sector towards private. Many nations followed suit over the

next few decades, as they wanted to address the growing concern in which the world population would exceed the food available to feed its people. Although the Green Revolution truly changed the agricultural system and was effective in many ways, it did not solve all the challenges. For one, it did not solve the issue of nutritious food that directly affected the human health. Farming limitations in countries such as Africa made it harder to reap larger yields of crops. Furthermore, the use of pesticides contaminated the drinking water and insects started developing immunity to these nitrates. In India, Green Revolution technologies correlated higher yields only when irrigation and water supply was available (Conway 1998). Improvements to correct these problems were soon underway and led to another stage in agricultural developments.

In 1966 the Central Seed Committee (CSC) realized the necessity for a seed law and passed the Seed Act as a national apex to govern and regulate seeds. It had two subordinate bodies, the Central Seed Certification Board and the Central Variety Release Committee, a regulatory framework to manage the distribution of seeds into the market. The road was paved for the private sector to enter into the seed business. The act stated that all seeds should conform to a standard of physical and genetic purity and had to get certified or labeled in order to enter into the market. This policy impacted India, which increased the number of foreign companies and agreements and ultimately opened the domestic industry to foreign import of seeds as well as to advancements in the agricultural technology. The seeds would undergo tight regulation and control through the Certification Agencies under the State Department of Agriculture. The New Policy on Seed Development in 1988 rang a new era for private enterprises to enter into the

once closed seed sector. Seed production was identified as a high priority industry and the once restricted multinational corporations now had a pass to enter into the seed business.

## **III. Monsanto/Mahyco**

### **3.1 Origins of Monsanto Company**

In 1901, John Francis Queenly found an American chemical company named Monsanto in St. Louis, MO. In its early years the corporation mainly produced saccharine. By 1920, they began manufacturing synthetic chemicals including a variety of pesticides. Monsanto assisted in the production of chemicals that was used by the U.S. military during the Vietnam War namely Agent Orange. By the 1960's the Agricultural Division was established and began the process of manufacturing more herbicides for the purposes of farming. Fifteen years later, Monsanto began its cell biology research, and Roundup, an herbicide, was commercialized. This set in motion the company's firmly established biotechnology research programs. Shortly afterwards in 1982, Monsanto successfully created the first genetically modified plant cell. The company penetrated into the commercial market in the United States with their Posilac, bovine somatotrophin (Bst) for dairy cows in the early 1990s, meanwhile partnering and acquiring many seed corporations both domestically and internationally.

### **3.2 Monsanto-Mahyco Partnership**

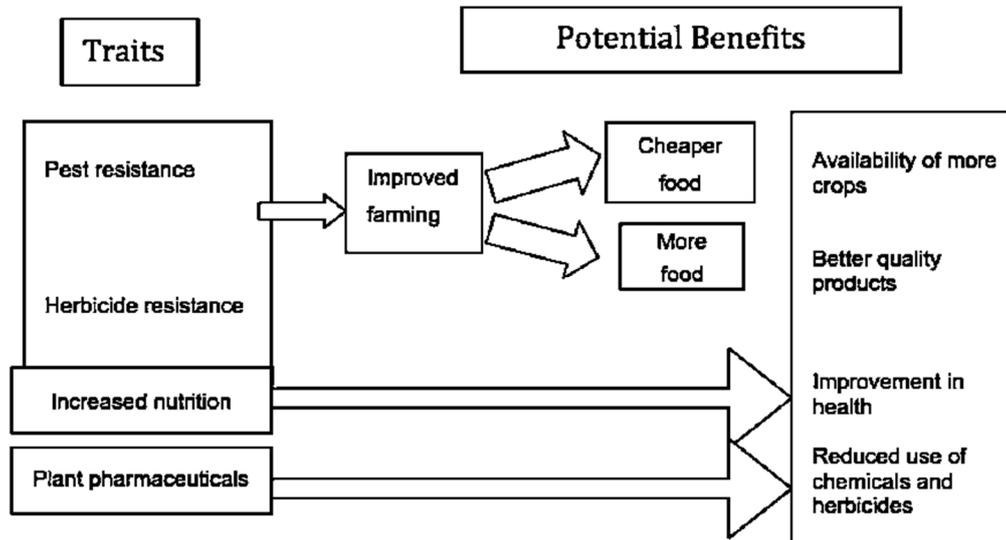
Maharashtra Hybrid Seeds Company Limited, also known as Mahyco, was established in 1964 by Dr. Badrinarayan R. Barwale and is the largest private seed company in India. In 1998, it was Monsanto's joint venture partnership with Mahyco that formed Mahyco-Monsanto Biotech Limited, with Monsanto acquiring 26 percent

of Mahyco stake. Jack Kennedy of Monsanto stated, "We propose to penetrate the Indian agricultural sector in a big way. Mahyco is a good vehicle (1998)." Initially, this task was not so easy as the Research Foundation for Science, Technology, and Ecology sued Monsanto to the Supreme Court in India claiming that the seed Nav Bharat-151 in Gujarat had traces of Bt and was considered extremely dangerous. They were afraid of contamination to the soil as well as other plants and claimed further testing was necessary.

### **3.3 Bacillus thuringiensis (Bt) Crops**

The year 2002 however, was a milestone for the newly joint company as the Genetic Engineering Approval Committee allowed India's first biotech crop for commercialization, *Bacillus thuringiensis* (Bt) cotton. Soon afterward they legally commercialized and sub-licensed the single protein Bollgard technology of the genetically engineered Bt to 28 Indian seed companies allowing local Indian farmers to choose from over 300 Bt cotton hybrid seeds. It promised a reduction of insecticide use, helping lower farmers costs. A reduction of herbicides meant that these new transgenic seeds had the ability to withstand pests. With an increase harvest, better quality, and cleaner cotton, it meant that farmers could have higher yield year after year. By 2012, 90 percent of the cotton area in India was covered under Bt cotton (State of Indian Agriculture 2012 Report).

[Figure 2] Potential benefits of various traits incorporated in the GM crops



Source: State of Indian Agriculture Report 2012

Today, Monsanto states that its core commitment is towards sustainable agriculture by developing innovative technologies, producing more, all the while conserving natural resources for a growing world population. Monsanto’s 2013 financial report states that it had earned a net sale of \$14.86 billion dollars, an increase of \$1.35 billion from 2012 and \$3.04 billion from 2011. The seeds and genomics segment has seen a growth of \$551 million dollars from the previous fiscal year. Monsanto Company currently ranks 197 in Fortune 500 in the United States as well as 154 in the Global 500 worldwide based on their gross revenue. Monsanto believes they have, “Achieved an industry leading position in the areas in which [they] compete in both of [their] business segments, expecting to see strong cash flow in the future while remaining committed to returning value to shareowners through vehicles such as

investments that expand the business, dividends, and share repurchases” (2013).

Monsanto has witnessed a tremendous growth and global presence with offices and testing stations in 68 countries operating across 6 continents.

## **IV. Opposing Views of Transgenic Crops in India**

Mahyco has created a long establishment in India promising to combat the issue of food security through its revolutionary transgenic technology. Through the adoption of Bt cotton, India has been debating on whether to accept and further commercialize GM technology or abandon it all together. In the midst of such stagnancy, it is vital to examine the affects GM technology has on India while considering the arguments of both polarized groups, for and against this science.

The Sanitary and Phytosanitary Measures (SPS Agreement) created by the WTO aims to create safety standards for regulating agricultural trade. Member countries are advised to adopt an international safety criterion allowing the justification for their measures with either relevant analysis of risk assessment or scientific evidence need be. Member countries are able to protect their state, not in a discriminatory way, but if they believe it is “necessary to protect human, animal or plant life or health” (World Trade Organization 2014). When dealing with biotech products, often times it is at the hands of the panel’s interpretation of the presented scientific evidence or risk assessment, and whether or not the country’s safety standards are legitimate and non-discriminatory. Article 2.2 of the SPS Agreement requires Member countries to ensure that they are complying with the SPS measure “based on scientific principles and is not maintained without sufficient scientific evidence.” In Annex A, the phrase risk assessment is defined as the spread of disease of unwanted pests as well as potential biological and economical consequences which could in turn cause adverse

health effects on humans and animals. Under Article 5.7, Member countries may maintain provisional SPS measures without meeting the risk assessment only if “relevant scientific evidence is insufficient” and the other conditions met. The analysis of determining what is scientific evidence and non-discrimination is difficult to balance. Indian is on a heated debate regarding the safety and effectiveness of generically modified crops and thus it is imperative to analyze both sides of the issue.

#### **4.1 Arguments for GM Incorporation**

Cotton is one of the most important and resourceful agricultural crops as it has been the preferred cash crop of millions of Indian farmers. As the second largest producer of cotton, India has been involved in the cotton industry through its harvesting, processing, and textile making activities. Yet for the longest time, producing cotton has been mobbed by bollworm pest infestations that have contaminated farmlands and reduced significant yields. India officially commercializing Bt cotton in 2002 marked the beginning of change for the agricultural industry. Farmers mostly grew their conventional cotton on small plots of land with less than 10 acres measuring only a few thousand hectares at the start of Bt’s introduction. Adoption rates of Bt transgenic crops continued to increase and cotton cultivated land have since reached up to 10.8 million hectares which is equal to 93 percent of the total cotton area of 12.1 million hectares in 2011-2012 (ISAAA 2014). “In 2007 alone, 3.8 million smaller farmers in India elected to plant 6.2 hectares of Bt cotton hybrid seeds- the fastest adopted seed technology in the recent history of

agriculture” (Choudhary and Guar 2008). As reported by the Indian Government Ministry of Agriculture, hybrid seeds are able to produce higher yields thus improving crop productivity. Pest resistant seeds improve farming, creating the availability for more crops to establish a synergy of cheaper foods with better quality. Congruently the following table demonstrates the requirement and availability of certified quality hybrid seeds yielding much more than the estimated requirements each year across all crops.

[Figure 3] Requirement & Availability of Certified/Quality Seeds of Hybrids

(Quantity in million tonnes)

S. No.	Crop	2009-10		2010-11		2011-12		2012-13 (KHARIF-2012)	
		Req.	Av.	Req.	Av.	Req.	Av.	Req.	Av.
1	Paddy	2.9	5.3	9.8	10.9	9.9	9.2	28.8	28.8
2	Maize	62.7	61.1	75.4	92.2	101.7	142.1	73.7	77.0
3	Jowar	17.2	19.9	11.5	13.9	13.1	13.9	12.1	12.5
4	Bajra	22.4	19.7	21.9	26.0	24.6	28.4	23.0	25.9
5	Sunflower	4.0	6.4	5.8	6.3	7.0	9.6	2.5	2.7
6	Castor	3.7	5.0	2.5	3.1	3.4	4.5	4.0	4.3
7	Cotton	1.1	15.8	14.5	15.6	19.5	22.5	22.2	25.2
8	TOTAL	124.3	133.4	141.6	168.1	179.1	230.1	166.3	176.4

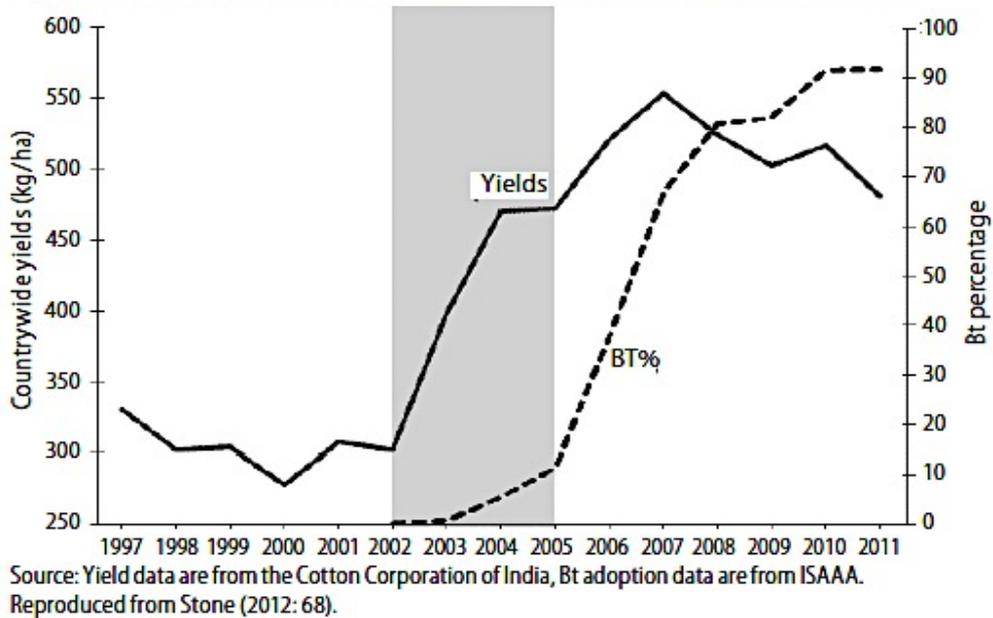
Req: Requirement Av. Availability

Source: Indian Government, Ministry of Agriculture 2013 Report

The successful cultivation Bt cotton has resulted in a 30 to 60 percent increase in productivity during the duration of ten years as well as 50 percent reduction of insecticide usage (Government of India’s Ministry of Agriculture 2013). These agronomic measures vary every year as seasonal variations and climate change affect

annual growth. In general, India reports that sizeable benefits have resulted from the introduction to Bt, which has played a catalytic role in allowing higher economic and profitable returns. India grew from being a prior importer of cotton to now becoming a large exporter. The figure below illustrates India's substantial escalation of cotton yields and percentage of fields planted to Bt once the technology was adopted rapidly into the farming industry.

[Figure 4] India's cotton yield data and Bt adoption data percentage from 1997 to 2011



With the significant increase of cotton-cultivated land, there has proved to be positive socioeconomic benefits that contribute to the productivity and growth of both rural and urban villages. The sizeable growth of Bt cotton production compared to conventional cotton has subsequently affected the employment sector in India. Hired

female laborers have benefited from employment in the manual cotton production systems as they work sowing, weeding, and harvesting the crops while men work in irrigation, plowing, and pest control (Subramanian and Qaim 2010). Additionally, with the need for less insecticide, men are able to allocate their time working towards other efficient tasks, focusing on other farm operations. Advocates for transgenic technology have praised Bt technology as a key venue for new employment opportunities especially for village farmers. Crop production has not only reaped benefits in higher employment but has been linked to increase in other sectors such as trade and transportation, inducing greater capital. Increased income has also aided in farmers' welfare, as they have been able to attain better health care, vaccinations for children, and experience a general increase in the quality of life (Choudhary and Guar 2008). Reduced exposure to insecticides in the soil and aquifers has also contributed in bettering villagers' health.

India's labor market has affected direct impacts on cotton profits and household income in different ways. For instance, poorer farmers received higher gains and returns from employment of females in their households as well as the expansion of alternative means of labor. As for the wealthier farmers, the households exclusively benefited from male alternative activities of labor rather than female employment. In a study of the impact of Bt cotton on poor households in rural India, researchers found that, "Strikingly the main beneficiaries are vulnerable farmers, whose household income gains are 134 percent higher under Bt than under conventional cotton disproving the heard argument that only wealthy farmers could benefit from GM crops"

(Subramanian and Qaim 2010). Nonetheless, when observing Bt transgenic technology on a surface level, high yield and reduced insecticides are only a subsection of its much deeper socioeconomic influences. The technology has generated greater income for households both above and below the poverty line, which has improved the quality of lives of rural farming sectors.

Since food security and aiding poverty is of utmost primary importance to India, activists argue that the continuation of GMO technology is a definite step in the right direction. For those supporting the science, Bt cotton has proven unparalleled success in all aspects of agriculture. Therefore, the commercialization of Bt food crops, especially brinjal, is appropriate for India to further reap and extend the already proven benefits that biotechnology has brought forth for the country. The Minister of Finance of India, Mr. P. Chidambaram declared, “It is important to apply biotechnology to agriculture. What has been done with Bt cotton must be done with food grains” (2007). Just like cotton, brinjal (eggplant) is a cash crop that is essential to India often described as the “King of Vegetables” because it is consumed virtually by every Indian household no matter the social class or food preferences. As the second largest producer of the staple crop with 26 percent of the world’s production share, brinjal is grown on approximately 550,000 hectares over almost all parts of the country. The field trials conducted by Maharashtra Hybrid Seeds Company (Mahyco) from 2002-2006 reported that Bt brinjal could reduce insecticide use by 77 percent as well as increase marketable fruits to 116 percent over conventional fruits. As far as economic benefits, researchers estimated that farmers will gain net profits of Rs.16, 299 (US\$330) to

Rs.19,744 (US\$397) per acre with national benefits to India surpassing \$400 million per year (ISAAA 2009). Based on these consolidated findings and research, whether to continue GM crops by commercializing Bt brinjal and other foods such as rice and wheat is an evident yes. Norman Borlaug, the father of the Green Revolution had said, “I now say that the world has the technology-either available or well advanced in the research pipeline-to feed on a sustainable basis a population of 10 billion people. The more pertinent question today is whether farmers and ranchers will be permitted to use this new technology” (2000). Just as Borlaug has said, when viewing biotechnology from a supporter’s point of view, its unfathomable to speculate delaying the science that could revert vital issues such as food deprivation and the costs of severe malnutrition if the benefits outweigh the cons.

#### **4.2 Arguments for GM Abandonment**

However, no matter the disputed success of India’s Bt cotton, the technology is heated with intense opposition from civil society groups raising voice regarding GMOs biosafety concerns, long-term human health implications, as well as sustainability of biodiversity. Social upheaval concerning the issue of transgenic foods have many blaming GM seeds as the culprit for the epidemic of farmer suicides that have swept throughout India for the past two decades. This tragic phenomenon amongst Indian farmers is claimed to be the manifestation of a deeply rooted crisis in the agricultural system since the 1990s. A report by India's National Crime Records Bureau (NCRB) revealed that between 1995 and 2011, an estimated 290,740 farmer suicides had taken

place due to economic failure, poverty and bankruptcy caused by the adoption of GMO. In the following years, for which there is no official data since that time, there have been thousands of additional suicides that have still not been accounted for. Thus, it is estimated that on average, “More than a quarter of a million Indian farmers have committed suicide in the last 16 years and in 2009 alone 17,638 farmers [took their lives]—which is one farmer every 30 minutes” (New York University 2011). The tragedy of Indian farmers suicides is the largest wave of recorded suicides in human history, although actual statistics underestimates figures such as women who do not have ownership or title over land.

Evidently, India is in the midst of social despair as its own people are continuing to take their lives. Thus, it brings about the question of causality and the triggering of such madness in order to revert the issue. While millions of families lives have already been devastated by the suicide epidemic to date, the agrarian crisis will continue to spread since millions of farmers are still battling the very issues that have driven so many to end their lives. Indebtedness and financial insecurity is a common trait and reoccurring theme in all the suicides, yet it only acts as a symptom to deeper-rooted political and agricultural issues. Although biotechnology supporters strongly disagree, opposition groups make tough claims that this debt cycle is caused by three key factors, which are GMO crops, weak education and information as well as international competition. Ever since the Government of India began reforming the economy and opening up its agricultural industry to the international market during the past few decades, smallholder farmers have increasingly gotten tangled in a web of

overwhelming debt. With poor sources of irrigation to harvest seeds such as Bt cotton, which requires greater water input, it usually results in a steep decline of farmers' yields and profits. During a disappointing harvest season, "Money from the sale of cotton may not cover even the initial costs of the inputs let alone suffice to pay the usurious interests on loans or provide adequate food or necessities for the family" (New York University 2011). Many have stated that although Bt promises to reduce pesticides and fertilizers, pests such as bollworms actually become immune to the herbicides paradoxically leading to farmers requiring more insecticides in order to properly eliminate these crop destroyers.

In 2012, the Indian Council of Agricultural Research (ICAR) and the Central Cotton Research Institute (CCRI) stated, "Cotton farmers are in a deep crisis since shifting to Bt cotton. The spate of farmer suicides in 2011-2012 has been particularly severe among Bt cotton farmers," implying that farmer suicides could be linked to GMO. Some farmers express how they feel cheated by the promises of GMO because instead of gaining profit, they are only burying into greater debt. Farmers have become depressed and driven so low to the point of unbearable economic and emotional distress that leads to self imposed physical harm. Many farmers choose to end their lives by ingesting the very pesticides they fell into such debt to purchase. However the problems don't end there, for the effects of such tragedies extends to the surviving families of the casualties who must bear the continuing burden of debt. As the families inherit the misfortunes, it becomes an overwhelming burden impossible to escape. With the possibility that other family members will commit suicide, there are cries of

desperation among all farmers and their vulnerable households sweeping across the nation. With many village children quitting school in order to support their families to work in the farmlands, India's agrarian crisis has spillover effects into other parts of society such as education. The problem India already faces with vast illiteracy intensifies, especially in poorer regions. With introduction to the new biotechnologies, farmers need the basic ability to read labels and understand instructions to harvest and cultivate the positive benefits promised from Bt crops. Yet, in many cases information is misunderstood leading to greater distress of crop failures. Seed companies are in many ways blamed for not properly labeling products to inform farmers the appropriate usage of water or chemical input for successful cultivation. Greenpeace has also accused Monsanto-Mahyco for not properly notifying farmers and local seed companies about their legally binding contract settlements. Amrit Gowda a local rural farmer stated that, "We didn't really have a formal agreement, Monsanto just made me sign a form that didn't have anything but just a date and the name of the company" (France24 News, 2011).

This is not to say that the Indian government hasn't taken initiative in responding to the long history of farmer suicides with limited forms of debt relief and compensation programs to address and alleviate the underlying financial causes. Activists argue that the programs however, ultimately failed in successfully and adequately responding to the crisis only brushing on the surface level issues without addressing what is at the core. As reported by the Center for Human Rights and Global Justice at New York University, it is evident that farmers in the cash crop sector

commit the vast majority of suicides (2011). Opposition groups have claimed that large and powerful multinational corporations who promote GMO such as Monsanto-Mahyco, dominates the cash crop industry such as cotton, brinjal, rice, and wheat as drivers to Indian agricultural costs, quality, and availability. With most of the Indian cotton companies now licensed to Monsanto, each making payments to use the licensed Bt genes, local companies are not allowed to make any other arrangements with other companies. Thus, large corporations have influencing power not only in the agricultural system but also the political system. Before the introduction of Monsanto or Bt crops, activists claims that “rural power” were so strong in mobilizing and supporting local small farmers in pressing the government for demands such as greater subsidies. However, many have accused multinational corporations of shifting this power dynamic to benefit their personal agrarian interests to gain corporate control over the entire seed industry.

Further expressing serious concerns about transgenic agricultural crops, is the question of whether advancement of testing is needed. Those rooting for GMO believe that no amount of further testing could disprove the positive benefits Bt has to offer. However, many government officials and regulatory authorities feel that adequate and confirmed research will not be easily granted until there has been thorough analysis that its effects on the environment, biodiversity, health of humans, and animal livestock are all proven to be safe. Dr. Pushpa M. Bhargava, founder Director of Centre for Cellular and Molecular Biology (CCMB) and currently the Supreme Court nominee on GEAC explains to the Indian Committee on Agriculture that the country has conducted

approximately half a dozen tests specifically on Bt cotton. These tests have been examined by seed companies themselves or by a laboratory using the very samples given by the companies. Director Bhargava states, “In India, we are dealing largely with Monsanto. Please allow me to say that if we were to make a list of unethical companies in all areas of industry around the world, then Monsanto will be number one and we have to be extremely careful. I am not suggesting or asking that we put a permanent ban on release of all GM organisms. All that I am saying is that they must be adequately tested and we have defined very clearly what adequate testing is” (Ministry of Agriculture Committee 2010).

Hence, arguments are made by high positioned individuals on the ethics of Monsanto and whether their primary incentives are aimed towards food security or corporate control. Shri Aniruddha Ramchandra Murkute, the president, of the Indians Farmers’ Union representative organization also stated to the committee, “We feel that Genetically Modified Seeds will bring a hazard in this country. Our sovereignty, our right to seed and our right to water are essential. When we raise the question of food security, unless we have better productive soil, unless we have good water, unless the pollination rate is more and unless good sunshine is there, we cannot produce more food. This is a common science. So, we need productive soil yet GM seeds will deteriorate it. The GM technology is a permanent perennial irreversible source of poison to these things. We are against chemical agriculture and we are for organic agriculture. Under this situation, why should we go for GM Seeds when experiments are not done properly? We do not know the good or bad sciences of it and if we go for

GM Seeds, we will have to take the responsibility” (Ministry of Agriculture 2012). Thus, Dr. Bhargava and Murkute add onto the growing number of people concerned by the underlying important question whether GM crop could address food security issues to eradicate poverty and hunger. Nonetheless, on one side people feel compelled to continue revolutionizing the very science that could revert vital agricultural issues such as food deprivation while the others prefers delaying the processes until there is a common agreement in the sufficiency of tests and social benefits that prove GMO will provide positive sustainability in the long run.

## **V. India's Current Actions and Implemented Policies**

Amid India's polarized debate on the issue of biotechnology, there has been a divide in ideas that has brought a spur of new policy implementations, social movements, and governmental decision-making strategies. India has been in the center of a tug of war battle in the agricultural sector, trying to conclude on a singular and agreeable means to overcome their food insecurity. Therefore, in order to organize and suggest future policy recommendations, it is important to assess and examine these current actions imposed both by the state and its people.

### **5.1 Seed Bill 2004**

Enacting a new and revised Seed Bill in 2004 replaced the 1966 Seed Act circulated by the government to overhaul the seed regulatory system. Policy makers began revising the previous act's deficiencies in making seed varieties registration obligatory. The system regulates the sales and certification of seed as well as its import and export to improve market conditions for private seed companies. The new 2004 Seed Bill states that, "Nothing in this Act shall restrict the right of the farmer to save, use, exchange, share or sell his farm seeds and planting material, except that he shall not sell such seed or planting material under a brand name or which does not conform to the minimum limit of germination, physical purity, genetic" (Seed Bill 2004 pg 15). A change from the preceding law is that this revision essentially mandates that any seeds branded or marketed be registered into the state's National Register of Seeds

database. Although the continuation of farmer-to-farmer exchanges and trade is allowed to continue, the proposed system also consolidates with the private sector such as transnational seed corporations like Monsanto. With global trade becoming more important today, India aims to revise its seed bill to harmonize seed laws and regulations both domestically and internationally. By making such amendments, the agricultural system opened up its seed markets increasing regulation and registration by law. For the government argues that with the knowledge of those selling the seeds, they could not be sure that the quality is adequate for food security. There are major criticisms from civil society actors who have protested that the bill endangers the traditional rights of farmers while benefiting large, powerful corporations. Farmer groups as well as non-governmental organizations have contended that the bill undermines the Protection of Plant Varieties and Farmers Rights Act in 2001 in protecting farmers' absolute rights to their indigenous and native seeds. Rather, they fear that the seed business will be taken over by private transnational corporations who will ultimately dominate the seed varieties through patents and branding. As a result in 2006, the Indian Government referred the bill to the Parliamentary Standing Committee on Agriculture (PSCA) to once again revise the act. However, the official enactment is pending, resulting in the 2004 Seed Bill to stay in force.

## **5.2 Bt Field Trials Moratorium 2011**

As a result of the bifurcated gap between the heated debates of GMO, India is in a state of social crisis where the intensity of opposition against transgenic crops

resulted in a moratorium to decide on the commercialization of Bt brinjal (eggplant) as well as approvals on other crops such as rice, wheat, maize, and chickpeas. The Genetic Engineering Approval Committee (GEAC), a regulator in the approval of commercializing transgenic crops, approved Bt brinjal on October 2009. However, India's former Environment Minister, Jairam Ramesh first imposed a ban on furthering GM approval, which overruled the committee's recommendations to further the technology. He stated that India would block Bt brinjal's release until "independent scientific studies establish, to the satisfaction of both the public and professionals, the safety of the product from the point of view of its long-term impact on human health and environment" (Ramesh 2010). Even within the GEAC there have been controversy between its members such as Dr. Pushpa M. Bhargava, the director of the Centre for Cellular and Molecular Biology, who opposed against Bt brinjal as well as the import of GM soybean oil. The director states that toxicity data on the crop showed "significant statistical differences between rats fed Bt brinjal and those given non-GM feed" (GEAC 2014). Although field trials are the first step in India for the sale and plantation of GM seeds, they have been effectively put on hold after facing opposition from states and environmental lobbying groups since February 2010. Massive social protests and public demonstrations from citizens intensified the feud already evident in the ongoing political disputes. India's supreme court appointed expert panels have recommended that field trials be suspended for 10 years until regulatory and monitoring systems could be strengthened, signifying the severe disagreement in the conclusion for transgenic technology.

### **5.3 India vs. Monsanto 2011**

To make matters more complicated, in 2011, a shocking lawsuit was made by the Indian government accusing the largest GM producer, Monsanto for violating India's 2002 Biological Diversity Act by developing Bt brinjal, a variety of eggplant, without prior approval. The act does not permit endemic breeds of plants to be genetically tested or modified like the native varieties of brinjal in the region of Karnataka. The case was first brought to attention by Leo Saldanha the director of a Bangalore based Environment Support Group alleging Monsanto's crime against India. The National Biodiversity Authority of India (NBA) claimed that this was an act of biopiracy and the stealing of indigenous crops in order to create a genetically modified version into field trials. Although the development of GM crops is not illegal in India, as Bt cotton is already commercialized into the market, the moratorium that was banned on Bt brinjal the year prior banned further developments to occur. Thus, the 10 year moratorium is what Monsanto is prosecuted of violating. Farmers and environmental lobbyists have added on to the stirring rally against the biotech giant, angrily saying that Monsanto has been stealing and taking their indigenous crops without any conformant. Without any allowance, they claim that Monsanto will make Bt brinjal into their own commodity and ultimately own these crops. Karnataka Biodiversity Board, K.S. Sugara stated that, "This can send a message to the big companies that they are violating laws of the nation. It is not acceptable that farmers in our communities are robbed of the advantage they should get from the indigenous varieties" (France24 News, 2011). Never before in history had a country filed a lawsuit

against a company for biopiracy. Therefore, India's decision to charge Monsanto with violating such laws is an intense move. After over a year of no comment from Monsanto or the Indian government to further pursue the lawsuit, on October 11, 2013, the Karnataka High Court allowed the National Biodiversity Authority (NBA) and the Karnataka State Biodiversity Board (KSBB) to continue the charges against Monsanto. There were pleas from both sides as senior representatives from Monsanto's partner, Mahyco urged to halt the criminal proceedings while pressures from anti-GMO activists petitioned against authorities delaying prosecution. However, further execution of actual trials has not occurred. The litigation is inconclusive and people are awaiting what actions the Indian government will pursue next.

#### **5.4 National Food Security Act (NFSA) 2013**

Although there is a stalemate in the state's decision to move forward with genetically modified crops, the government has been legislating major policy bills to try to address their food security issue. On September 10, 2013, India's Parliament passed the National Food Security Act (NFSA), which primary objective is to guarantee 70 percent of India's population cheaper subsidized grains to ensure access to adequate quantity and quality foods. The act targeted on alleviating hunger, malnutrition, and poverty especially in the poorest areas of the country. World Bank states that India accounts for a third of the poverty in the world (201). In India's National Family Health Survey, collected data estimates that "almost half of the country's children under five are classified as chronically malnourished and more than

a third of Indians aged 15 to 49 are undernourished” (2006). Thus, there has been much hesitation if this annual multi-billion dollar program could actually work. Now that food is a legal right for 800 million Indians, the government must ensure that the program runs efficiently in providing the food subsidies to these people. Under the Targeted Public Distribution System (TPDS), each beneficiary can buy a total of five kilograms of subsidized rice, wheat, and coarse grains a month (NFSA 2013). Prices range from one to three rupees, which is much cheaper than market prices that sells from twenty rupees onward. Pregnant women, lactating mothers, and children under the age of fourteen are also entitled to one free meal per day for a given period of time. Therefore, the enactment of the bill is a step in the right direction for the food deficient state to combat food insecurity, having been a crucial problem for so long. However, major government decisions do not come without criticism. Food security analysts question how India will identify the beneficiaries through their system. For the bill does not mention how the government will classify or even categorize the individuals based on their poverty level let alone allocate monthly grains to them.

The concern over corruption in the food distribution system is an issue riddled with possible disastrous setbacks. Corruption has continuously undermined India’s food program even in previous programs as grain supplies were siphoned off before fully reaching the intended recipients (Wall Street Journal 2013). NFSA must regulate and police the food supplies from ending up in illegal black markets sold at inflated prices. Its proposition to deal with their food security to solve world hunger is an ambitious task that must be met with persistence, regulation, and with absence of

corruption in order to see tangible results.

### **5.5 Doha Development Round: Bali Negotiations 2013**

The Doha Development Rounds have also seen some sort of progress following agreements made in Bali, Indonesia on December 2013. After approximately five years of deadlock leading to a near collapse of the rounds in the World Trade Organization to liberalize international trade, there have been gradual changes. The trade talks began breaking down in Geneva 2008 as India proposed for an exception to increase its farming subsidies arguing that by doing so, it can support and protect the poor rural farmers. Trade negotiators would argue that although agriculture is a huge sector with more than half of working Indians employed in the field, officials simply want to look favorably to win support from the poorer class for elections. In the midst of such dispute, negotiators in the Bali conference finally came to a temporary agreement to a four-year peace clause until 2017. Therefore in India's case, food security crisis will not be challenged and in exchange India must "not distort trade or adversely affect the food security of the other [WTO] members" (World Trade Organization 2013). In putting food security aside, other topics of concern were negotiated such as trade facilitation and increasing developing countries market access to other markets. With the implementation of the four-year peace clause, India has been readily trying to manage its own domestic food security issues by enacting such bills as NFSA in 2013. Time will tell if these legalized policies prove to live up to its promises and whether India will ultimately be for or against GM technology.

## **VI. Policy Recommendations**

It is evident that agriculture is in many ways the support and backbone of India's people as well as its economy. As the largest industry in India, the majority of the farming rural population relies on agriculture to provide the basis for their livelihoods as part of their lifestyle and traditions. All people regardless of social status in rural or urban India depend on the sector to a certain degree. With India's economy being so dependent upon the growth and profitability of the agricultural industry, it becomes a lifeline that affects all spheres of the country socially, politically, and economically. One of the most notable is the delayed progression in the Doha Development Rounds. Due to India's systematic failures of farming and agriculture, it has not only been costly to their domestic state but has rippled into global trade agreements impacting entire world populations. Therefore, when examining the policies already implemented by India to combat food security, it is clear that there have been successes and failures in the actual output of these proposals. The government actively initiating policies such as the National Food Security Act and the revised Seed Bill can be in itself an achievement as this shows the state's realization of the necessity to seek fundamental change. However, in reality these additional acts will never be enough to carry on the weight of eradicating India's food insecurity without aiming at the underlying layers of deeply rooted corruption, inefficient distribution system, lack of education, and dwindling natural resources that undermine biotechnology and GMOs integration. Currently the country's food and agricultural

policy is unable to achieve their objectives to ensure food and nutritional security not only by means of adequate quantity but also the quality of affordable food available for its citizens to live a life of dignity and ease (NFSA 2013). Still, food programs and regulatory distributional systems are crippling with deep levels of corruption, inconsistency, and fragmented objectives. Government leaders, policy makers, and citizens are unable to make collective decisions not only on how to mitigate food insecurity but also on the issue of approving commercialized transgenic GM crops. Since the food and agricultural sector in India has affected the nation in almost every systematic way, the issue remains one of the primary reasons for the deadlock of the Doha Development Rounds stalled trade deals. In a recent meeting Amit Narang, a Counselor at India's UN Mission said that, "The issue of food security is central to the pursuit of poverty eradication and sustainable development in developing countries and must be treated with the same urgency as other issues, if not more" (United Nations General Assembly 2014). Therefore, this level of urgency is felt by all 160-members in the organization, as pressure to build some sort of mechanism for coordination is clearly evident after 13 years of talks. The act of addressing an issue is distinctly separate from enforcing the needed subsequent action. Hence, policy recommendations directed towards the perspective ministries in the Government of India as well as multinational corporations will be proposed all in efforts to anticipate future reformation in India's hunger alleviation.

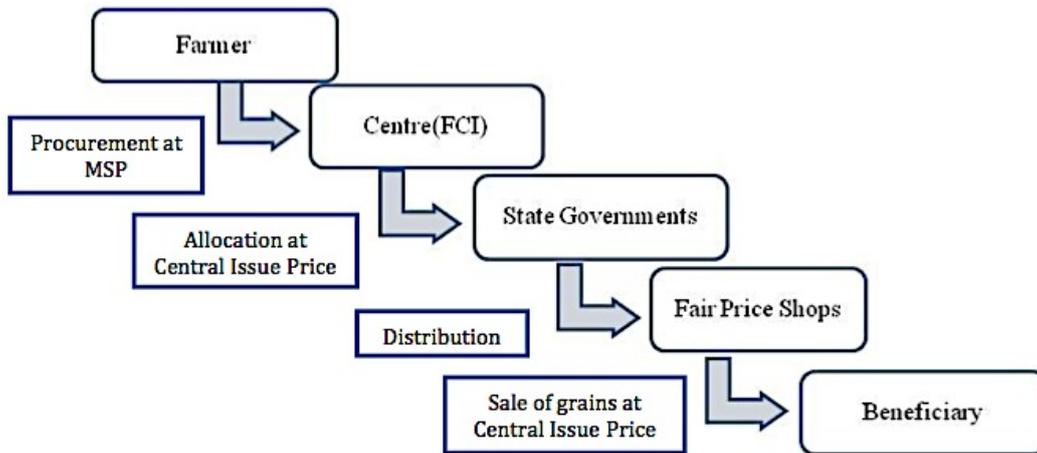
## **6.1 Targeted Public Distribution System (TPDS)**

Although many panelists, board of directors, and activists emphasize that the lack of production and quantity is the primary concern behind food deficiency, it is also important to take into consideration the impact of regulatory distribution systems directly affecting the allocation of India's food grains to its people. It is one thing to produce excessively and another to successfully transfer those harvested goods to the starving citizens that are in dire need. The Food and Agriculture Organization reported that India grows enough food grains producing over 50 million tons, yet it is home to a quarter of the world's undernourished (2014). With enough surplus to export onto the international trade market, India has been experiencing record high grain production and harvests. However, in the center of the nation's impressively high food production are millions of people still starving and malnourished by the inability to gain access to these subsidized grains. Such phenomenon heightens the speculation that increased food quantity isn't the only solution to feeding India's starving population but rather an effective mechanism of distribution.

India's most recent food security bill, The National Food Security Act (NFSA) is a milestone in the nation's history that has ignited both a great level of skepticism as well as hope that the act can potentially be the answer to ratifying poverty and food shortage across the nation. Since India has already dealt with so many ineffective food security acts, NFSA must prove a different outcome through tackling the existing challenges and lessons from previous bills. A key aspect of the act relies on the current

Targeted Public Distribution System (TPDS), which facilitates in the distribution mechanism in delivering subsidized food grain rations to 75 percent of the rural and 50 percent of the urban population, totaling 800 million people while identifying these eligible households as well. Originally institutionalized by the government was the Public Distribution System (PDS) in the 1960s but due to issues and failures in effectively reaching the poorest citizens, it led to an amendment and re-launch of the current Targeted Public Distribution System (TPDS) in 1997. TPDS focuses on families below the poverty line allowing for the rural poor to access basic commodities and food grains at affordable prices. Through a multi-level process, the central government procures and purchases food grains such as wheat and rice from domestic farmers, later allocating those grains to states' storage facilities (Balani pg1). The state governments identify the eligible beneficiaries based on whether they are below the qualifying poverty line category. Afterwards, each state delivers the grains from the central depots to ration shops called Fair Price Shops (FPS) where beneficiaries can buy their food grains entitlement at minimum prices. The figure below illustrates how the TPDS operates through a multilevel process where the central and state governments of India share responsibly in the food distribution system

[Figure 5] The responsibilities and network of India's Targeted Public Distribution System



Source: PRS Legislative Research report 2013

It may be idyllic to say that India's food distribution system is one without any flaws but the truth of the matter is that the system is riddled with hidden challenges that thwart the effectiveness of such measures in every systematic level. TPDS has since suffered from limitations due to problems of high administrative costs, poor monitoring systems, grain leakage, black market corruption, inclusion of the non-poor, and lack of accountability (Mane 2006). Hence, I devise policy recommendations directed first and foremost towards the Government of India's Ministry of Consumer Affairs, Food, and Public Distribution to improve the nation's Targeted Public Distribution System (TPDS).

There is much to amend starting with the central government's responsibility of providing storage facilities and food grain depots. A harrowing lack of proper food warehouses in the midst of higher grain yield has led to a paradox of plenty as huge stockpile sacks of rice and wheat stored in the open, rot and go to waste. It is estimated

that “in all, about 6 million tons of grain worth at least \$1.5 billion perish, while the losses could be far higher because more than 19 million tons are lying in the open, exposed to searing summer heat and monsoon rains” (Reuters 2012). According to the International Food Policy Research Institute, the Public Distribution System “costs the Indian government 750 billion rupees (\$13.6 billion) a year, almost 1 percent of annual GDP. Yet 21 percent of the country’s 1.2 billion people remain undernourished, a proportion that has changed little in the last two decades despite an almost 50 percent increase in food production” (2012). Due to poor storage mechanisms, India is not only wasting precious food that can feed the stomachs of hungry citizens but monetary value as well. Biraj Patnaik a principle advisor in India’s supreme court also acknowledges the disappointing fact that, “The problem of rotting grains and the poor going hungry lies within the system itself” (2012). Sanjeevan Bajaj, the chief executive of the Quality Forum of the Federation of Indian Chambers of Commerce and Industry also admits, “The issues we have with food security are traceable to issues we have around supply chain bottlenecks, transport and storage” (2014). Villages such as Khamano and Saddomajra in the state of Punjab are dumping grounds for stockpiles of wheat and rice that have been accumulated during the recent decade of record high surpluses. Tarps are usually the only protective mechanism used to cover the thousands of sacks of decomposing food grains. Hakkam Singh, a workman at the open field in the village of Saddomajra says, “the wheat has been lying there for the past five years. It smells very bad. Nobody steals it, but people use it to feed fish and poultry farms” (Reuters 2012). At other dumping sites, locals sometimes mix the rotting grains with fresh wheat or rice to

distribute to the poor who use ration cards for government subsidies. Since 2007, the Indian government has raised their purchasing price for farmers' grains, which eventually spurred frenzy for greater production.

As a result, India is now facing a new problem in appropriately depositing these harvests. Grain stocks are officially stored in government warehouses at a record 82.4 million tons while 20 million tons are label as "stored" even though they remain outside. Parul Soni, an executive director at the New Delhi Ernst & Young estimated that up to 7 percent of the country's annual grain production goes to waste because of insufficient storage facilities, corrupt transport, and distribution networks (Mukherji and Roy 2012). For the last 25 years the food storage in India has had little to no upgrade at all. Thus, in order to ratify these issues the government must push to add between 10 million tons to 20 million tons of storeroom capacity in the warehouses to accommodate each state's excess food grains. The Food Corporation of India (FCI), which operates a vast network of depots spaces and distribution centers, should improve the weak silos facilities to become more durable in protecting grains from damage due to rain, monsoon floods, torn sacks, and rat infestations.

There also needs to be an increased quantity and the quality of sacks and tarpaulins that are waterproof and slash proof for extra durability. Cold temperature controlled storehouses as well as food delivery trucks will also prevent any alterations in the quality of grains from deteriorating due to severe climate changes. By providing better facilities, food can be safety secured for a prolonged period of time without any premature waste. Faster allocation and distribution process from these storehouses to

ration shops will ultimately reduce millions of tons of grains from being stored in stockpiles for excess periods of time. An efficient systematic process of transporting a daily measured output of grain allows for fresh grains to be transferred into the warehouses. Therefore, FCI needs to create a speedier storage system that efficiently cycles through the output and input of food grains to ensure that outdoor, open dumping grounds are no longer needed.

Since a fifth of the food warehouses are located near Fair Price Shops (FPS), the government relies heavily on overloaded railways and trucks for delivery. Corruption also occurs during the transportation process from the storehouses to ration shops. During the journey, officials all along the chain whether they are grain storage depository managers or shop keepers, steal large quantities of food and sell it onto black markets instead of transferring grains into public distribution shops. The high quality subsidized foods are also prone to swapping with less nutrient and older grains. A kilogram of rice, wheat, or coarse grains costs only 1 to 3 rupees for the poor beneficiaries under the ration system. Nonetheless, the mentalities of these corrupt officials are to bank personal profits by stealing and reselling these grains at market prices for up to ten times more expensive.

The National Security Services (NSS) and World Bank commissioned a study in 2012 revealing, “Just 41.4 percent of the grain picked up by the states from federal warehouses actually reaches Indian homes.” According to figures compiled by Bloomberg, a global financial software, data and media company, “\$14.5 billion in food was looted by corrupt politicians and criminal syndicates over the past decade in the

state of Uttar Pradesh alone. Thieves blunt the country's only weapon against widespread starvation, a five-decade-old system that has failed to deliver record harvests to the plates of India's hungriest" (Srivastava and MacAskill 2012). Clearly this is unacceptable and unjust for poor citizens who deserve more than twice as much grain quantity and better quality foods. Sting operations in efforts to combat corruption during food transportation have been conducted twice in 2013 by Indian television channel, Aaj Tak. "Operation Black" exposed the deeply rooted nexus among policemen, ration shop owners, as well as FCI officials all working together to transfer and sell food distribution meant for ration shops to mills, companies, and black markets. It is advised to increase the number of these sting operations around states to bring awareness to the communities that illegal activities are happening in the food security system. Caught officials such as policemen, food price shop owners, and warehouse managers should receive follow-up punishment by way of losing their licenses or serving jail time once they are taken and questioned in court.

Governments should also make policies enforcing mandatory Global Positioning System tracking devices on the trucks as well as Radio Frequency Identification (RFID) chips to track and make sure the transportation of food grains from storage depots are ending up in the intended ration shops. Although the Indian Government was planning to introduce the technology in their 11<sup>th</sup> Five-Year Plan commission drafting, they have still yet to enact the policy. To prevent any thieves interfering with the GPS and RFID tracking devices, tamper-proof radio frequency sensors must also be installed to alert any suspicious activities. Similar to a bar code the

RFID tracking tags should be encoded underneath labels to stick directly onto the grain sacks. This technology transfers wireless data to a remote reader in real time to catch any suspicious activities as they are happening. Thus, in an instant RFID will count, track, manage inventory while cutting time costs, operating costs as well as manpower. The moment the shipment arrives at the ration shops, the scanner will read the package and have accurate description of its contents. RFID mobile scanning readers at each chain activity location including storage facilities, trucks, and the fair price shops (FPS) to monitor and track the grain depots that are entrusted is also recommended. In each chain of command the responsibility must be placed on those individuals through enforcement, rewards, and accountability.

To prevent rough inventory estimates from occurring, the state government should also make compulsory inventory checkups to make sure precise and accurate numbers reveal food stocks both delivered and received equally match. This technology has already been widely used by major corporations such as Amazon to aid in a more effective and cost efficient distribution system. For India, the new system can reduce unsuspected illegal food leakage while proving to be an effective tool in protecting the poor citizens grain entitlements and monthly life rations. Without the prolonged corrupt acts of criminal activities hindering the quantity, quality, and speed of distribution, the malnourished population can once and for all be ensured the food they deserve.

The amount of subsidy grains distributed from the central to state government is based on the availability of the quantity of food stocks over the last three years. By revising the problems of food grain availability through adequate storage facilities and

anti-corruption sting operations as mentioned above, more than half of India's food either rotting or being stolen can be safely locked for TPDS. Once food grains meant for the beneficiaries are securely delivered by the help of GPS and RFID tracking devices, greater availability of food allows for states to increase the number of recipients who can qualify for food rations. It should however be highlighted that the current system still comprises of many errors that continue to hinder TPDS effectiveness.

Properly identifying households below the poverty line is a vital task under the state government in need of an advanced mechanism to precisely pinpoint the eligibility of poor citizens. The target public distribution system has excluded large numbers of families due to problems associated with accurate surveying below poverty line (BPL) measurements and misappropriation of populations all requesting the need for ration cards. An expert group set up in 2009 by PRS legislative research to advise the Ministry of Rural Development estimated that, "About 61 percent of the eligible population was excluded from the BPL list while 25 percent of non-poor households were included in the BPL list." The result is large welfare costs linked with wrong exclusion of the target population. This ultimately translates to an increase in the poor's malnutrition and matter of survival. In a country where more than 70 percent of the population living in rural areas is dependent on sustainable farming, they are vulnerable to loss of income due to climate change, decreased harvest, and debt. Therefore, the proxy income indicators that are used to determine levels of poverty sometimes fail to capture real severity of food insecurity in households. With large

inclusion and exclusion errors, this implies that some recipients are not getting of their deserved subsidized foods while those who are ineligible are gaining undue benefits (PRS 2013). TPDS has therefore worked counter productively in targeting and reaching the underrepresented poor, as qualifying families are considered ineligible for government subsidized foods.

To get better accurate evaluation of who qualifies as beneficiaries under the National Food Security Act, there must be greater action from India's Ministry of Rural Development and state governments in hiring more civil workers as well as volunteers to conduct door-to-door census data collection. Although this method may be more difficult in larger states with greater poor populations, it is vital to still conduct personal census especially documenting household poverty levels in the poorest communities and neighborhoods. Absolute income lines issued by the Planning Commission should be updated and based on official poverty lines for the current year not criteria's dating back to 1993-1994. To counter administrative problems for determining the eligibility of beneficiaries, official estimates of actual households must be reported by each state. A report by the Comptroller and Auditor General of India (CAG) stated that no survey was undertaken in 18 out of 31 States and Union territories to identify BPL families (2000). Rather than simply checking family income to determine below poverty line (BPL) or above poverty line (APL) levels, identification surveys can also include other indicators such as household size, employment, children in school, health records for history of diseases, body mass index, and debt liability. This will give thorough information for surveys to be

conducted by professional agencies, NGOs, and academic institutions to base new criteria for below poverty levels. Door-to-door data accumulation conducted by government personnel is also a technique for potential corrupt officials to be investigated. Fair price shop owners should be evaluated in their responsibilities to maintain accurate records and information of below poverty level (BPL) and above poverty level (APL) beneficiaries as well as accounts of monthly inventory and balance stocks. Food storage facility managers as well as transportation delivery truck drivers should be evaluated and questioned in follow-up accounts of their responsibilities by inspectors as well.

The phenomenon of “ghost cards” is another indicator of misused inaccurate classification of recipients under TPDS. These falsified ration cards are made in the name of non-existing people enabling some individuals to gain extra rations while depriving an equally deserving citizen from months to year’s worth of food. To tackle these acts of fraud and false identification, the government must enforce compulsory photo identifications on ration cards. Since it is inevitable that other forms of deception may arise through altering and tampering these identification photos, states should implement photo requirements similar to passport pictures or drivers licenses. Micro print security features as well as government seal and holograms can further prevent ration cards from being easily replicated. Electronic scanning systems can also be useful in pulling household beneficiary information immediately. This changed system of digital cards checks in and out recipients while providing secured verification of each individual’s identity. Fair Price Shops can therefore be assured of a decreased

level of ghost cards. Ultimately, the rationale for the targeted public distribution approach is to deliver affordable food subsidies to the poor, but the truth of the matter is that ‘benefits meant for the poor often end up being poor benefits’ (Sen, 1995). To make TPDS become a more meaningful system of operation, the central and state governments should urgently amend the current system to be free from issues of food waste, black markets, misidentification, and overall corruption. Under joint cooperation and responsibility by the Indian government, Food Corporation of India (FCI), information centers, and NGOs, the policy recommendations mentioned above can be enacted to improve the current public distribution system. As long as these problems that continue to plague TPDS remains unresolved, it will be difficult for the poor and undernourished populations to ever be fully assured of food security.

## **6.2 Irrigation System**

India is facing yet another crisis in its lack of efficient irrigation systems that hinders its ongoing food security efforts. With a requirement of higher per capita income to support the growing population, degrading natural resources such as water as well as concerns of climate change has put escalating pressure on India to implement a change in their irrigation systems. The Ministry of Water Resources states, “India has 4 percent of water resources of the world, while it has to support 16 percent of world population and 15 percent of livestock. The per capita water availability has reduced to about one third since its independence” (2012). Depleting aquifers and irrigation sources also pose challenges on the country requiring urgent attention.

Irrigation has been the main plank and foundation for growth of agricultural production. Therefore, success in irrigation is of utmost importance in order to foresee critical improvements to India's food security and economic growth. The purpose of irrigation reform is to aid the progress of successful GM cultivation, as many lobbyists have been concerned with Bt crop failures due to farmers' insufficient access to water. With this dwindling key natural resource, it has left a country with half its population in the agricultural sector frantic for change. Greater water input is vital for successful Bt harvesting to allow the technology to reap higher and better quality yields. By transforming India's vulnerable agricultural industry through enacting an effective system of irrigation, India can anticipate movements in its currently stalled Bt field trials. Whether India decides to terminate the advancement of Bt technology altogether or expunges the moratoriums to allow biotechnology to expand in food crops, farmers' access to water can make all the difference for the potential Bt brinjal, rice, and wheat. Success in irrigation is a clear sign for success in agriculture, enabling the full benefits of Bt technology to sweep into transforming India's current issues facing mass farmer suicides, Bt moratorium on field trials, and finally the deadlock of Doha Development Rounds.

During the 1950s through the 1960s, the government of India, facing the brink of famine and droughts, established ground water irrigation systems in order to increase agricultural production (Food and Agriculture Organization, 2003). However, India is still currently experiencing severe problems as irrigation systems have become too expensive for investments. Many are incomplete and increasingly being neglected,

causing a backlog to successful grain harvests. In particular, large-scale canal systems are in very poor condition as they are inadequately maintained and operated. The timing of water supply is unreliable to farmers who depend on access to water in order to sustain their crop growth. Climate change has caused irregular monsoons that have resulted in unpredictable seasonal droughts and floods. As the population is rapidly increasing, water demand is equally rising as well. With water being such “a scarce natural resource, fundamental to life, livelihood, food security, and sustainable development,” there is fear that the severe constraint on the availability will bring detrimental results to the nation’s already vulnerable stance (State of Indian Agriculture 2013). Therefore, I propose policy recommendations directed towards the Government of India’s Ministry of Water Resources responsible for development, conservation and management of water to make additional changes for sustainable irrigation infrastructures and efficiency.

The Ministry of Water Resources has already initiated many programs such as Participatory Irrigation Management with the establishment of the Water User’s Association to manage and maintain various water related projects. Other missions include Flood Forecasting, Ground Water Exploration Programs, and the National Water Academy to educate engineers in the current irrigation technologies. It is not to say that these projects have been in vain, but they have driven up much financial costs while being unable to fully achieve these performance goals (Indian Ministry of Water Resources 2013). Currently, India is in a position where their economic growth is of utmost importance and agricultural yields as well as their exports are coupled with

their primary objective. The promise that Bt crops bring greater yield, may be a viable way to sustain their domestic grain production and food surplus for exporting to the international market. India has tried to resolve their water irrigation issues through the standard integrated approach that seems to checklist problems, while assuming its most desired outcome. However in reality, rigid boundaries and systematic practices contain limitations and poses hurdles that can disrupt proposed plans. New systems have resulted in mismanagement, lack of information, incomplete construction, and have contributed to driving the financial costs, which are a heavy burden to the state.

Therefore, India can try a different approach. The clumsy approach is one that assumes coordinating tasks are expensive and often times difficult to accomplish successfully. Instead of rigid systems, this approach does not require the introduction of new institutions and mechanisms, but rather cooperates with the existing circumstances. For many Bt cotton farmers who are in rural areas desperate for water, the dripping irrigation system seems to be a solution. Its compatibility with poor irrigated farmlands has made it exceptionally popular among sugar cane growers in India. The existing method can be used for growing and cultivating Bt cotton as well. Drip irrigation utilizes an effective technique where direct, slow, and frequent watering, emitting on or below the soil surface. Due to the fact that it is persistently keeping the soil moist at a frequent interval rate, the crops are not deprived of water and thus the soil surface remains fertilized. This is essential in the growth of Bt crops. The drip irrigation can expand to reach these farmers, thus reducing the need for more expensive technologies. The result may be a greater crop yield annually, which in turn can reduce

famer suicides and create an agricultural export economy in India.

The Central Board of Irrigation and Power (CBIP) as well as state governments should also administer a series of public consultations that are held in central locations and areas of major irrigation projects. Establishing discussion in these public consultations can provide voice and participation to local farmers, Irrigation Development staffs, politicians, researchers, and the press who are all to a certain degree affected. Each state's level of irrigation reform needed is distinctive so these informal public rounds can facilitate a framework for the necessary steps towards structured reform in a transparent and open manner. Although some states such as Andhra Pradesh began the series since 1996, there are many other states that have not held public consultations that still struggle to incorporate well-rounded feedback from all the beneficiaries of irrigation systems. Nonetheless, reforms to the irrigation agencies alone are not likely to improve system performance but rather joint management between government agencies and water users is required.

### **6.3 Monsanto Customer Perception**

Monsanto has generated a lot of talk and debate among Indian farmers, many who strongly oppose their involvement in India. However, the corporate can mitigate these differences by adopting a business ethics method called Creating Shared Value approach and improve their overall corporate image in India (Porter and Kramer 2011). Since anti-GMO activists portray Monsanto as a large multinational corporation that is gaining corporate control over India's agricultural sector, whose only goals are to

maximize their own profits, moratorium and stalemate has been the government's response to the people's cry of distained voices. Monsanto needs to realize that what is good for society may also be good for their business as well. Creating societal benefits in a powerful way can lead to a huge economic value for the firm. Smart companies include ethics and strategy while utilizing resources to the best of their ability all the while supporting the advancement and benefit to society (Moon 2011).

However, one of the biggest problems facing the corporation is its brand perception among the people. As the firm has grown tremendously over the years, Monsanto has the capacity to build a much stronger trusting image to enhance its credibility while imprinting a lasting impact in India. None can deny that Monsanto has already transformed its position as once a chemical company to an agricultural multi-national corporation whose mission is sustainable farming. However, although they have transitioned from one sector to another, they must push the boundaries to further integrate themselves into the Indian market. Instead of being limited to purely business practices, Monsanto can extend their reach in India by aiding in societal and agricultural distresses within the GMO industry. An example of a company that has taken these positive measures is Nestle, which used this model to revamp their image in 2006. They have been in India for over a century and have taken many steps to becoming one of country's most trusted brands. Nestle has taken CSV to heart and has successfully created a stronger brand as well as generated a loyal customer following. Following this business model and by placing their primary focus on agriculture and Indian farmers, Monsanto will be able to tackle some of the growing issues that India is plagued with

today such as farmer suicides in rural and less developed areas. By adopting the CSV approach, Monsanto can improve their corporate image to the people in India through good works and contributions to their country.

#### **6.4 Farmers' Educational Programs**

By cooperating with the Government of India's Ministry of Agriculture as well as NGOs, Monsanto and India can collaborate in creating education programs on biotechnology and sustainable Bt crop development. Many farmers and GMO regulators in India are misinformed about how to successfully harvest and cultivate transgenic crops. With the high prevalence of illiteracy and low educational backgrounds especially in rural areas, launching workshops programs while working with local agriculture specialists can aid farmers to properly plant and harvest Bt crops for higher yields. Thus, it leads to lowering Bt and GMO crop failures due to misinformation, contributing considerably to diminishing farmer debt and eventually, suicides. Training schools and farmer-scientists interactions will educate while giving exposure on Bt crops to both current GMO cultivating farmers as well as prospective farmers who may want to adopt biotechnology. Skills training and field visits for rural youth can be a great introduction for the younger generations to gain first hand insight to later utilize the knowledge on biotechnology for future farming. As more and more seed companies are selling GMO seeds, farmers should be able to gain deeper awareness of the science beyond what they may read on labels or word of mouth. In general, these facilitated training and agricultural educational workshops allow farmers to share

knowledge with one another, gain access to facilities, and support services while building a mechanism for community support in a social level as well. Investments in schools in rural areas where farmers are concentrated in can also help the company raise future employees and promote their own business growth, creating both direct and indirect jobs.

## **6.5 Additional Recommendations**

Additionally, Monsanto can invest in building new high technology storage facilities with temperature regulation throughout various geographical areas, especially concentrating on those that have a lack of storage depots, as many storehouses had not been upgraded over 25 years. This will result in food not going to waste and rotting outside. Instead, the plethora can be stored effectively and with the proper distribution system as recommended previously, can enable poor families to gain access to quality grains. Although currently, only Bt cotton is widely commercialized, these acts can pave the way for more Bt crop varieties to pass through Indian law. As people's mindsets begin to shift from anti-lobbyist claims of corporate tyranny, views about Monsanto may spur a more positive association once they bring assurance unto the people who are most skeptical of their presence.

Currently, Monsanto is seen as a corporation that imposes top down propositions without directly involving themselves with the very people who are using their products. Therefore, there is a mendable disconnect between the company and the farmers, we must bridge the proliferated gap by touching the very lives of individuals affected,

through a bottom-up approach. Being proactive in improving social conditions through education, irrigation, storage facilitation, and state partnerships can easily reconnect Monsanto to the Indian people. The polarized voices will lessen and thus government pressure to block future GM crops from entering into the market.

Joint partnership between the Government of India's various ministries and multinational corporations such as Monsanto is critical for holistic reforms to see notable results. While acknowledging the government's ambitious efforts in enforcing policies aimed at feeding their starved population, it is evident that India still needs to bring in a more efficient management system through distribution, irrigation, corporate businesses, and educational approaches. Rather than congratulating ourselves on how smart and insightful we have become in acknowledging these new tasks, we ought to ask why we have not acted on these ideas before and what is still preventing us today. If India continues to make aggressive new policies for food security like the NFSA Act, they must in accordance tackle the inner layers of agricultural systems such as TPDS, misinformation, and natural resource deficiencies to truly enforce a noticeable difference. The bifurcated gap between lobbyist groups on each end of GMO opinions has brought a worrisome divide that can be improved with Monsanto's aid as well. Although compelling intentions to prompt change is an essential step towards implementation, without follow-up execution on proposed plans, the vision for India's food security and Doha Development Rounds will remain uncommitted to nothing more than simply improved discourse.

It is without a doubt that many other developing countries face similar

problems to India's food security, especially in countries ridden with famine, malnourishment, and domestic agricultural burdens. Amending food distribution, irrigation, and farmers' educational systems are not only recommended for the Indian government but other developing nations who face similar chronic issues as well. As previously mentioned, India is seen as a leader in the developing world, following its footsteps, developing nations can also find success by using biotechnology to its full advantage in cultivating greater crop yields and pest resistant technology in order to combat food insecurity and protectionism in international trade.

## **VII. Conclusion**

The creation of multinational negotiations and free trade agreements between countries has contributed to globalization and internationalization at a rapid pace. The World Trade Organization provided a vehicle for achieving this through the lowering of trade barriers between states. In addition, the Doha Development Round's efforts to further reach the accessibility of market access means that all member countries can reap its benefits. However, rather than progressing smoothly, the Doha Development Round has seen a deadlock where negotiations seem to have hit a wall during its over long decade efforts to further globalize. Many have attributed India and its protectionism of its agricultural sector as one of the main causalities for this ongoing stalemate. As one of the leaders in the developing world, India is often cited as an example to many developing nations who look towards it as a model in global affairs.

The issue of India's food insecurity not only affects their domestic policies but also has spillover effects during international negotiations. Only by resolving India's food shortages can the Doha Rounds move forward from the present state. This is not to say that overcoming India's food insecurity will completely eradicate any discrepancies within the negotiation itself, but rather act as a big push to generate further talks in hopes of achieving the most ideal settlement. As an effort to fight food shortcomings, India has come a long way from the mid 1990s, gradually opening its doors to multinational corporations. With the introduction and commercialization of Bt cotton, India's local farmers were hopeful that they would reap more yields than

traditional farming. Although evidence shows harvests have increased, there are still polarized voices that divide the country on the issue that has prevented further commercialization of other transgenic crop varieties. In effort to mitigate the opposing views regarding this technology, the government placed a temporary moratorium on future genetically modified crops. India however, has come too far to abandon biotechnology. With its multiple regional and international negotiations taking place, India bears the responsibility to move forward with embracing this technology for greater agricultural production yields. In order to reap the greatest benefits from using this science, the state also shares the obligation of adequately providing the necessary tools to farmers such as proper water irrigation that directly affects every living organism. Many rural areas in India lack the suitable water resources for Bt plants to thrive. As a result yields are poor, driving rural farmers to fall into tremendous debt, sometimes even taking their own lives in desperation. In addition, the government's efforts to combat malnutrition and hunger through providing subsidized quality grains have been thwarted from an inadequate and unreliable distribution system.

The problem is not the production of food, but rather the manner in which the food gets into the hands of the people. Therefore, with the recent enactment of the NFSA 2013 Act, India's renewed commitment to ambitiously tackle food security issues is dependent on the targeted public distribution system, which must be coupled with these following policy changes. By systematically targeting the root causes of such corruption, inefficiency, and stalemate in the smaller scale of domestic agriculture, there is hope for India to overcome its formidable challenges in larger levels of

international regulations and trade. By taking a step-by-step approach, we can hone in on reverting destructive causes to later influence positive outcomes towards India's progression in its subsidiary goal of moving forward with GMO crops, its primary goal of achieving food security, and in a larger scale its final goal of lessening deadlock in the Doha Development Rounds. The policy recommendations should not be seen as unrealistic or utopian in nature as it deals in revising what the government has already enacted. India has established a beginning foundation towards eradicating its food security issues but must now polish the inefficient gaps that hinder its success. In sum, as GM technology increases crop cultivation, the targeted public distribution system allocates those goods increasing the success rate of the National Food Security Act, which ultimately addresses India's stalemate in the Doha rounds. Just as the WTO's Bali Ministerial Conference, European Union's Trade Commissioner, Karel De Gucht says, "The fate of the entire WTO is at stake and both metaphorically and physically, we have come too far to fail" (2013).

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## 국 문 초 록

# 인도의 식량 안보와 미래 규제 개혁의 전망: 도하개발라운드 교착 상태의 진전

현재 인도는 개발 도상국 중 대표적인 나라의 하나이다. 인도의 영향력은 국제무대에서 주요하고 지배적인 역할을 부여 받으며 빠르게 성장하고 있다. 도하개발라운드 지연은 인도의 불안정한 식량공급 체계와 식량부족, 농업시장 개방 기피에 기인한다. 인도의 농민을 위하여 국제적인 보조금 수준을 수용한다면 인도의 농업은 위태로워질 것이다. 현재 상황으로부터 도하개발라운드가 진전을 보려면 우선 인도의 식량 안정을 위한 핵심과제를 다루어야 한다. 인도의 법 개정을 통하여 Monsanto와 같은 다국적 유전자조작회사들이 들어와서 더욱 질 좋고 생산량이 많은 Bt 기술을 소개할 수 있었다.

새로이 개발된 기술로 식량기근과 심각한 영양실조라는 핵심 문제를 Bt 기술의 상품착수화 대상 확대를 통하여 바꿀 수 있을 것이라는 기

대가 있다. 그러나 Bt 목화는 현재 상품착수화된 단 하나의 GM 농작물이다. 인도의 농업영역에서 생명공학이 어느 분야에 속하는지에 대해 의견이 뚜렷이 갈라지고 있다. 중점 문제는 식량기근인데, 식량기근의 근본적인 원인은 부정부패, 관개수로의 부족, 비효과적인 식량분배에 있다. 위의 문제를 해결하면 GM 농작물 실패와 Bt 유예, 농민자살 문제를 개선할 수 있다. 결과적으로 이런 노력을 통하여 도하협상을 진전시킬 수 있다.

즉, 도하라운드의 침체에 대하여 인도의 식량안정 계획과 방법을 가장 핵심적인 문제로 다루기를 권고한다. 이런 인도의 식량문제는 세계 통상을 위한 실제적인 합의를 조정하는 160개 모든 회원국에게 영향을 미친다. 식량불안정의 내부문제를 해결하지 않으면 외적인 산출물의 변화도 기대할 수 없다. 원인을 분석하지 않으면 결과도 바뀌지 않을 것이다. 따라서 인도가 집중하고 있는 공공배분 체계, 관개수로 체계, 농부교육프로그램, 더욱이 Monsanto에 대한 소비자 인식을 개선한다면 식량불안정과 도하교착 상태는 진전이라는 큰 변화를 볼 것이다. 인도는 이미 생명공학 의존도가 너무 높아졌고 국제기구의 인원이 되어 있으므로, 가장 바

람직한 방법은 식량안정을 획득하는 것이다. 이 식량안정은 아직 합의되지 않은 국제통상 협상에 결론을 이끌어 내는데 효과적으로 영향을 미칠 것이다.

주요어 : 도하 개발 라운드, 인도, 생명 공학, 유전자 변형 생물체 (GMO), 식량 안정

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