Agricultural GMOs in India

Dimensions of influence in the politics and policy of Bt cotton and Bt brinjal

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

This thesis looks at the divergent policy decisions on the commercial release of two genetically modified (GM) crops in India. Bt cotton was introduced in India in 2002, and has spread widely across the country, though not without controversy. In 2010, the first GM food crop – Bt Brinjal (eggplant) – was put forward for approval. In contrast to the Bt cotton decision, and following heated debate and a series of public consultations across the country, an indefinite moratorium was placed on the crop.

In this thesis, I unpack the various factors that shaped both decisions and the politics that accompanied them. To facilitate this analysis, I use a conceptual framework that combines four key forces that are often the focus of food governance analysis, but which are not always considered together. I argue that the divergence in outcomes can be explained by a confluence of shifts in key elements of the policy process. These dimensions of influence can be understood in four related categories: corporate actors, institutional mechanisms, science and science networks, and discursive elements. Changes that took place in each of these dimensions in the period between the two decisions align to explain divergent outcomes that no individual influence could.

The conceptual framework I develop in this thesis presents a useful structure to analyse the often-complex and multi-causal processes and outcomes related to food and environmental issues. The results of this research have implications for the future direction of agricultural GMO policy in India, as well as in other countries in the global South.

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List of Abbreviations

ABLE-AG	Agriculture Group of the Association of Biotech Led Enterprises
AIBA	All-India Biotech Association
ASI	Association of the Seed Industry
BRAI	Biotechnology Regulatory Authority of India
Bt	*Bacillus thuringiensis*
CEE	Centre for Environment Education
CICR	Central Institute for Cotton Research
CPB	Cartagena Protocol on Biosafety
CSA	Centre for Sustainable Agriculture
DBT	Department of Biotechnology
EC I	Expert Committee 1
EC II	Expert Committee 2
FAO	Food and Agriculture Organization of the United Nations
GEAC	Genetic Engineering Appraisal Committee
GM	Genetically modified
GMO	Genetically modified organism
IAASTD	International Assessment on Agriculture, Science and Technology for Development
ICAR	Indian Council of Agriculture Research
IIVR	Indian Institute of Vegetable Research
MMB	Mahyco-Monsanto Biotech India Ltd.
MNC	Multinational corporation
MOA	Ministry of Agriculture
MoEF	Ministry of Environment and Forests
MST	Ministry of Science and Technology
NGO	Non governmental organization
NCRB	National Crime Records Bureau
NPM	Non-Pesticide Management
PDS	Public Distribution System
PIL	Public Interest Litigation
RCGM	Review Committee on Genetic Manipulation
SAI	Seed Association of India
SAP	Structural Adjustment Program
SHP	Smallholder Program
TNAU	Tamil Nadu Agriculture University
UAS	University of Agriculture Sciences
UPA	United Progressive Alliance

Chapter 1

Introduction and Methodology

Introduction

India approved its first genetically modified (GM) crop for commercial cultivation in 2002. Bt[1] cotton was introduced to farmers' fields accompanied by widespread media coverage, and promotional campaigns that heralded the crop as the first step towards a new agricultural revolution (Scoones, 2005). Over the next ten years, however, as Bt cotton gradually spread across the country, this arguably simplistic narrative transformed into a heated debate. While proponents continued to argue that the crop and the technology behind it were the key to economic growth and poverty reduction, critics held that it disempowered farmers and was environmentally damaging. Contrary to industry promises, they claimed, the technology was not scale-neutral, and was pushing small and marginal farmers into a deeper cycle of debt and poverty while large corporate entities profited.

In this polarized context, a new genetically modified organism (GMO), this time a food crop – Bt brinjal (eggplant) – was put forward for approval in 2006. This was, in many ways, unexpected. Unlike cotton, brinjal is not a major commodity crop; it is grown on only 550,000 hectares in the country (Choudhary and Gaur, 2009), and almost all production is consumed domestically (FAO, 2012b). Cotton, on the other hand, is grown on 12.1 million hectares, making India the second largest cotton producer in the world after China, and the second largest exporter after the United States (NCCA, 2012). Just under 90% of this acreage is now being grown with Bt cotton (James, 2012). In this context, it is not hard to imagine why being able to market Bt cotton in India was prudent for the GM sector; understanding its motivations to have a variety of genetically modified brinjal commercialized is not as straightforward. Some believe that Bt brinjal was in fact a "gateway" crop, put forward to strategically help the corporate sector with future GM crop commercialization requests by setting a precedent for a speedy approval process for other crops

[1] Bt stands for *Bacillus thuringiensis*, a bacteria that produces a substance toxic to lepidopteran insects, some of which are common agricultural pests. Bt crops are engineered with a gene from this bacteria, which makes the crop itself produce the toxin. Engineered plants are hence poisonous to pests susceptible to this toxin, including one of cotton's primary pests, the cotton bollworm. The fruit and shoot borer, which attacks brinjal, is also susceptible to the Bt toxin.

with similar characteristics (Ramanjaneyulu, 2011). Brinjal was perhaps particularly suitable because, despite its small acreage, it is amongst the most widely consumed vegetables in the country (Choudhary & Gaur, 2009).

Industry motivations aside, Bt brinjal passed through most of the regulatory stages with relative ease, as Bt cotton had, and in 2009, was delegated to the Minister of Environment and Forests for a final decision on its release. The outcome of this decision, however, was starkly different from the one on Bt cotton. Following a series of public consultations and nationwide protests, and despite pressure from a number of international and domestic sectors, the minister imposed an indefinite moratorium on the commercial release of the crop in February 2010. He cited several reasons for his decision, ranging from biodiversity protection and human health concerns, to socio-economic wellbeing and public opposition (Ramesh, 2010).

The divergent story of these two decisions presents a unique and fascinating puzzle: Why were outcomes of the policy decisions on Bt brinjal and Bt cotton in India different, and what factors account for these differences? To answer this question, it is important to unpack not only the various influences that shaped both decisions, but also the ways in which they changed over time and interacted with each other. It is also useful to tease out whether any one factor was significantly more influential than others, and whether there is a coherent pattern to the political processes of both decisions. The political situation of a country first approving and encouraging extensive cultivation of a major GM crop, and then placing a moratorium on another is, in itself, an unusual situation. Research based on this puzzle is even more novel; few studies have considered such opposing decisions on GMOs. However, the various aspects of this story feed into a broader analysis in the literature, on current and future decision-making patterns around GM crops in the global South.

In this thesis, I unpack and analyse this puzzle. Using primary and secondary data, and a conceptual framework based on four approaches to governance analysis, I compare the various factors that shaped the Bt cotton approval and the Bt brinjal moratorium. I do this by defining four dimensions of influence on decision making to explain the divergent policy outcomes.

These dimensions are corporate power, science and scientific networks, institutional and regulatory mechanisms, and discursive shifts.

I argue that both policy processes were shaped by a variety of influences in each of these four categories. The differences in the two outcomes can be explained by a confluence of shifts in each of these dimensions of influence, as well as the ways in which they interact. In the case of Bt cotton, corporate actors played a central role in shaping public discourse and political process, and ultimately the approval decision. In the years between the two decisions, however, a number of shifts were brought about by key actor coalitions in each of these dimensions, transferring the balance of influence away from the corporate-dominated context in which Bt cotton was approved, and towards one that considered a wide range of factors related to food security in India. The policy process around Bt brinjal, in turn, was compelled to consider a wider range of influences, impacts and voices than the Bt cotton one did, leading to divergent policy outcomes in the two cases.

Significance and Contribution to Literature

Despite India's recent economic boom, over 40% of the population still lives under the poverty line, and over 20% is undernourished (UNDP, 2012a; FAO, 2010). An even larger section – over 60% – depends on agriculture for its livelihood (Ministry of Agriculture, 2012), underlining the importance and urgency of studying issues related to food security and agricultural sustainability in India. GM crops occupy a particularly important space in this discussion. The stakes are high: India is the centre of origin for several food crops, including brinjal, and has significant stocks of much of the world's agricultural biodiversity. High numbers of farmer suicides – a staggering quarter of a million in the past decade – in Bt cotton growing areas have given rise to questions about the socioeconomic impacts of the crop, and biotechnology in general (Sainath 2012). Together these factors point not only to the need to study the impacts of India's biotechnology policy decisions, but also to the need for a debate around GMOs that sufficiently engages with a broad range of voices and that is, in a meaningful way, pro-poor.

The controversy around GMOs is fuelled, at least in part, by the fact that the science on GM crops – on productivity as well as risk – is far from certain (IAASTD, 2009). Specifically, Bt

cotton has only been commercially grown in India for 10 years, and Bt brinjal has never been grown anywhere in the world. Furthermore, no GM food crop in the world has ever been, at least intentionally, grown in its centre of origin, making information about potential contamination and the impacts of diversity loss in such situations scarce. According to Williams, in this "realm of non-consensual science, the power to determine what counts as knowledge, which actors disseminate it, and the terms on which it is communicated has an enormous impact on public policymaking" (Williams, 2009).

Much of the existing literature on GM politics and policies has focused on the transatlantic divide in approaches to GM regulation. Less attention has been devoted to evolving political processes and regulatory regimes in developing countries, and specifically in India, which presents a set of political and socio-economic dynamics that may well be both reflective of, and influential towards, GM policies in other developing countries. Existing studies on GM crops in India are based almost entirely on experiences with Bt cotton. I broaden this literature by considering the various interrelated factors that shape policy making around GM crops in India, and include in my analysis the recent decision to place a moratorium on Bt brinjal's release in the country. The findings of this research have implications not only for the future of domestic decision making around the role of GM crops in India's food security strategy, but also in the international arena, as evolving national-level regulatory regimes inevitably interact and influence each other over the coming years.

Methodology

I have used an interpretive and iterative methodology for this research, beginning with a review of existing scholarly and popular literature. I also conducted fieldwork, consisting primarily of interviews with key informants, as well as analysis of relevant policy documents and NGO reports. I then analysed my primary and secondary data, using a conceptual framework I describe in the next chapter, to analyse the findings in relation to the research question, as well as others that arose in the research process.

Literature review

I began my research process with a review of the scholarly literature. The brief history of biotechnology, the political debates around it, the trade pressures and disputes it has led to, and the effects of the international regulation on these have all been well documented, as have the role of corporate actors and institutions in these processes. I also considered the ways that science is translated into policy and the gradual discursive shifts that have accompanied the spread of biotechnology from the global north to south. These literatures are outlined in detail in the next chapter.

I also completed a media and press analysis to assess if and how public discourse about GMOs in the country changed in the years between the two decisions. The nationwide consultations and protests, as well as public statements and reports by independent scientists that preceded the final Bt brinjal decision, drew public attention to the issue, as did the original debate around the introduction of Bt cotton in 2002.

Fieldwork and interviews

My fieldwork was conducted in India. This was largely in the form of interviews with key informants who were involved in the recent moratorium decision or the civil society campaign that preceded it. This list included activists from NGOs connected to the case, many of whom are doing on-the-ground research; farmer associations and farmers growing cotton (both Bt and conventional) and brinjal; government officials; researchers; and journalists. (See appendix for a full list of interviewees).

My research was primarily based in two parts of the country - Delhi, the capital city of India and seat of central policy processes, and Andhra Pradesh, a state in the south. The latter is one of the primary cotton-growing regions of the country, and its farmers have had extensive experiences with Bt cotton. It is also one of the states that grow brinjal, and hence farmers here were both involved in, and stood to be profoundly affected by, the Bt brinjal decision. One of the seven consultations held by the environment minister was conducted in the state's capital, Hyderabad, which is also the centre of much activism around GM and agricultural issues in the region and country.

Most of the interviews I conducted took place in Delhi, in person. About half of these were with people based in Delhi, and the other half with individuals who are based in other parts of the country, but met with me while in the city. During my fieldwork, a group of civil society organizations hosted a public consultation on the proposed national biotechnology framework, the BRAI. The event consisted of four panel discussions, and featured several central stakeholders (scientists, activists, farmers and consumer group representatives), some of whom spoke with me personally after the sessions as well.

I also conducted interviews in Hyderabad, Andhra Pradesh, with scientist and convenor of the Centre for Sustainable Agriculture, Dr Ramanjaneyulu, and leading scientist Dr P.M. Bhargava. In the rural parts of the state, I met with several farmers and activists from the grassroots organizations Deccan Development Society and South Against Genetic Engineering, and attended a community meeting on Bt cotton, hosted by members of the local farming community.

While in India, I was also able to access non-academic sources of information on both crops and policy decisions. These included accounts of farmer experiences with Bt cotton, which have been documented by farmers themselves, as well as the organizations working with them[2]. There is virtually no academic literature on the Bt brinjal decision and process so far. There is an abundance, however, of NGO reports and statements. I have drawn on these as well as publicly available government documents on the background research, political process and policy decisions to track and analyse both cases. The latter includes an extensive 532-page document that records testimonies by NGOs, farmers, state ministers and scientists on the Bt brinjal consultations, as well as on the consultation process itself (CEE, 2010b).

Approach and analysis

I use a political economy lens to analyse my data, and to understand the policy and politics of GM crops in India, as well as their impact on environmental and socio-economic contexts of

[2] See, for example, the Deccan Development Society and the Community Media Trust at http://www.ddsindia.com/www/cmt.htm and Qayum and Sakkhari 2003, 2004 and 2005.

food security in the country. A political economy approach encourages equal attention to both politics and economics, and emphasizes the interaction between them. Environmental political economy, then, has been defined as “work concerned with the structure, organization and operation of political-economic systems (that is, mechanisms for making collective choices) as they confront environmental problems" (Dryzek, 1996, p 27).

In the context of this research, this implies considering all stakeholders, including businesses, civil society, scientists and governments, to be important political actors. I study their influence and role in decision making, formally and informally, and with a focus on the power relations and knowledge politics between them. Based on my use of the literatures in the next chapter and the political economy approach mentioned above, I develop a novel framework for analysis that takes into account the role of political and economic actors and influences, and the interactions between them.

Thesis Structure

In Chapter 2 I briefly lay out the background and current context of GM crops in the world, and the politics and policies that accompany them. I go on to review relevant concepts and literatures on the international political economy of food and the environment, outline approaches to analyzing GMO governance, and identify existing gaps in the literature. Drawing and building on these themes and in order to address the gaps, I then outline a unique conceptual framework, which I use in the second section of this thesis to analyse my case study on two policy decisions on GMOs in India.

Chapter 3 recounts the events as they happened. I describe the political and socio-economic context in which Bt cotton was approved in 2002 and the ways in which its cultivation played out after it was released for cultivation. I then go on to trace the decision-making process that preceded the moratorium on Bt brinjal in India, and the various political, socio-economic and scientific factors that influenced this process. This account leads directly into my analysis.

In Chapter 4, I use the conceptual framework described in Chapter 2 to analyse primary and secondary data, and unpack the various factors and dynamics that led to the two decisions. I

explore the changes generated by a number of actors in the years in between them, and argue that together, these changes led to shifts in all four dimensions of influence, which in turn created divergent policy outcomes in the two cases.

I conclude in Chapter 5 by examining the implications of this research, my argument and my conceptual framework, and briefly outline the possible impacts of new and recent developments that are outside the scope of this analysis. The findings of this research feed into broader questions about future policy directions that India may take in its approach to GMOs and food security in the country.

Chapter 2

Approaches to GMO Governance

Background

Despite growing attention to the issue, global hunger and food insecurity levels continue to be extremely high and, for the most part, rising. The United Nations Food and Agriculture Organization (FAO) estimates that there were 868 million hungry people in the world in 2010-2012 – 12.5% (or an eighth) of the world's population (FAO, 2012a). This number explains the international attention on issues of food security in the past few years, an important and heated subset of which is the debate around the role of agricultural biotechnology.

Genetically modified organisms, or GMOs, are organisms whose genetic structure has been modified by the process of genetic engineering. This process is essentially the removal of a gene packet from one organism, and its insertion into another organism's genome. In the case of agricultural crops, a plant is engineered with the gene of another organism to express particular characteristics or traits from the latter. Unlike the process of cross-breeding, in which varieties of the same crop species are crossed to select for certain traits, genetic engineering may cross the "species barrier," or in other words, moves genes from one species to another. An example of this is the insertion of a bacteria gene into plants to make them pest-resistant, which is currently one of the most common crop modifications.

The only two GM traits that have so far been commercialized are herbicide tolerance and pest resistance. Herbicide tolerant crops, most commonly engineered by Monsanto to be tolerant to its glyphosate-based herbicide, Roundup, account for 59% of global GM acreage (James, 2012). They allow farmers to spray entire fields with Roundup, killing weeds, but not the GM crop plants. Pest resistant crops are engineered with a gene from the bacteria *Bacillus thuringiensis*, which produces a chemical toxic to some butterfly, moth and beetle species. The modification makes the engineered crops themselves toxic to those insects. Bt crops account for 15% of global GM acreage, while crops that are engineered with both herbicide tolerance and pest resistance, or "stacked" crops, make up the other 23% (James, 2012). Both traits are engineered into primarily

four crops. These are corn, soy, canola and cotton, which together make up 95% of all GM crops cultivated globally (James, 2012). Small quantities of herbicide tolerant sugar beet grown in Canada, and virus resistant papaya and squash grown in the US and Hawaii, account for the other 5%. The multinational seed corporation Monsanto owns 90% of all GE seed and traits on the market (Etc Group, 2008).

The global area under genetically modified crop cultivation has climbed from 1.7 million hectares in 1996, when the first GM crop was introduced, to 160 million hectares in 2011 (James, 2012). This is limited however, to six primary countries that together make up 90% of the global area under GM cultivation: The US alone accounts for 43% of global GM acreage; Brazil and Argentina collectively add 33% to this number; Canada and India add 6% each, and China accounts for 3%. Although a number of other countries in the global south are now growing GMOs, their collective cultivated acreage is under 10% of the global area under GM crops (IAASTD, 2009; James, 2012).

For the first several years after the technology's commercial introduction in the United States in 1996, cultivation and trade of GM crops was centred largely in the global north. However, it is now increasingly shifting to developing countries as well, and with it, so are debates about regulatory frameworks for GMOs, and their role in food security goals. While some tout GM crops as the solution for the global hunger and environmental crises, especially in the light of a growing world population (Paarlberg, 2010; Borlaug, 2004), others contend that they erode biodiversity, strengthen corporate control, disempower farmers and exacerbate inequality (IAASTD, 2009; Shiva, 2011).

Critics have raised several concerns about GMOs. These include the risk of hybridization from GM crops to their wild relatives (Ellstrand, 2001) and the risk of contamination from GM to non-GM and organic crops (Dale, 2002). This kind of contamination has been seen in Mexico, with GM corn from the US (Quist and Chapela, 2001) and in Canada, when GM canola contaminated organic canola fields (Marvier and Van Acker, 2005). Weed resistance to the Roundup herbicide used with herbicide-tolerant plants, and pest resistance to the Bt toxin in pest-resistant crops have also become growing concerns over the past few years (Ellstrand, 2001; Benbrook, 2012). In the

US for instance, studies have found that overall levels of herbicide and pesticide use have increased by 525 million tonnes in the past 15 years, and weed resistance has become a serious issue (Benbrook, 2012). Similar patterns have emerged in countries growing Bt crops, such as India, where pest resistance and the emergence of secondary pests is forcing farmers to adopt more concentrated pesticides (CGMFI, 2012).

Much attention has been given to health concerns as well, with scientists arguing that the 90-day biosafety testing method currently used in most regulatory protocols around the world is inadequate (Criigen, 2012). Some feeding trials have been found to cause serious health effects (Séralini et al., 2012; Ewen and Pusztai, 1999) but these results are far from being uncontested (Bourne et al. 1998; Enserink 1999; for an overview of the debate on health effects see Hadfield, 2000 and Smith, 2007). All these debates exist in the context of a broader one about corporate control. While proponents of GM crops hold that companies such as Monsanto have the resources to carry out the technological innovation needed to feed the world (Bill and Melinda Gates Foundation, 2009), critics contend that this corporate control is a dangerous and disempowering aspect of the technology, and emphasize the need for farmers – especially smallholder producers in the global south – to retain access and control to their seeds, farming practices, and traditional knowledge (Shiva, 1993, 1997).

Parallel to these debates about corporate control, and environmental and health risks, exists a persistent tension between countries in relation to regulatory frameworks for GMOs. The international debate around the ways in which GMOs should be regulated has, in past years, been polarized between the precautionary approach adopted by the EU and the much more permissive approach of the US (Bernauer and Meins, 2003). However, countries in the global south, as they increasingly join the discussion, are not necessarily converging into one of these factions; they are instead diverging in a range of unique directions, developing new approaches, policies and controls (Falkner and Gupta, 2009). This divergence highlights the importance and timeliness of studying international GM policy and the ways in which debates about the role of GMOs in addressing food insecurity, especially in the global south, are playing out.

India is one of the countries where the politics and policy of GMOs is currently going through formative, and potentially widely influential, stages and changes. The agricultural and food security context in India makes these changes particularly relevant. Both poverty and hunger levels in India are very high, despite the recent, highly publicized economic boom in the country. The statistics speak for themselves: Almost 40% of the country's population lives under the national poverty line (UNDP, 2012a) and half the population lives on less than US$2/day (The World Bank, 2012). India is rated 15th on the Global Hunger Index, and is one of only three countries globally where hunger levels increased between 1996 and 2011 (Greber, Fritschel and Schofield, 2011). India is also home to the second highest number of children with malnutrition in the world, and loses four children every minute to preventable diseases (UNDP, 2012b). These figures are underlined by the country's income-inequality levels, which are among the highest in the world, and are rising (Times of India, 2011b). Not unrelated is the fact that 60% of the population relies on agriculture for its livelihood, 78% of which farm on less than 2 hectares (Ministry of Agriculture, 2012). The importance of finding economically and ecologically sustainable solutions to food insecurity in the country clearly cannot be overemphasized.

It is precisely because the stakes are so high that ensuring that the solutions and approaches adopted to addressing food insecurity in India do indeed represent the best interests of hungry and poor people - in other words, that those policies are truly pro-poor – is germane. Agricultural biotechnology is a key aspect of these discussions of food security in India.

Approaches to GMO Governance

Much of the literature on GMO governance has centred on the transatlantic divide in approaches to GMO adoption and regulation. This rift has been analysed extensively in the context of the Cartagena Protocol on Biosafety (CPB), the negotiation and ratification process of which highlighted the deep differences between the precautionary approach put forward by the EU, and the US's much more permissive stance on GMOs (Falkner, 2000; Andrée, 2005). It has also been studied in the context of the US, Canada and Argentina's WTO case against the EU, which claimed that the EU's stricter and more precautionary biosafety policies were trade restrictive (Brack, Falkner and Goll, 2003; Rafferty, 2004; Lieberman and Gray, 2008, 2006). As a response to this, much of the literature on GMO governance has analysed these trans-atlantic

differences in policy approaches, their cultural and political contexts, and their impacts on international trade (Bernauer and Meins, 2003; Prakash and Kollman, 2003; Stephan, 2012).

While these aspects of GMO governance are very important, and definitely shaped the politics of the first decade of GM commercialization, they do not tell the whole story. There has been significantly less attention paid to the ways in which international regulatory mechanisms interact with experiences of GMOs on the ground, and perhaps even more importantly, how these experiences vary from country to country and even crop to crop. Many of these differences are based on the set of actors involved in specific situations. These actor coalitions vary geographically, and are changing rapidly as GMOs, and the debates that accompany them, spread to new regions. These debates encompass a broad range of topics, from environmental and health concerns to those related to corporate control, farmer livelihoods and other socio-economic impacts.

The global food governance and international food politics literatures frequently attribute policy outcomes to one of four major factors. These factors are corporate power, science networks, normative and discursive influence, and institutional mechanisms. I use these themes to develop a conceptual framework situated at the interface of all four dimensions of influence, emphasizing not only the importance of each independently, but also the shifts within each dimension over time, and the interactions between them. This collective analysis helps explain outcomes that no single dimension could accurately on its own. In the next section I provide a brief background on each of these themes, and the ways in which they influence and engage with political and policy processes around GM crops.

Corporate power

Private firms have been a major player in the world food economy for centuries. In fact, some of the first transnational corporations, such as the British and Dutch East India Companies, were trading agricultural products as early the 1600s. In the 1800s, large grain trading companies were established, and several of them – ADM, Louis Dreyfus, Bunge, and Cargill – are still operating on a vast scale today, and control between 75 and 90% of current global grain trade (Clapp, 2011, p 98). However, the growth in the agribusiness sector has been particularly significant in

the past few decades. With the rapid push to adopt "science-based", industrial and large-scale modes of food and grain production in the 1970s, corporations grew their operations significantly (Clapp, 2011). This shift was accompanied by a deregulation trend in the US and Europe, and a concurrent liberalization and globalization process that began in the 1980s, and spread across the world through the 1990s (Falkner, 2003). This process shrank existing state roles, while opening up markets and lifting regulatory restrictions on corporations that were then able to broaden their reach significantly (Friedmann, 1993; Clapp and Fuchs, 2009).

Along with this expansion, the 1980s and 1990s also saw the emergence of large-scale corporate concentration. This occurred both horizontally and vertically along the supply chain, and led to a growth in corporate strength and market power (Murphy, 2008). The expansion in scale and concentration of agri-food corporations has been accompanied by a growth in the role and influence these firms hold in policy-making processes. Due to the small and concentrated number of actors, companies are increasingly able to set and influence prices (affecting both producers and consumers) in global markets (Clapp, 2011). Perhaps even more significantly, however, they are playing an influential role in setting standards and shaping regulations (Clapp and Fuchs, 2009; Murphy, 2008). This has led to the emergence of private and often voluntary rules and standards that are set by the very firms they are meant to regulate (See for example Clapp, 1998; Clapp, 2006), or by firms working together with NGOs, but without the involvement of governments (Cashore, 2003; Gulbrandsen, 2009; Pattberg, 2005). These rule "regimes" may then be legitimized by states or international institutions, and often enforced on other actors, as well as the global food economy as a whole (Clapp and Fuchs, 2009).

These trends have all played out within the decision-making arenas around GMOs as well. Fuchs and Kalfagianni argue that private regulation is a product of corporate actors having both the *power* to govern, as a result of their structural strength, as well as the *authority* to govern, where the latter is a product of the fact that they are perceived as legitimate political actors (Fuchs and Kalfagianni, 2010). This can be clearly seen in the role that corporations have played in domestic policy-making situations around GMOs in the US, as well as in China, Mexico, South Africa and India (Newell, 2003, 2007a; Gupta and Falkner, 2006). Corporate actors, then, have moved from playing a role that is primarily an economic or market related one, to one that is firmly rooted in

both political and social spaces, and can be seen to have structural, instrumental, and discursive power (Fuchs, 2007). The latter manifests itself when corporate influence goes beyond shaping rules and standards to shaping norms as well. This is most directly seen in corporate advertising in media, but also takes place when corporations publish reports and briefs, and engage in public and scientific debates about health, environmental and ethical issues (Clapp, 2011), including those associated with GMOs (Hammond, Dudek and Nemeth, 2006). They are often socially positioned as "educators," who are responsible for health and safety (Fuchs and Kalfagianni, 2010), as well as for setting moral guidelines. This last aspect is a major flavour in the debate around GMOs, and the industry-dominated argument that GMOs are needed to feed a hungry and growing population come with a "discursive high ground" that is pervasive and persistent (Kleinman & Kloppenburg 1991; Williams 2009; See for example Monsanto n.d.).

This social and political role is further strengthened by the growing instrumental or lobbying power corporate actors such as Monsanto have in national and international politics. This can be seen in the influence wielded by large and powerful lobby groups that are affiliated with particular corporations or entire corporate sectors. It can also be seen in what has been coined the "revolving door" phenomenon, where individuals move back and forth between appointments with Monsanto and government, carrying the interests of one to the other (Clapp, 2011; Robin, 2010).

Corporate influence has also grown in governmental and intergovernmental decision-making arenas. Where powerful corporate actors would earlier have sought to influence policy through indirect means such as lobbying, they are increasingly working with and alongside governments, as partners and political actors in their own right (Biermann and Pattberg, 2012). This was apparent, for instance, in the negotiations on the Cartagena Protocol on Biosafety, where industry players were influential members of the US aligned "Miami Group," alongside national governments (Clapp, 2003).

While much attention has been paid to the growing power and influence of corporate actors in the past few decades, it is worth noting that a nuanced study of business power in environmental or food governance goes beyond an examination of merely how much or what kind of power

businesses wield. Falkner, for instance, emphasizes the importance of considering the ways in which corporations interact with both state and non-state actors. To address this need, he introduces a neopluralist perspective, which holds that business actors represent an important but not necessarily dominant source of power, which can be and is limited by other actors. Based on this, he argues for an analysis that is both issue-specific and considers historical background (Falkner, 2007).

Much of the literature on corporate power has focused on the role that private interests play in shaping environmental and food policy, including GMO policy, in international arenas. Several scholars have also considered the influence of corporations on agriculture and food issues in developing countries. Less attention has been given, however, specifically to corporate influence in shaping decisions related to genetically modified foods in the global south, where political and social contexts are not always directly comparable to those in the US and Europe. Few of these have focused on the unique situation in India.[3] Those that have, focus almost exclusively on policy and experiences related to Bt cotton, the only GM crop being cultivated in the country. This thesis broadens this discussion by including the more recent case of Bt brinjal, the role of corporations in the current political context in which the debate surrounding it played out, and the ways in which major private interests interacted with other state and non-state actors.

Science and science networks

Environmental science and politics are inextricably connected. Several scholars have examined the interaction between the two, and the ways in which science is used and translated into policy. Some have explored the various roles scientists as experts can play in relation to policy making, advocating for an approach that informs decision makers of all available options, along with their consequences (Pielke, 2007). Others emphasize that effective environmental decision making requires an acknowledgement of the political nature of science, and effective science requires an acknowledgement of less formal, situated and experiential knowledge systems (Bocking, 2004). Irrespective of their approach, a number of scholars emphasize the inevitable and complex interplay between science and policy: "The notion that scientific advisors can or do limit

[3] Exceptions include Newell, 2007 and Glover, 2007, 2009 and 2010.

themselves to addressing purely scientific issues, in particular, seems fundamentally misconceived" (Jasanoff, 1990).

Gupta et al also draw the link between science and politics, arguing that the position of science and science networks in policy-making processes is becoming increasingly institutionalized (2012). One of the implications of this trend is that in order to be influential, science must be generated in a participatory manner, be linked with the political process, and must find ways to integrate and interact with a broader range of knowledge-types than merely technical expert voices (Gupta et al., 2012). These knowledges include those that consider socio-economic and cultural value sets and traditional knowledge, both of which are almost always place- and case-dependent, but are often neglected in technical governance processes. Much attention has been paid to the "politicization of science" in recent environmental literature; less attention, the authors argue, has been devoted to the equally worrying trend of the "technicalization" of politics (Gupta et al., 2012).

Along with being inextricably tied up with political decision making, science is also in constant interaction with social systems. Litfin, in her important work on knowledge and power in international environmental politics, emphasizes that "objective" technical expertise does not directly generate policy (Litfin, 1994). It is instead shaped by social values, feeds into existing social narratives, and is "framed and interpreted in ways that bolster certain policy positions" (Litfin, 1994). As such, social factors also play an important role in shaping scientific communication (Bocking, 2010).

These studies have extended into the heated debate within the international scientific community on GMOs, and agricultural biotechnology research has often been labelled as being both politically motivated (Sahai, 2011) and politically influential (Rifkin, 2001). Much of the attention of this debate has been on biosafety issues and risk analysis, with some scientists arguing that GM crops (both those that are in pre-approval stages, as well as those that are already on the market) are safe, while others contend either that current levels of biosafety testing are inadequate and the results uncertain (IAASTD, 2009) or that they pose potential

environmental and human health risks (see for example, Séralini et al. 2012; Ewen & Pusztai 1999).

Alongside the biosafety debate, researchers also disagree about the actual levels of success and failure of GMOs on the ground. Much of this debate has been – and still is – unfolding in the global south, where hunger, poverty and biodiversity are all high, and specifically in the Indian context as well. In the case of the latter, the literature focuses on cotton, and ranges from studies (both scholarly and otherwise) that report as high as an 80% yield increase in cotton crops after GMOs were introduced (Qaim and Zilberman, 2003) to those that have found significant decreases in cotton yields, as well as increasing pest resistance, and deteriorating livestock and soil health over the past decade (Qayum and Sakkhari, 2005).

Interestingly, the dynamics between the authors of these diverging studies have at times nudged the debate into the arena of another overlapping issue – the previously discussed one of corporate influence. In his critical analysis of articles by Quaim and Zilberman, and those published by a group of researchers at Reading University who also found positive yield benefits (Kambhampati and Morse, 2006; Bennett, 2006; Bennett et al., 2004; Morse et al., 2005), Dominic Glover questions the authors' independence and credibility. Along with criticizing the scientists' methods and analysis, Glover discusses the fact that Monsanto and Mahyco fully or partially funded the Reading Group and much of their research (Glover, 2009). Just one of many such examples, this case shows the inevitable inseparability of various aspects of the GM issue, and also highlights the need for research that crosses disciplinary boundaries.

The debates around GM safety and success have developed in parallel to the one about the need for GM crops to feed a growing population. Again, this discussion crosses disciplinary lines. Well known researchers such as Gordon Conway, Robert Paarlberg and Norman Borlaug, for example, have argued fervently that the research, development and cultivation of GM crops is the only way to solve a growing hunger crisis and to provide food security for a growing population (Conway, 1997; Paarlberg, 2010; Borlaug, 2004). Others, such as the Nuffeld Council on Bioethics, acknowledge that there are other options based on changes in current production and distribution practices, but argue that the "redistribution of surpluses among and within

countries poses serious practical and political challenges," leaving no option but the research and cultivation of GM crops (Nuffield Council on Bioethics, 1999). In stark contrast, the counter-view holds that the hunger crisis is not caused by production-based issues, but instead by unequal distribution within the food chain. These scholars argue that biotechnology governance must be considered in the context of a "world in which hunger and poverty are rooted in inequality and lack of access to (readily available) food" (Jansen and Gupta, 2009; See also Altieri and Rosset, 1999; Rosset, 2005).

The social and political "subjectivity" of science is manifested not only in a variance of opinions on what credible and sound science is, but also in a range of perceptions and projections of the place that science should occupy in political processes. This can be seen clearly, for example, in the international negotiations leading up to the ratification of the Cartagena Protocol on Biodiversity. The negotiations were defined by a rift between the US and other countries in the Miami Group, who rallied behind the idea of needing "sound science" to justify restricting GMO trade, and the EU and other developing countries in the Like-minded Group, who were advocating for a less permissive, precautionary-principle based policy (Andrée, 2005). The case brought before the WTO by the US, against the EU, for restricting GM imports was split across the same lines.

This thesis is informed by and contributes to these broader debates, and the literatures they are embedded in. It focuses, however, on the complex dynamics involved in the translation of scientific research into policy, the politics involved in what is often (misguidedly) seen as an "objective" process of research and input, and the ways in which other stakeholders – farmers, civil society members, government officials and industry representatives – interact with this process. These themes have been given significantly less attention in the literature on the politics of GM crops, specifically in the germane and timely context of GMO cultivation and decision making in developing countries like India.

Institutional mechanisms

Despite how long institutions have been an important idea in the social sciences, there is still wide disagreement on their definition (Hodgson, 2006; Kingston and Caballero, 2009). Some

understand them as systems that lay out social rules and shape social interactions (Hodgson, 2006). Others define them as social structures that have the potential to create change or as patterns of behaviour around which social expectation is created (Mearsheimer, 1994; Hodgson, 2006). However, the most commonly used definition is Douglass North's conceptualization of institutions as a set of rules that shapes social interaction. He defines institutions as "the humanly devised constraints that shape human interaction." These constraints influence political, social, and economic exchanges (North, 1990, p 3).

North argues that one of the main purposes of institutions is to reduce uncertainty by "providing a structure to everyday life" (North, 1990, p 3). This structure comes from two types of rules – formal ones such as laws and regulations, and informal ones, which include social norms and conventions (North, 1994, p 360). Keohane emphasizes a similar idea when he defines institutions as "persistent and connected sets of rules, formal and informal, that prescribe behavioural roles, constrain activity, and shape expectation" (Keohane, 1989, p 3). This distinction between formal and informal rules takes a number of forms. Some understand formal rules to be those that are enforced by specialized actors (Milgrom et al., 1990) while others hold that they are explicit and enforced exogenously by the state or other authority, as opposed to informal rules, which are implicit codes of conduct (Kingston and Caballero, 2009; Keohane, 1989; Tuomela, 1995).

In this thesis, I draw on the idea of institutions as sets of rules, and focus on formal rules, or the various regulatory and constitutional frameworks and agreements that shape the ways in which political actors interact with each other and the policy process. These actors are closely connected, but not identical, to the institutions that constrain them (Yeager, 1998). Such an actor may be defined as an organization, or a formal or informal group that has defined roles and responsibilities in order to achieve a specific objective(s) (Uphoff, 1992). In North's words, then, institutions are the "rules of the game," and organizations are the "players" (North, 1990). While separating the two may be often be harder in practice than in theory (see for example Hodgson 2006), I focus here on the influence of institutions themselves, and allow this starting point to lead into the related discussion of the actions of the "players" they shape.

Scholars who approach studies of international environmental politics and governance from an institutionalist perspective hold that institutions, both formal and informal, play a central role in shaping economic and policy processes and outcomes (see for example Boliari and Topyan, 2007; Pande and Udry, 2006). A number of them have considered the various levels – international, regional, national and local – at which clusters of institutions and governance mechanisms work (Biermann et al., 2009). Others have focused on the interdependence of states (Keohane, 1982; Paterson, 2006), and argue that states rely on international institutions to facilitate cooperation and promote their common interests (Timmons et al., 2004). In this context, questions of which institutions and levels of governance are best suited to addressing various environmental problems become particularly relevant.

The structure and functioning of a broad range of institutions has gone through significant changes in the past few decades due to patterns of globalization, as have the interactions between them. The "fragmentation" process this has led to in various governance levels (Rosenau, 1993) has meant that policy outcomes emerge not just from state-level institutions, but also from broader global mechanisms, as well as from regional and local levels of governance (Vogler, 2003; Paterson, 2006). A subset of this debate has been caught up in discussions around whether global environmental problems can be addressed by existing multilateral institutions, such as the various agreements of the United Nations, or whether in fact a new international environmental institution is needed to cater to new problems (Najam, 2003; Biermann, 2009; Esty, 1996).

This literature also focuses on the emergence of new non-state institutions and "players" due to globalization, and the diminished state power that has come with it (Strange, 1996). However, it may overstate the autonomy of new private actors (Falkner, 2003), and neglect an analysis of the pivotal role state-level institutions and governments still play in environmental governance (Compagnon et al., 2012). For instance, formal, domestic institutions and the actors they constrain at the central and state[4] levels, are very influential in decision making around agriculture and food in India, making such an analysis essential to a discussion about GM policy. Private actors, for instance, often challenge the role and power of the state in some ways, but also

[4] The Central or Union government in India refers to the federal government, and state governments refer to the governments of the 28 states in the country.

rely on the state and its institutional and legal structures to operate within (Compagnon et al., 2012). Similarly, civil society, while often explicitly and radically challenging the power, decisions, and decision-making process of governments at all levels, also directs its actions towards governments when lobbying for policy change. The result is a hybrid relationship where private and government actors together play roles in setting standards and defining policy and policy-making processes, and which are simultaneously influenced by pressures from civil society actors concerned with social and environmental implications (Falkner, 2003; Fuchs and Glaab, 2011).

Another branch of the global environmental governance literature questions whether globalization and the rising prominence of international and multi-level institutions has led to regulatory convergence between international and domestic policies (Kollman and Prakash, 2007; Busch et al., 2012). While some argue that multi-level institutional linkages have led to domestic standards being collectively raised or lowered (Drezner, 2005; Kollman and Prakash, 2007), others hold that domestic policy approaches to environmental issues remain diverse and diverging, due in part to the persistent power and influence of domestic institutions and factors shaped by national-level political economy (Kollman and Prakash, 2007; Weiss, 1998).

This discussion of policy convergence, which is particularly relevant in the case of biotechnology policies, has taken place largely in the context of multilateral international institutions and developed countries (Busch et al., 2012). Fewer studies have considered this "convergence" effect on developing countries[5], despite the fact that their evolving biotechnology frameworks present a particularly timely set of issues. Existing studies on this topic consider the cases of biotechnology regulation in Mexico, China and South Africa (Gupta and Falkner, 2009), and contend that the restrictive policy directions in these countries can be explained, in part, by factors related to domestic institutions (Busch et al., 2012).

In this thesis, I unpack the various factors that have shaped domestic decision making around GM crops in India, and in doing so, shed light on the roles of formal domestic institutions, the ways in which they interact with non-state and international actors, and consequently, the way

[5] Exceptions include Gupta and Falkner, 2009 and Busch et al, 2012.

the "convergence effect" is playing out in India. I also consider the influence of international institutions. Multilateral environmental agreements, such as the Cartagena Protocol on Biodiversity, the primary regulatory mechanism for the international movement of GMOs, has had a varying level of impact on the ground. Soon after the CPB was ratified, studies considered how it would influence domestic policy frameworks in developing countries (Gupta, 2000b; Gupta and Falkner, 2006). My research is informed by this literature, while also adding to it. I consider the impact that the CPB has had in the 10-year period since it was introduced, as well as in the context of two specific policy decisions. In doing so, I assess the ways in which the CPB has interacted with domestic policy frameworks, and whether it has in fact widened or narrowed the international policy making space around GMOs.

Discursive patterns

Institutional, corporate and scientific influences all play out in constant interaction with another essential dimension of environmental politics: ideas and discourses. A discourse can be simply defined as a "cohesive ensemble of ideas, concept, and categorizations about a specific object that frame the object in a certain way and, therefore, delimit the possibilities for action in relation to it" (Epstein, 2008, p 2). They are, in essence, the way in which we understand and confer meaning on the situations and realities around us. In her study of the changes of international norms and practices around whaling, Epstein introduces the useful idea of a "powerful discourse." She explains it as a discourse that "makes a difference," giving an example of how the now prevalent anti-whaling discourse displaced the previously normalized one around whaling (Epstein, 2008). I draw on this idea while tracing the discursive shifts that took place in India around GMOs in the past decade, to assess whether indeed, a "powerful discourse" emerged in the years in between the two opposing policy decisions.

The influence of a powerful discourse comes from an "ideational power," and not a material one (Fuchs and Glaab, 2011). In the case of GMOs, this can be seen in the ways in which corporate actors have shaped the discourse around agricultural biotechnology as an ethical issue that is about food security, and not safety (Williams, 2009). However, it is also often used by environmental and social NGOs, who otherwise have neither the coercive power of states (Wapner, 1995), nor the material resources of corporate actors (Holzscheiter, 2005; Fuchs and

Glaab, 2011). Instead, their influence stems from their ability to change social norms and behaviours, "by dislodging traditional understandings of environmental degradation and substituting new interpretive frames" (Wapner, 1995). They further this power by promoting these discourses within existing state structures (Holzscheiter, 2005). In doing so, they act as both knowledge brokers (Litfin, 1994) and norm entrepreneurs (Holzscheiter, 2005). This authority makes them important political actors in their own right (Wapner, 1995).

This ideational power plays a particularly important role in situations with high levels of scientific uncertainty (Litfin, 1994; Fuchs and Glaab, 2011) and in situations with a strong civil society presence. The debate over GMOs internationally, and specifically in India, has been characterized by both (See for example, IAASTD, 2009; Newell, 2007). Furthermore, it is embedded within a morality-based discourse on feeding the world, which draws on both ideational influence, and a scientific influence itself tinged with uncertainty (see page 16). In this research, I draw on the concepts of ideational and "knowledge power" (Litfin, 1994), but extend Litfin's largely science-based definition of knowledge, to include traditional ideas, experiences and expertise on agricultural issues in various parts of the country. The actors that hold this power then, are also broader, and include civil society actors and farmers, who come together to create an influential actor coalition that draws its power from non-material sources.

While recent literature has been engaged with understanding the emergence of NGOs in international environmental politics, the intricacies of their roles are far from being clearly mapped. This is especially true in the case of GMOs, where normative values are highly contested. In India, where civil society is both active and influential, there is need for a much deeper understanding of the ways in which NGOs are shaping public opinions and discourses, and the ways in which those shifting discourses are in turn influencing policy and regulation. Further, as Fuchs and Glaab emphasize, ensuring that the interaction between ideational and material power is balanced is particularly important for a democratic policy process (2011).

In this thesis, I do not theorize the discursive capacity of NGOs as much as endeavour to map out shifting public opinions and responses to GMOs, understand how they played out, and explore the role of NGOs in the process. Perhaps most importantly, I consider the interaction between

actors relying on both material and ideational power, in the context of a policy decision that has not been given much attention in the literature so far.[6]

Conceptual approach and framework

A political economy approach concentrates on uncovering and studying not just the various factors that lead to political decision making, but also the links and interactions between them. A number of scholars of food and environmental governance have explored the linkages between one or two of the categories I have outlined above. Gupta et al, for instance, have explored the connections between science networks and international institutional mechanisms (2012). Litfin emphasizes the discursive and social value of science when she says that "information does not emerge in a void, but is incorporated into preexisting stories to render it meaningful" (1994). Similarly, others, like Clapp and Falkner, have done extensive research on the power and influence of corporate actors on political processes and institutions (Clapp, 1998, 2003; Falkner, 2003). Newell has explored the links between civil society and corporate actors, and analysed the impact of "scientizing" public debate (2001).

As I have highlighted in this chapter, policy and politics around GMOs are shaped by not just one or two of the influences mentioned above, but by all of them. Much of the literature on the international political economy of food attributes food security and environmental policy outcomes to one of these approaches to governance, and some consider the interlinkages between one or two of them as mentioned above. However, in the case of GM policy in India, political processes and outcomes are shaped by not just one or two, but all these areas, and an analysis that does not consider the tightly interwoven dynamics of all four dimensions of influence is unable to capture a complete and accurate picture of the complex policy-making process.

My research then, is situated at the interface of the four approaches to governance studies mentioned above. Drawing on these literatures, I define four "dimensions of influence" that together contribute to shaping final policy outcomes. These dimensions are corporate power, science and science networks, institutions and regulatory frameworks, and discursive shifts and

[6] Gupta, 2011 is a recent exception. In this article, Gupta looks at the recent decision on Bt brinjal, to understand how legitimacy was conferred on the participatory decision-making process around it.

public opinion. I analyse the key sets of dynamics and shifts that take place in each one of the dimensions individually, the interactions between them, and the confluence of those changes, which together change the political and socio-economic context of decision making.

Specifically, corporate actors and interests play an important role in political processes through direct and indirect influence and pressure (Levy and Newell, 2005; Clapp and Fuchs, 2009). Scientists and science networks similarly shape decision-making processes, and scientific research is translated into both policy and public discourse in a range of important ways (Gupta et al., 2012). This translation process becomes particularly important in a situation, such as with biotechnology, where there is a high level of uncertainty or non-consensual science (Williams, 2009). Such situations are also significantly shaped by public opinions and the changes in narratives (Litfin, 1994; Holzscheiter, 2005). Discursive shifts often emerge from the work of civil society organizations that use their ideational power to shape policy and policy processes (Wapner, 1995; Fuchs and Glaab, 2011). These processes themselves are, despite the emergence of new political actors, closely tied up with the work of governments and state institutions (Compagnon, Chan and Mert, 2012). These institutional systems then, are also changing, and continuously interacting with other actor coalitions. These influences are all examined in detail earlier in this chapter.

These categories are made up of diverse and often dissimilar elements, and the lines between them are not always clear-cut. The corporate dimension, for instance, plays out primarily through its leading actors, both individuals and firms. I consider institutions, in this work, primarily as sets of rules that then mould the actions of state and international actors. Both these "rules of the game," and the way they impact the "players," are discussed in relation to the institutional dimension. Scientific influence is exerted on the process through the participation of networks of Indian and international scientists, as well as the presence of a changing body of scientific knowledge itself. In as much as the latter plays an important role in shaping public discourse, it overlaps with the fourth dimension of influence as well. This section focuses primarily on popular narratives and framings of GM crops. It also considers civil society actors who, in the cases I discuss, played a major role in shaping these narratives.

As in the political situations this research unpacks, however, the boundaries between one dimension of influence and another are often blurry. As mentioned above, science often overlaps with public discourse, and scientists shape institutional processes. Similarly, corporate actors wield material and structural power to influence decision-making processes, but also discursive power that shapes public narratives. These overlaps are not only inevitable, but also present an important site of analysis that reflects the complexity of political process and policy outcomes on the ground.

This framework draws on others in existing literature. In their study of changing trends in international environmental governance, for example, Biermann and Pattberg focus their analytical framework around emergent actors, considering the role of international bureaucracies, global corporations, and science networks (2012). Others have defined conceptual frameworks to explore the interplay between ideas, institutions and interests (Clapp, 2012; Williams, 2005).

I combine this conceptual framework with an empirical case study of two policy decisions on GMOs in India: the approval of Bt cotton for commercial cultivation in 2002, and the more recent 2010 moratorium on Bt brinjal. I consider the political process that preceded and led to both decisions, and the ways in which each of the dimensions of influence mentioned above shaped the final policy outcomes. In doing so, I update the literature on GMOs in India, which so far has focused on Bt cotton (see for eg, Scoones, 2005); unpack the various dynamics that play into decision making in this field; and outline the implications of these dynamics. It is important to note however, that I do not aim to rank the relative importance of various actors and influences, but to understand the particular set of conditions that led to these decisions, and to unpack the inherently messy but important interplay between them.

My research shows that a number of shifts occurred in the years in between the two decisions, brought about by a mobilized civil society, calls for independent research from the scientific community, and some key institutional dynamics. These changes in turn shifted the balance of influence, away from the corporate dimension of influence and towards the others, resulting in different decisions in the two cases. However, no single one of these influences can

independently explain the divergent policy outcomes, and as such, my analysis considers all four dimensions of influence together, to explain what neither one of them could on its own.

Chapter 3

Policy decisions on Bt cotton and Bt brinjal

The Bt Cotton Story

Bt cotton was introduced to Indian fields in 2002. Its commercialization was preceded by a complex and somewhat secretive approval process (Bhargava, 2011; Scoones, 2005), in which a multitude of influential corporate actors, along with key government and science figures, played active roles. The crop was developed by Mahyco-Monsanto Biotech India (MMB), a joint venture between the Indian seed company and the multinational agribusiness giant. MMB's request for approval in 2002, however, was not the first time that Bt cotton had been proposed for release in India.

Over a decade earlier, in 1990, multinational seed and biotech giant Monsanto applied to the Department of Biotechnology (DBT) to bring their genetically modified Bt cotton seed to India. This request was originally denied by the department in 1993, since the technology transfer fee was very high (Newell, 2007a). Five years later, in 1995, Bt cotton surfaced in the approval lineup again (for a complete sequence of events, see page 43). This time, however, the applicant was an Indian seed company, called Mahyco, which applied to import 100 grams of transgenic cotton from Monsanto, to backcross with its own seed in Indian labs. The company was given approval, and in the next two years, went on to conduct experiments and develop three lines of Bt cotton (Scoones, 2003b).

In 1998, Monsanto bought 26% shares in Mahyco, officially giving the multinational corporation veto power and making it, in essence, one of the owners of the Indian company (Bhargava, 2011). This move led to a newly formed joint venture, Mahyco-Monsanto Biotech India Ltd (MMB), and was considered by many to be very strategic, since the director of Mahyco, Dr B. R. Barwale, was a well-known figure in the industry, and had close connections with the DBT and others involved in the regulatory process (Gupta, 2000b; Scoones, 2003a).

In 2000, MMB put in a request for approval of the cotton seed they had developed to the government, and were given permission by the DBT's Review Committee on Genetic

Manipulation (RCGM) to conduct 40 field trials in 9 states in the country (Scoones, 2005). It conducted these trials on 100 hectares in 7 states (Gruère et al., 2008). In 2001, the approval went on to the Ministry of Environment's Genetic Engineering Approval Committee (GEAC) for permission to release the crop into the environment. Meanwhile, in India and internationally, GM crops were being given increased public and media attention. Monsanto was regarded with great suspicion, and activism against GM crops was becoming increasingly vocal. In part due to this attention, as well as the complicated regulatory negotiations that had been taking place between the company and regulatory bodies, the GEAC asked the Indian Council of Agricultural Research (ICAR) to advise them on what had become a complicated decision. ICAR conducted further trials, in 11 locations in six states, and concluded that Bt cotton was effective (Scoones, 2005). The crop was approved by the GEAC on March 26, 2002 (Scoones, 2003b), and introduced to farmers for commercial cultivation later that year.

Interestingly, in 2002, some months before the crop was given official approval, the media exposed stories of illegal Bt cotton being grown across several thousand hectares in the western state of Gujarat. The seed was traced back to the Indian company Navbharat Seeds, and found to be Monsanto's MON 531, which had been illegally imported and sold. The seed had also reached several other states in the country, through a number of seed distributors. Reports claimed that farmers had purchased it for a quarter of the price that the approved variety was set to cost (Sadashivappa and Qaim, 2009). This development undoubtedly put pressure on members of the GEAC and the government to formally approve a crop that had informally already found its way into the fields. The central government at the time ordered the Gujarat state government to find and burn all illegally sown cotton fields. This has allegedly never been done and illegal Bt cotton seed is still widely available in Gujarat and other parts of the country (Bhargava, 2011; Sahai, 2011).

Economic context

Bt cotton was introduced in the context of a recently liberalized post-reform economy. In the early 1990s, following the implementation of Structural Adjustment Programs (SAP), India instituted a series of economic reforms that removed trade and investment barriers, opening up markets in the country and encouraging foreign direct investment. The reforms changed the

dynamics between state and central governments and greatly reduced the role that the government played in several sectors, both in terms of economic support as well in a regulatory role. Private sector players occupied this space, becoming influential in standard and agenda setting (Gupta, 2000b).

This change played out in significant ways in relation to agriculture and food security as well. The reforms withdrew government consumption supports to low-income communities, greatly reduced subsidies for fertilizers (Acharya and Acharya, 1995), as well as for services like electricity and irrigation, and reduced the amount of food circulated through the Public Distribution System (PDS) (Vyas, 1993; Arora, 1999). Food procurement and market prices shot up, especially for essential commodities such as wheat and rice. Increasing prices and lower subsidies combined to directly and adversely affect food security for marginalized, small-scale producers (Arora, 1999). In addition, trade barriers on agricultural goods were lifted, customs regulations relaxed, the rupee devalued and exports subsidized (Gulati, 2002; Krishnaswamy, 1994; IEG, n.d.). These measures opened markets to private investment – both national and international – in economic sectors that had been previously controlled exclusively by the state, including agriculture. These markets expanded into rural economies, greatly increasing pressure on small and marginalized farmers (Singh, 1995). Large multinational companies rapidly began investing in India, and it was soon after the reforms were instituted that Monsanto applied to bring Bt cotton into the country.

Increased trade activity due to the liberalization package was accompanied by a government push for farmers to move from growing subsistence food crops to export-oriented commodity crops, including cotton. Although cotton has been grown in India for centuries, and has been a major product in India's important textile trade, development of hybrids began in the 1970s, and spread through the central and southern parts of the country only when farmers began being encouraged to grow it as a cash crop for export several years later. India remains the only country in the world that uses hybrids, and not varieties, for cotton production (Stone 2007). This, as discussed in the next chapter, had significant consequences when Bt cotton was introduced, since it meant that farmers already relied on the market for their seed stock. GM

cotton was developed based on these hybrids, and today there are over 70 modified hybrids available across the country (Gruère et al., 2008).

Regulatory context

Biotechnology in India is regulated, as per the 1989 Biosafety Rules, by two bodies in the Union government: the Ministry of Environments and Forests (MoEF), and the Department of Biotechnology (DBT), which resides within the Ministry of Science and Technology (MST). The Genetic Engineering Approval Committee (GEAC) [7] is the apex body under the MoEF, with the authority to approve GM crops for release and commercial cultivation. It is an inter-ministerial committee with representatives from several ministries and departments, as well as public sector scientists (Scoones, 2003b). The DBT also has a sub-body, called the Review Committee on Genetic Modification (RCGM), which oversees research approvals. The GEAC is responsible for regulating deliberate releases and commercialization approvals. Though clear in definition, the lines between research and commercial release have proved blurry in the past, and have been the topic of controversy in the country. Field trials, in particular, pose a confusing case (Gupta, 2000a). Both the RCGM and GEAC are composed of scientists and government officials from various disciplines. Neither of the committees include members of the general public or civil society (Gupta, 2000a).[8]

Unsurprisingly, there are tensions between the MoEF, whose mandate it is to protect the environment, biodiversity and the socioeconomic activities connected to both, and the DBT (Newell, 2008). The latter's mandate, interestingly, is to regulate as well as to develop and promote biotechnology in the country (Scoones, 2003b). This promotional function goes beyond the wording of its official mission. Several of the scientists that sit on the RCGM and GEAC have been criticized for having a pro-industry bias, or for being involved in developing GM crops themselves (Gupta, 2000; Bhargava, 2011; Krishnan, 2011). The department's scientific advisor was chastised in the media, during the Bt cotton process, for neglecting the official

[7] Now the Genetic Engineering Appraisal Committee. The environment minister made this change at the same time as the moratorium decision (Ramesh, 2010).

[8] When the GEAC was first set up, Dr Suman Sahai of the civil society organization Gene Campaign was a member. She however reportedly left the committee because she didn't feel her opinion was being adequately considered (Krishnan, 2011).

procedures to push through approval requests from industry. The department has been accused of being, in essence, "a mouthpiece of multinational biotech firms" (Newell, 2007a).

Experiences with Bt cotton

Adoption of Bt cotton was slow in the initial years. In 2004, two years after its commercial release, only 5% of cotton-growing area in India was cultivating Bt cotton. After 2006, however, this number began to climb rapidly, and by 2011, 9.4 million acres, or 90% of the area under cotton cultivation in the country was growing Bt cotton. The yield numbers over this time period, however, show a very different trend (see figure 1). While proponents call Bt cotton a "remarkable success" (Choudhary and Gaur, 2010; Prabu, 2010) and highlight the fact that yields increased from 302 kg/hectare in 2002-3 to 554 kg/hectare in 2007-8, critics emphasize that this growth has stagnated in the past 5 years at an average of 500 kg lint per hectare (CGMFI, 2012; Kranthi, 2011).

The success or failure of Bt cotton across the country remains contested, at least partially because the crop's performance has varied geographically, depending on soil, water and climatic conditions. Areas that have regular access to irrigation have seen far better yields than those that rely on rains have, especially in years with poor monsoons (Gruère et al., 2008; Sahai, 2011). Reported results, however, have also varied from one study to another. Studies mentioned earlier by Qaim and Zilberman, and a series of articles published in various journals by a group of researchers from Reading University, have all found that Bt cotton has been an overwhelming success for farmers in India (Qaim and Zilberman, 2003; Kambhampati and Morse, 2006; Bennett et al., 2004; Morse et al., 2005). These studies have been criticized, however, for using data from field trials (which don't represent the realities of most farming conditions in India), for their methods of analysis, and for their connections to corporate funding (see for example Glover 2010).

Critics have also argued that much of the yield increase in cotton can be explained by factors other than the introduction of the GM seed (CGMFI, 2012). Infrastructural improvements to irrigation and seed improvements in hybrid varieties are two such examples (Stone, 2012). Others hold that 70% of the 73% yield increase that has been reported since Bt cotton was

introduced took place between 2002 and 2005, when between 0.5% and 5% of the area under cotton had shifted to growing Bt hybrids, showing that yield increases cannot be attributed to the new GM seed, and are almost certainly due to other facts such as those mentioned above. From 2005 till the present, when adoption rates have climbed to 90%, yields have only increased by 2%. Significantly, in just the past 4 seasons, yields have dropped by 13% (Stone, 2012).

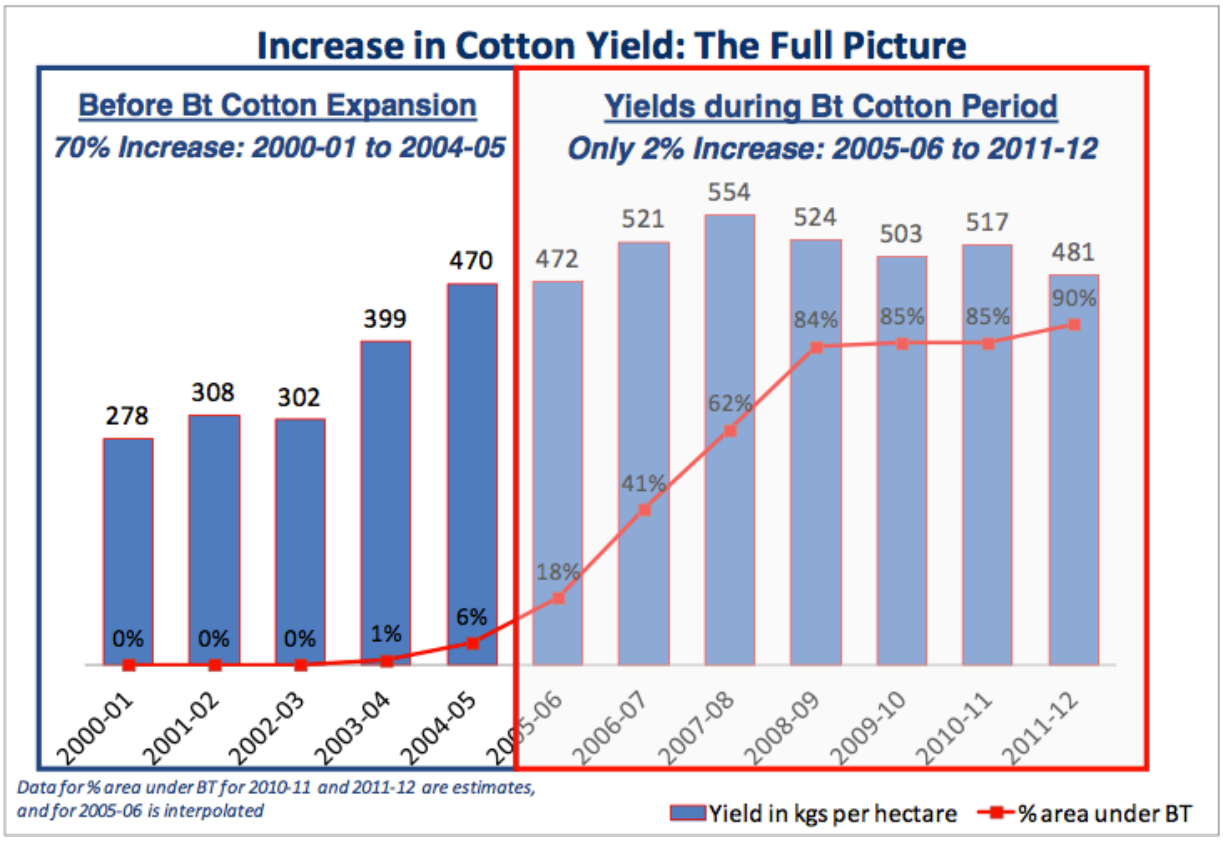

Figure 1: Yield increases and adoption rates of Bt cotton (2000-2012). In the years during which yields increased significantly, very few farmers were growing Bt cotton. Adoption rates have increased since then, but yields have not increased proportionally. Graph from CGMFI, 2012.

These trends are averages across the country. Some regions have seen particularly drastic failures of Bt cotton. In the southern state of Andhra Pradesh, for instance, where land holdings are small, soils marginal, and unpredictable monsoons the only source of water, the government estimates that 3.3 of the 4.7 million acres planted with Bt cotton in 2011 had a yield loss of more than 50% (CGMFI, 2012). Overall, in states such as Andhra Pradesh and Maharashtra, average yields are currently either the same as, or less than, the levels they were at before Bt cotton was introduced (Stone, 2012). Farmers in Punjab, who have regular access to irrigation, have seen

yield increases in some years. Gujarat, however, accounts for much of the overall yield increase. Along with the introduction of Bt cotton, however, the state has also seen the construction of several new check dams, and the introduction of new seed and pesticide. Keshav Kranti, director the Central Institute for Cotton Research (CICR) believes that these factors had an important role to play in the yield increases (Kranthi, 2011).

Along with yield stagnation and crop failure, critics and farmers have reported on other impacts as well. The cotton bollworm, the primary pest that Bt targets, was reported to have developed resistance to Bollgard I, the first Bt cotton released commercially (Sharma, 2010a; Monsanto, 2010). In response, MMB developed and released Bollgard II. In addition, in the initial absence of the bollworm when Bt cotton was first introduced, other secondary pests moved into cotton growing areas. Mealybugs, aphids and thrips, to name a few, now pose serious problems for cotton farmers across the country (Monga, 2008; Ghoswami, 2007). Industry and government scientists are increasingly recommending higher-intensity pesticides as solutions for both problems (Subramani, 2011), pushing up already-high input costs. While pesticide reduction was the primary selling point for Bt cotton adoption in India, recent studies have found that overall state-wide pesticide use has not decreased in any Bt cotton growing state, with the exception of Andhra Pradesh[9] (see figure 2).

Farmers across several districts of the cotton growing areas have reported that their livestock fell sick or died after grazing on plant debris from cleared Bt cotton fields. A report compiled by research-based NGOs, veterinary scientists and local farmers' associations showed that a total of 1820 sheep died in 4 villages in one region, after grazing in Bt cotton fields (Ramdas, 2010). Farmers and farm workers who pick Bt cotton by hand have complained of skin and respiratory allergic reactions (Ho, 2006; Mandloi et al., 2006). Civil society and scientists' organizations have conducted studies, but no government studies have been published on either issue (Kuruganti, 2007; Chaudhry, 2010).

[9] This is due, at least in part, to the fact that over 15% of the state's area has been shifted to Non-Pesticide Management over the past six years.

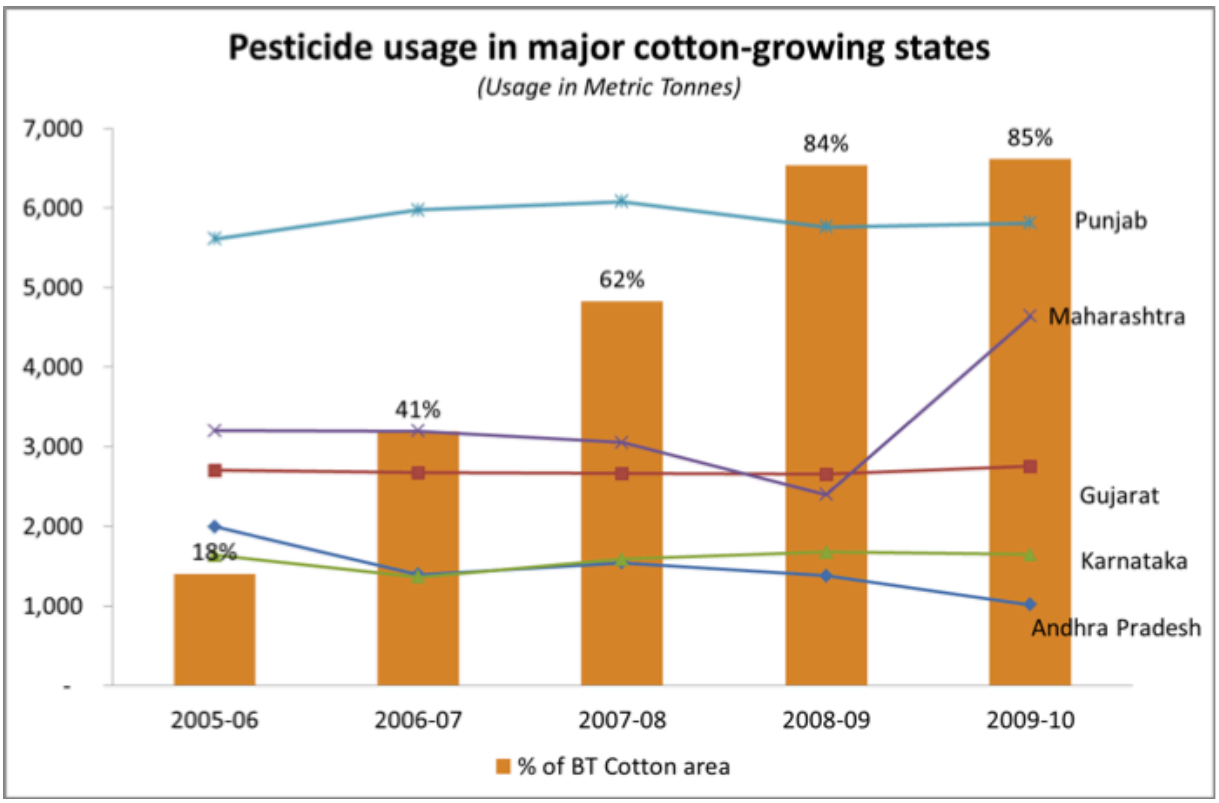

Figure 2: Pesticide-use levels in Bt cotton growing states (2005-2010). Graph from CGMFI, 2012. Data from the Pesticide and Documentation Unit, Directorate of Plant Protection, Quarantine and Storage, Government of India.

Farmer Suicides

Staggering numbers of farmer suicides in India, almost all of which are in the cotton belt, have drawn further attention to Bt cotton and its impact on rural communities. In 2008, 16,196 Indian farmers committed suicide, and in 2009, this number rose to 17,368, bringing the total number of suicides in the past 15 years to just over a quarter of a million (Sainath, 2011, 2012; NCRB, 2009). It is worth noting that these figures are based on official government data, and do not include women, who legally do not hold land title and are hence not considered to officially be farmers. The total numbers would likely be significantly higher with this correction.

Government officials, researchers and activists all disagree on the nature of the link between Bt cotton and the suicides, and no official conclusive study has been conducted to assess the connection. Although the numbers were not nearly as high, farmers were committing suicide before Bt cotton was introduced. A debilitating cycle of poverty, debt and insufficient farm incomes to pay off loans were major factors (Stone, 2012). The introduction of Bt cotton has, in

many parts of the country, severely exacerbated this cycle. Bt cotton seed is anywhere from 2 to 3 times more expensive than conventional seed (CGMFI, 2012), and farmers take large loans from private moneylenders to cover their costs. In regions where secondary pests have developed, or the bollworm has developed resistance to Bollgard cotton, farmers buy more concentrated pesticides, which, along with having serious environmental and health effects (Ho, 2006), also further push up input costs. When yields are poor or crops fail, as they often have in years with poor rainfall and in rain-fed areas, these farmers are unable to repay their debts. The story of farmers drinking pesticide to commit suicide in these situations has become entirely too familiar.

Anthropologist Glenn Stone argues that the proximate cause of the suicides is famers getting stuck in debt traps when they borrow money from moneylenders, at exorbitant interest rates, to buy inputs (Stone, 2002). To combat bollworm resistance to Bollgard cotton, they apply more pesticide to their fields, increasing their input costs, and possibly further increasing the evolution of pest resistance in their fields. This "pesticide treadmill" is exacerbated by the deeper issues of "the emergence of a global corporate agricultural oligarchy, the internationalization of gene patenting and the poorly understood process of agricultural deskilling" (Stone, 2011)

An internal advisory sent out by the Indian Agriculture Ministry in January 2012, and leaked to the Hindustan Times, makes the link for the first time between Bt cotton and farmer suicides (Haq, 2012). It also acknowledges that Bt cotton production has decreased over the past decade and that pesticide use has increased. This advisory, although it was covered in national media, was not officially made public by the government. No comprehensive government studies have been done on Bt cotton performance across the country so far, and the government has not addressed civil society's calls for an acknowledgement of the crop's connection to suicides.

The Bt Brinjal Story

In 2006, four years after Bt cotton was introduced to fields, a new genetically modified crop was put forward for approval to the GEAC. This time, however, it was a food crop: eggplant, locally called brinjal. Like cotton, the crop was modified with the Bt gene, and was owned by Mahyco, who had been developing it in a public private partnership with three Indian research centres: the

Tamil Nadu Agriculture University (TNAU) in Coimbatore, University of Agricultural Sciences (UAS) in Dharwad and the Indian Institute of Vegetable Research (IIVR) in Varanasi (CEE, 2010a). Initial research on Bt brinjal started in 2000, and the first confined field trials were conducted in 2004 (CSA, 2006). The company claimed that Bt brinjal would significantly increase yields by reducing crop loss due to infestation by the fruit and shoot borer.

The request led to unprecedented controversy, that neither industry nor regulatory bodies had expected. The GEAC, on the direction of the Supreme Court of India,[10] initiated the formation of a panel of experts to assess biosafety data provided by the company. This Expert Committee (EC) put out its first report in 2006, recommending that the crop could go to the next step and be tested in large-scale field trials. Following this, a second Expert Committee (ECII) was set up to assess the trial results, and they in turn recommended approving Bt brinjal to the GEAC. Based on the findings of this report, the GEAC recommended that Bt brinjal be approved for commercialization in India (for a complete sequence of events, see page 43).

Realizing that the debate surrounding Bt brinjal and GMOs in India was controversial, however, and despite the fact that it did have legal authority to make the final decision, the GEAC handed over the final decision for the crop's release to the central government. The minutes of the 97th GEAC meeting, held on 14th October, 2009, say about the Bt brinjal approval "… as this decision of the GEAC has very important policy implications at the national level, the GEAC decided its recommendation for environmental release may be put up to the Government for taking final view on the matter" (GEAC, 2009).

Since it is nested in the Ministry of Environment and Forests, the GEAC is technically under its senior most official, the Minister of Environment and Forests, who at the time was Jairam Ramesh. Stepping out of the guidelines of the official regulatory process, in which the members of the GEAC are collectively responsible for commercial approvals, the final decision about commercial release of the crop was hence left to one individual – minister Ramesh. Ministers of other relevant departments, such as the Minister of Agriculture, Sharad Pawar and the Minister

[10] The Supreme Court of India was involved in this stage of decision making due to two public interest litigations that has been filed with them some years earlier in 2004, and 2005. Both are discussed further on page 41.

of Science and Technology, Prithviraj Chavan did, however, voice their opinions. Both ministers are vocal supporters of GM crops as well as the industry behind them, and released statements just days later saying that their respective ministries were supportive of releasing the crop for commercialization (Sharma, 2010b; Koshy, 2010). Citing the success of Bt cotton, Pawar argued that a decision not to release Bt brinjal would "set the clock back" and "completely demoralize [the] scientific community" (Ranjan, 2010).[11]

In what has been since labelled an unprecedented move (Radhakrishnan, 2011), the minister himself went beyond regulatory requirements and decided to hold a series of national consultations on the topic before making a decision. The consultations took place in seven locations across the country. These were Kolkota and Bhubaneshwar, capital cities of the states that produce 30% and 20% of the country's brinjal respectively; Ahmedabad and Nagpur, both in states that have extensively cultivated Bt cotton; Hyderabad and Bangalore, both primary research centres for the biotech industry; and Chandigargh in Punjab, the state considered most agriculturally developed. In stark contrast to the approval process for Bt cotton, all documents on Bt brinjal were made public at this stage, and the minister put out a call for feedback from scientists, civil society and other concerned individuals, as well as from the chief ministers of brinjal growing states (CEE, 2010b).

Public participation in the consultation was unexpectedly high. Approximately 6000 people registered for the seven events together, and another 2000 attended or demonstrated outside the venues. Of these, just under half registered as farmers, another 20% were NGO members, environmentalists or representatives of a consumer forum, 11% were scientists, 10% fit into the rather disparate category of "business, traders, industry, citizen group or individuals," 8% were students or researchers, and 4% government officials or politicians. In addition, the minister received 9000 written submissions, including articles, letters, reports and books. Collectively, the duration of the consultations added up to 25 hours, and all seven events were chaired by Ramesh (calculated from CEE, 2010).

[11] Along with disagreeing with Ramesh on the final decision, Chavan also argued that there was no need for nationwide consultations, and that the final decision should be taken by the GEAC and not the central government. A publicly released letter from Ramesh to Chavan addressed this issue, and Ramesh effectively retained control of the final decision (Koshy, 2010; Times of India, 2010).

The consultation period lasted from January 13th, 2010 to February 6th, 2010. On February 9th, 2010, Ramesh announced that Bt brinjal would not be given regulatory approval, and that adopting a "cautious, precautionary principle based approach," he would be placing an indefinite moratorium on the crop, "till such time that independent 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 the environment" (Ramesh, 2010). The moratorium, as he made clear in his final decision and his statements to the media afterwards, was in no way a temporary ban, or a conditional approval. It was in fact a moratorium that would hold indefinitely, and Bt brinjal could only be reconsidered for approval by going through the entire regulatory process again, when the substantial issues raised in the decision document had been addressed (Ramesh, 2010).

The minister also made some other smaller decisions at this time. One of these was to change the name of the GEAC from "Genetic Engineering Approval Committee" to "Genetic Engineering Appraisal Committee." The other was to request the six leading science academies in the country to produce a rigorous review of GM crops in India and Bt brinjal in particular. This study was completed and its report submitted in September 2010. Along with bring heavily critiqued by NGOs and several scientists, who alleged that it was essentially plagiarized from an earlier report authored by a pro-GM scientist, the report was also lambasted by the Minister for similar reasons (Times News Network, 2010).

The minister cited several reasons for his decision. The opposition from several state chief ministers (CMs) was a primary one. All seven of the CMs who wrote to him, as well as the four who communicated verbally with him, expressed hesitation. The minister also cited the lack of adequate biosafety testing, the fact that there are other options for pesticide reduction, such as Non Pesticide Management (NPM), the fear of pest resistance, contamination and loss of biodiversity (heightened by the fact that India is the centre of origin for brinjal), and issues related to corporate control and the need for more public investment in biotechnology. He mentioned the country's international obligations as a party to the Cartagena Protocol, the lack of an adequate science-based regulatory framework, public resistance to the crop, and the related public interest litigation (PIL) currently in the Supreme Court, which had not been resolved.

More than once, the final decision alludes to the need to assess where and in what situations Bt cotton has failed, and how those weaknesses should be avoided. More detail on each of these points can be found in the next chapter.

In the meantime, other events were taking place across the country, all of which were to come together around the time of the moratorium. In early 2004, activist and convenor of the civil society group Gene Campaign, Suman Sahai, filed a public interest litigation in the Supreme Court. The case called for amendments to existing regulation, which it declared unconstitutional, and a rigorous, stringent and comprehensive regulatory process to be put in place (Sahai, 2004). While the case has still not been resolved, the Supreme Court has initiated a number of measures to ensure transparency in the GEAC process. One of these was to nominate eminent scientist P M Bhargava to the GEAC. Dr Bhargava vocally criticized much of the committee's process, the ECI and ECII report results, and the conflict of interest he claimed several members of the committee had. These issues were mentioned in the minister's final decision, as well as covered extensively by the media (Express News Service, 2010).

In 2005, a second PIL was filed by Aruna Rodrigues of Sunray Harvesters as lead petitioner, along with several other activists and members of NGOs working on food and farming issues (Supreme Court of India, 2005). The case called for a ban on all GMOs until a rigorous biosafety protocol was developed in the country, and claimed to fill in gaps that the PIL filed by Sahai did not address. Since they dealt with the same issues, the two cases were clubbed for hearings, as per court procedure (Sahai, 2011). Neither case has been concluded.

Another factor that the minister mentions in his final decision is the enormous amount of feedback received from international scientists, many of whom expressed serious doubts on the adequacy of the biosafety and environmental testing and the EC II results. These scientists included Dr Seralini from France, Dr Gurian Sherman, Dr David Andow, Dr David Schubert, Dr Norman Ellstrand and Dr Allison Snow from the US, Dr Canterbury from New Zealand and Dr Judy Carman from Australia. Some of these were individuals from whom the minister had specifically requested feedback (CEE, 2010b).

Civil society was greatly engaged and mobilized in the years before the Bt eggplant decision came up. With an increasing number of activists and farm groups starting to work in areas where Bt cotton crops were failing and farmers struggling, the wider issue of GM crops and their effect on small-scale and often rain-fed agriculture had come to the forefront of the civil society movement. Groups such as Greenpeace India and the Association for International Development India became highly engaged in the GM issue as part of their sustainable agriculture programs. Groups such as Navdanya, Deccan Development Society and Centre for Sustainable Agriculture that had already worked on these issues, intensified their work, and in addition, new groups such as Alliance for Sustainable and Holistic Agriculture (ASHA), Coalition for a GM-Free India, and South Against Genetic Engineering emerged during this period.

It is hard to pinpoint which of these factors had the most impact, and contributed to the moratorium decision. A close look however, shows some interesting patterns that have played out in the past with Bt cotton and more recently, with the Bt brinjal case. The next chapter examines these patterns to try and understand the political and socio-economic dimensions of influence in both decisions, the ways in which these influences interacted, how they changed in the period between the introduction of Bt cotton and the moratorium on Bt brinjal, and which of them influenced the decisions, and in what ways. The last chapter concludes with some thoughts on what these patterns tell us about the future direction of GM policy making in India.

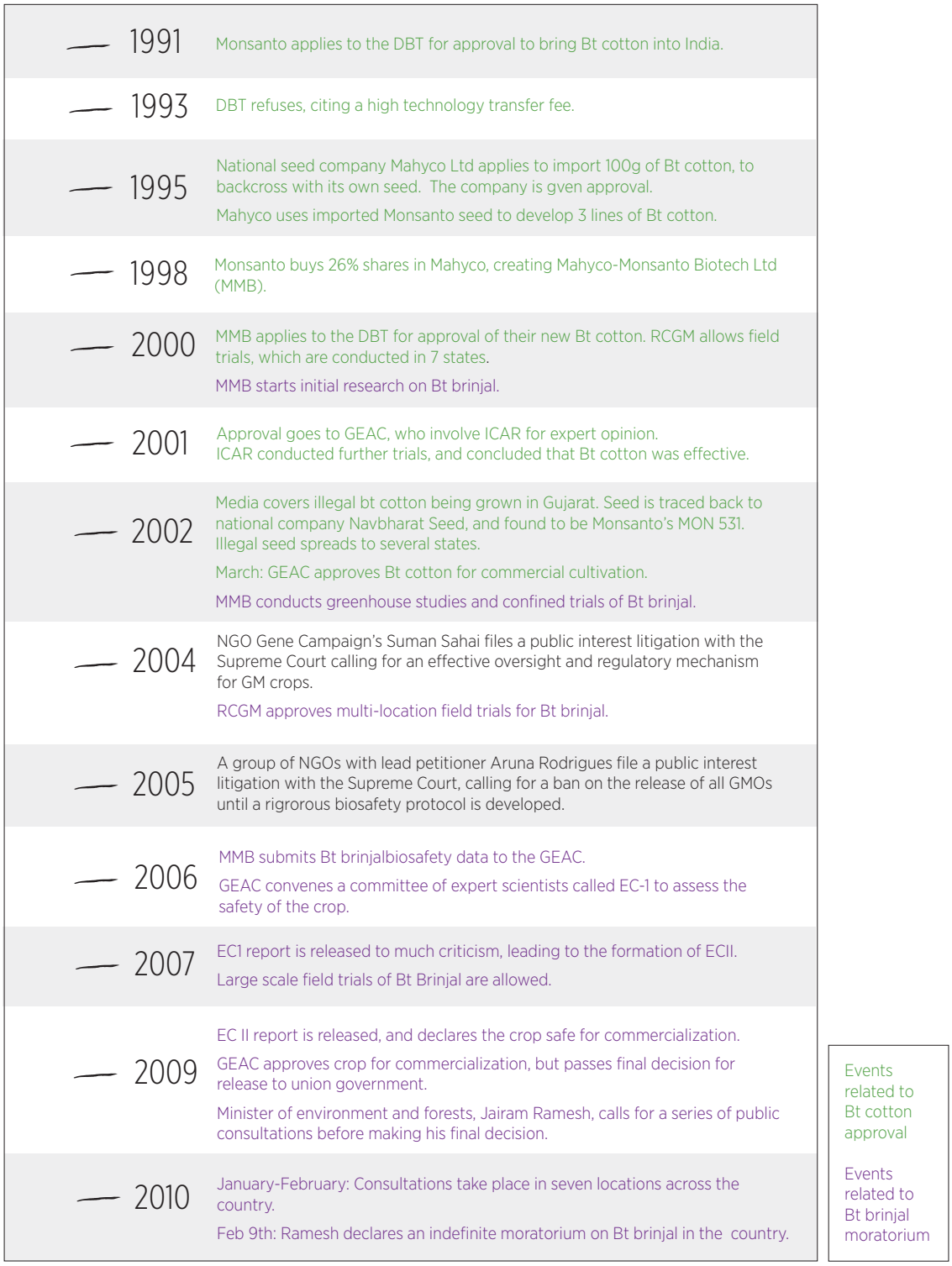

Figure 3: Sequence of events of GM approvals in India

Chapter 4

Dimensions of Influence in Bt cotton and Bt brinjal decisions

Introduction

The existing literature identifies four primary sources of influence on policy making around genetically modified organisms. These, as discussed in chapter 2, are corporate power, institutional mechanisms, scientific research, and discursive framings. Over the course of the time period between the approval of Bt cotton for commercial cultivation in 2002, and the final stages of the Bt brinjal decision in 2010, a number of shifts occurred in each of these areas, and in the ways in which they relate to each other. These changes in turn shifted the balance and relative importance of various dimensions of influence, resulting in different policy outcomes in the two cases.

Specifically, an analysis of the political and economic context of the late 1990s and early 2000s, when Bt cotton was making its way through the approval process (see figure 3 on page 43), reveals a relatively unmobilized civil society sector, a high level of uncertainty within the scientific community, and an industry-aligned institutional mechanism for GM approvals. In addition, corporate actors occupied an important decision-making space during that period. Liberalization policies of the mid 1990s had opened up Indian markets to foreign investors, and greatly encouraged private interests to step into research and development roles previously controlled almost exclusively by government agencies and institutions. This move also led to the strategic strengthening of relationships between leading corporate actors and regulators, and increased their direct input and participation in regulatory processes. As a result, corporate actors were very influential in the decision to approve Bt cotton, and essentially were able to exert this influence in a regulatory context that was relatively unshaped by pressures from other dimensions of influence, such as civil society and public discourse, science and scientists, and domestic and international institutions, all of whom were not highly engaged in the approval process around Bt cotton, or the wider debate around the use of agricultural biotechnology in India at the time.

Over the course of the next eight years leading up to the Bt brinjal decision, this balance of power shifted significantly. While the corporate sector was as strong as it had been in past years, other players and dimensions of influence in the country "caught up" in a sense, creating a counter influence that significantly challenged much of the corporate sector's discursive and structural power, which had been instrumental in shaping the decision to commercialize Bt cotton. The various shifts in each of the other dimensions of influence – science, public discourse, and institutional mechanisms – led to a widening of the discussion around GM crops in India's food security strategy. The policy process around Bt brinjal, in turn, was compelled to consider a wider range of factors, impacts and voices than the Bt cotton one did.

In the next sections, I examine each of these dimensions of influence in the context of the Bt cotton approval and the Bt brinjal moratorium, in order to unpack the differences between the two decisions, and the implications of these differences. I show that while there was an interplay between elements of all four dimensions in both decisions, changes in each of the dimensions and the ways in which they interact with each other led to a shift in the balance of influence in the case of Bt brinjal, with the emergence of a body of science, the strengthening of civil society and the narratives that accompanied it, and the presence of key institutional mechanisms. These influences widened the political process to include a range of factors that go beyond the corporate-shaped emphasis that was central in the case of Bt cotton.

While the balance of power falls in different sectors at different moments, the policy decisions I discuss and the political processes they are embedded in are all situated at the confluence of all four dimensions of influence and as such, all are inseparably interconnected, and all are implicated. No single one of these influences can independently explain the policy outcomes on the two crops, but when considered together and with the connections between them, interesting patterns emerge that shed light on current decisions, as well as possible future directions on Indian responses to GM crops.

Corporate Influence

Corporate actors have played a significant role in shaping India's evolving biotechnology policies. Major industry players from biotech firms and business associations were prominent in

the boardrooms that set the national biotechnology agenda in the 1990s and early 2000s, and were well linked in to the regulatory structure that eventually approved Bt cotton for commercial use in the country (Newell, 2007a; 2007b; Scoones, 2010, 2005). Although these players were no less objectively powerful in 2009-10 when Bt brinjal was put forward for approval, there were some key differences in the political and economic contexts during the two periods, which effectively changed their relative influence in the two decisions. These differences centre around two main aspects: the first has to do with the connections between corporate actors and regulatory structures, and the related influence the former had in decision-making processes, and the second is related to the existing market domination context in which each of the two crops was introduced.

Corporate connections to regulatory processes

Major business actors have been closely tied to the GMO regulatory process since GM crops were first introduced in India. In fact, it was arguably because of industry influence that Bt cotton was initially approved. As described in the previous chapter, Monsanto's initial request in 1991 to commercialize Bt cotton seed in India was turned down due to a high technology transfer fee (Newell, 2007a). The years that followed were defined by a package of economic reforms that focused on liberalizing the economy, opening up markets to trade and encouraging foreign investment. One of the results of these changes was a shift from a decision-making process controlled closely by the central and state governments, to one that gave an influential position to the private sector in standard and agenda setting (Gupta, 2000a). During this period, Monsanto strategically bought 26% of the shares in a national seed company called Mahyco, forming the joint venture Mahyco-Monsanto Biotech India.

Industry associations also figured prominently in the agenda setting process in the years just before and after Bt cotton was approved. Groups such as the Seed Association of India (SAI), Association of the Seed Industry (ASI), the All India Biotech Association (AIBA), the Confederation of Indian Industry (CII) and the Agriculture Group of the Association of Biotech Led Enterprises (ABLE-AG) enjoy, in their own words, "excellent relations" with the Department of Biotechnology, and members of these associations often sit on each other's committees (Newell and Mackenzie, 2004). Key corporate actors, such as Kiran Mazumdar-

Shaw, who is head of the biotechnology firm BioCon Ltd, president of ABLE-AG and chair of the CII's National Committee of Biotechnology, also maintain close connections with policy processes. Along with her multiple industry positions, Mazumdar-Shaw – dubbed the "Queen of Biotechnology" in the media – also heads the Karnataka government's Vision Group on Biotechnology, and has played a key "agenda-setting role" in discussions on biotechnology regulation in the country (Newell, 2007a; Scoones, 2003a). This closeness played a significant part in presenting the case for the commercialization of Bt cotton, as well as for a broader inclusion of GM crops in India's agricultural development policies, which "is premised on a set of assumptions that leading firms have played a key part in constructing and embedding in policy debate" (Newell, 2007a). Eleven years after their first attempt, and clearly in part due to the links that had been forged in the interim years, MMB applied for the commercial release of Bt cotton again. This time the crop was approved.

While industry links to the DBT and its host, the Ministry of Science and Technology, have always been close, this is not equally the case for all other ministries involved in biotechnology regulation. The Ministry of Environment and Forests, for instance, had remained fairly distanced from the negotiations and lobbying involved in early regulatory processes around GMOs. The ministry is home to the apex decision-making body on GM approvals, the Genetic Engineering Appraisal Committee (GEAC), whose members have been criticized for their links with industry (Bhargava, 2011). Other than those who sat on the GEAC, however, members of the MoEF were not closely involved in the approval of Bt cotton.

This dynamic changed significantly in the case of Bt brinjal. The crop request went through the usual steps, being approved for large scale trials in 2007, and being passed on to the GEAC (see figure 3 on page 43). The latter, after receiving approval recommendations from two Expert Committees (EC-I and EC-II), recommended that the crop be approved for commercialization. However, by this stage, the case had become controversial. Media attention to GM crops and Bt brinjal in particular had grown, as had public scepticism of the regulatory process and corporate involvement. Not wanting to be held responsible for potential repercussions in such an environment, the committee passed the final decision on to the central government.

This transfer was key.[12] It meant that corporate actors now had to lobby government officials they had been relatively unconnected to, and effectively changed the level of influence that corporate representatives or connections could have on the final policy outcome. Unlike in the cases of the Bt cotton hybrids that had been approved so far, the brunt of the responsibility to approve or reject Bt brinjal now rested with one person, the union minister of environment and forests, Jairam Ramesh, who was seemingly less linked to industry and its interests. In his final decision document, in fact, the minister goes so far as to specifically mention the need for the country to think about the role of the seed industry, and ensure that public institutions and farmers are able to retain control over it (Ramesh, 2010).

The consultation process held by the minister brought up two other important points in relation to corporate influence in the regulatory process. The first, as mentioned briefly above, was the conflict of interest amongst members of the GEAC, exposed largely by Dr P M Bhargava, a scientist nominated by the Supreme Court of India to sit on the committee. The attention directed to the composition and functioning of the committee played into the general context of the Bt brinjal decision, and underlined the weaknesses of the regulatory process for GMOs in the country. Being as they are inherently interconnected, both this and the section above on the participation of the involved ministries and departments will be discussed in more detail in the section on institutional influences.

The second issue raised frequently in the consultations concerned the relative roles of the public and private sectors in research and ownership of GM crops. This is also not a new discussion, and has been closely connected to the history of GM crop introductions in the country. Bt cotton was introduced as the beginning of a new movement, which would be the successor of the Green Revolution in India[13] (Scoones, 2005). While this largely invokes a positive set of images and meanings for most people, it also highlights one stark difference. The technologies introduced in the Green Revolution were researched, developed, distributed and marketed by public sector

[12] Related institutional aspects of this shift are discussed further in the next section.

[13] Despite some level of controversy and critiques levelled towards the practices and long term impacts of the Green Revolution by activists and in the critical literature, the overall effect of the introduction of Green Revolution methods of cultivation are generally considered very positive in the country.

institutions and universities in India. In contrast, Bt technologies have been developed by private companies, and are owned by them as well (Parayil, 2003; Wield et al., 2010). Bt cotton seed, for instance, is sold under 60 brand names, since the same number of companies have been licensed by MMB to sell their seed (Shiva, 2012), and Bt brinjal is also owned by Monsanto's joint venture company, MMB. Public resistance to the private ownership over seeds and crops has been culminating since the introduction of Bt cotton, and was voiced repeatedly throughout the Bt brinjal consultations, including by those who are otherwise supporters of the technology, as long as it is being developed and controlled by public institutions, for the "public good" (CEE, 2010b).

Market dependence and dominance

One of the biggest differences in the economic contexts of the two decisions was the level of corporate dominance over the seed market. Farmers had shifted from using traditional varieties of cotton to using hybrids that they bought commercially, and that were sold by seed companies, several years before the introduction of Bt cotton. Because of this, very few still saved their own seed, and a large majority depended on the seed companies and the market for their seed stock every growing season (Ramanjaneyulu, 2011; Siridhar, 2011). Activists argue that at least partially because of this market dependence, farmers had limited options to access alternative seed sources when Bt cotton was introduced and heavily marketed. This issue became more severe over time, as the adoption rates of Bt cotton climbed. In the past years, as Bt cotton crops in some parts of the country failed, and other pest-related issues arose, farmers and activists allege that although they would have liked to move away from Bt cotton, finding non-GM seed in the market has become almost impossible (Shiva, 2012). For some, this explains why, despite its failure in several regions, almost 90% of the area in cotton cultivation in the country is under Bt cotton. As one of the major civil society organizers said, "We lost the cotton case because we didn't have cotton seed" (Ramanjaneyulu, 2011).

The issues that arose with farmer dependence on the market were exacerbated by the widespread distribution of illegal Bt cotton before the crop was officially released for commercialization. In 2001, MMB was conducting large-scale field trials of Bt cotton on 100 acres, in seven states across the country. While these trials were still being conducted, it was discovered that thousands

of hectares of land in Gujarat were already under Bt cotton cultivation. The seed that farmers had planted was traced back to a national seed company called Navbharat Seeds, who had illegally imported Monsanto's Bt cotton event MON 531 (Gruère et al., 2008). The company had marketed the seed, now referred to as Navbharat 151, as being resistant to bollworm, but without any mention of the fact that it was genetically engineered. Farmers unsurprisingly bought the seed in large numbers (Jayaraman, 2001; Newell, 2007a). The company was taken to court, but while the case continues even today, Navbharat 151 continues to spread across the country, as it is illegally bred and distributed widely (Wield et al., 2010; Bhargava, 2011; Sahai, 2011).

A few months later, in 2002, the DBT declared the field trials safe, and the GEAC approved the first Bt cotton under the trade name Bollgard I for commercial release. The de-facto release of Bt cotton may well have added to the pressure on the government to approve it for commercialization, given how extensively it had already spread, and that containment was near impossible. A similar situation played out in Brazil some years earlier, with similar results. Despite the fact that Brazil had banned the production and marketing of GM crops since 1998, GM soybean seed was being illegally imported from Argentina and grown in the Southern part of the country (Scoones, 2008). The area under illegal GM soy cultivation eventually grew so large that the government was forced to permit its commercialization (Silveira and Borges, 2005; Cohen and Paarlberg, 2004). Similarly, in the Indian case, some activists go so far as to argue that this was one of the primary reasons that Bt cotton was pushed through the approval process: "The regulators were looking like fools … saying we won't approve [Bt cotton] when it had already spread to more than 10,000 hectares in Gujarat. … Seed was being supplied to places all over the country. Seed from Gujarat was reaching Punjab years before Punjab got a formal approval… a formal approval didn't really matter after that" (Kuruganti, 2011).

The increase in acreage under Bt cotton was portrayed by corporate actors as being testament to the success and usefulness of the technology. Monsanto's Director of Corporate Affairs for India, Ranjana Smetacek, said:

> Like the adoption of any new technology, people planted [genetically modified cotton] on smaller acres initially, but the ever-increasing Bollgard plantings demonstrate that the Indian farmer is willing to embrace a technology that

> delivers consistent benefits … Clearly the steadily increasing Bollgard acres being planted by increasing numbers of Indian farmers bear testimony to the success of this technology and the benefit that farmers derive from it (in Stone, 2007)

High levels of adoption, however, were not necessarily linked to the positive experiences farmers were having with the crop. Small-scale farmers in parts of the country do not always know what seed they are buying from the maket, and have no choice but to believe what they are told by seed agents (Shah, 2008). Further, unlike with other crops, because Indian farmers were reliant on commercial hybrid cotton seeds, they were faced with a staggeringly variable and volatile market, where seed brands and their accompanying promises and prices were constantly changing and highly unpredictable. Because of this high inconsistency and unfamiliarity, the usual process of farmer choice-making based on experimentation and environmental learning was interrupted, and replaced with what anthropologist Glenn Stone calls "agricultural deskilling" (Stone, 2007). Farmers were instead adopting Bt cotton brands in a series of "fads," based on which one was the newest in the market, and on the promises they came with, instead of on which was showing the best results in their own environments. This disempowering trend was exacerbated by the fact that almost all the information farmers drew on (including the material presented as being objective or factual, as opposed to promotional) came from the same corporate sources that sold the seed (Stone, 2007). Market-dependent farmers then, may be portrayed as having the freedom to choose to grow Bt cotton or not, but this choice only applies to richer farmers who have the knowledge and ability to make such market-choices. For all others, the market dominance of Bt cotton and the choice discourse that accompanies it merely reinforces existing unequal power relations (McKinney, 2012).

Bt brinjal was introduced for approval in an economic and market context that differed from the one described above in some key ways. The most important of these differences was that a negligible proportion of the brinjal seed planted every year is "with industry," (Ramanjaneyulu 2011) or in other words, supplied by seed companies and bought by farmers in the market. As with many other vegetables and food crops, most smallholder farmers grow varieties, and not proprietary hybrids of brinjal. They save seeds from their own crop, and hence do not depend on seed companies for their seed stock every year. While at first glance this difference would most obviously have impacted the pattern and rate of adoption if Bt brinjal has been commercialized,

it also created a different atmosphere in the period leading up to the moratorium decision, where farmers and those working with them were able to say that they didn't want – or more importantly even, need – the product that was being offered to them. Unlike in the case of Bt cotton, these choices were situated in a set of options that closely aligned with the day-to-day experimental and environmental knowledge farmers had with growing varieties of brinjal, and not within a powerful set of corporate influences which, essentially, if rejected, left farmers in a worse position that before. A civil society activist summed this effect up:

> The problem is [when] you are dependent on them and then you are fighting with them, [it] makes no difference. Cotton is a classic case. If Monsanto stops selling seeds, you have to close down your cotton cultivation. So then how do you fight them? The first step towards fighting is to cut off your dependence. That's where the strength lies. That's where the solution actually lies (Ramanjaneyulu 2011).

It is perhaps worth noting that along with differences in domestic market contexts, the international economic and trade context for both crops is also very different. India is the second largest producer and exporter of cotton. In 2009 and 2010, cotton export values for India were $1.9 and 2.9 billion respectively. Brinjal figures tell a very different story. Although the country is one of the largest producers in the world, worldwide brinjal production still adds up to a mere fraction of cotton production (FAO, 2012b). Furthermore, almost all brinjal produced in India is consumed domestically. Export values of brinjal in the same two years were a negligible $47,000 and $36,000 respectively (FAO, 2012b). Although neither the minister in his final decision, nor involved researchers and civil society members attribute much importance to this difference, these figures may have made the economic stakes of the decision on Bt brinjal lower than those of Bt cotton, in turn making it easier for other dimensions of influence to play a more instrumental role.

Bt cotton, then, was introduced in India into a market context where farmers were dependent on the corporate sector for their seed, and a regulatory context where corporate actors occupied prominent and influential positions. In contrast, corporate influence on the final decision on Bt brinjal was significantly diminished when it was passed onto a minister less enmeshed in the close links between corporate and regulatory actors. This, along with the facts that brinjal is not a

major export crop and that farmers do not rely on the corporate sector for their brinjal seed, meant that the corporate sector's relative influence in the Bt brinjal case was somewhat weakened. Other dimensions of influence played a part in this shift, while also being able to exert greater pressure on the overall decision-making process because of it.

Institutional Influences

Several scholars of GM policy have argued that the transatlantic divide between the EU's precautionary policy and the US' permissive approach to GMOs is polarizing the policy arena, and drawing other countries to one of the two extreme ends of the spectrum (Bernauer, 2003). Others believe that the EU's precautionary paradigm is more influential, creating an overall "trading up" effect in domestic policy approaches to GMOs (Prakash and Kollman, 2003). However, this view does not appear to adequately represent the multitude of policy approaches to GMOs in the global south. Busch et al, for instance, find that far from acting as a polarizing force, the transatlantic conflict has created "room for manoeuvre" that developing countries have strategically used when setting their own policy directions (Busch et al., 2012). Many of these directions can be explained better by the interplay of various domestic interests and institutions, than by the pressures applied to them by international regulatory mechanisms and governments.

Despite the important influence that non-state actors such as businesses and civil society have had on India's biotechnology policy and regulatory framework, state institutions remain in a central role. Government bodies act as the intermediary between various non-state actors, as well as the central body that international institutions and actors interact with. In the case of GMOs, various factors have shaped domestic regulatory frameworks. In China, for instance, international mechanisms and institutions have been a primary influence in shaping domestic policy (Falkner, 2006b). However, in the case of India, both Bt cotton and Bt brinjal decisions were primarily influenced by the convergence of key domestic institutional factors. Bt cotton was approved in India before the primary international regulatory mechanism for GMOs, the Cartagena Protocol on Biodiversity, was ratified. In the case of the Bt brinjal moratorium, while international institutions did play a role, they were not primary shapers of the decision, but were used strategically, and in the final stages of the decision-making process, to legitimize policy

directions determined in earlier stages by domestic influences. While domestic forces were central to both decisions, there were some particularly influential factors that came together in the case of Bt brinjal, shifting the existing balance of influence away from a corporate dominated policy-making space, and towards one that was based on the range of impacts being raised by a wider variety of stakeholders. These influences include key institutional structures within government and the GEAC, judicial mechanisms that allow the courts to intervene in policy processes, and institutional dynamics between state and central governments.

Ministry of Environment and Forests

One of the easily identifiable influences in the policy process around Bt brinjal was the institutional relationship between the GEAC and its host agency, the Ministry of Environment and Forests. The fact that the apex regulatory body is nested within this ministry meant that its head, the Union Minister of Environment and Forests, Jairam Ramesh, became responsible for the final decision on Bt brinjal when members of the GEAC passed it on to the central government. This was not the standard regulatory process, but it was a key move towards the final outcome. The GEAC has the regulatory authority to make a final decision, and has always done so in the past, for several Bt cotton approvals. However, in the case of Bt brinjal, the members of the GEAC realized that they had a "hot potato" issue in front of them (Sahai 2011), and did not want to be responsible for future repercussions of the release of the crop. Since the GEAC is nested within the MoEF and is technically under the minister, and in the absence of any other clear protocol on such a situation, the final decision was put in the hands of Minister Ramesh. Union Ministers of Science and Technology, Prithvi Raj Chavan, and of Agriculture, Sharad Pawar, were given a chance for input. Both ministers, who are known to be supporters of GM crops, recommended that the crop be approved. Had the GEAC been more closely connected to one of these ministries, the final decision may well have been a different one.

The minister took several unexpected and arguably unprecedented steps in the weeks preceding his final decision, which directly shaped the final outcome. The first and perhaps most important of these was his decision to hold a series of consultations across the country, to gauge scientific, public and farmer opinion on Bt brinjal. The consultations were coordinated and managed by the Centre for Environment Education, a partnership between the MoEF and a non-profit group, and

took place in seven centres chosen for their proximity to Bt cotton growing regions, brinjal cultivation, or both. Several thousands of participants attended each event, and there was an unusual consensus afterwards, between scientists, farmers, civil society activists and other politicians, that in giving voice to such a large number of people, the consultations were an unprecedented example of democratic decision making (Bhargava, 2011; Kuruganti, 2011; CEE, 2010b; ILTB, 2010). The final outcome was definitely shaped, at least in part, by what the minister heard at the meetings. Some feel that the minister decided to hold these consultations just to play his "usual populist game" (Jishnu, 2011). Others however, believe that it was in large part due to his background in rural development work, and his experience as minister of commerce in his home state of Andhra Pradesh, where he had seen both Bt cotton cultivation and alternative agricultural models such as Non Pesticide Management in effect (Siridhar, 2011; Ramanjaneyulu, 2011; Kuruganti, 2011). Farmers and civil society members remember him visiting fields to hear and see their experiences (Kuruganti, 2011).

Motivations aside, a surprising number of people from both scientific and civil society backgrounds seem to agree that the minister made an unusual effort in uncovering facts, and delving into the various aspects of the controversy (Ramanjaneyulu, 2011; Kuruganti, 2011). One activist who was closely involved in the campaign said, "he is someone who has already been exposed to the fact that…there is nothing like a technology being neutral. And he understands … that technologies do have different impacts across time and across communities" (Kuruganti, 2011). Scientists feel similarly. Several mentioned that he was in close contact with them through the consultation period, asking for expertise and analysis on various factors (Sahai, 2011; Bhargava, 2011).

Significantly, however, an important part of what the minister appears to have been able to achieve during the consultations is creating a platform where a broad diversity of stakeholders was able to voice their opinions. In a country with the numbers, complex hierarchies of social status, and deep public attachment to agricultural and food issues as India, this is not an easy task. Even those who, in the past, have been most critical of political and policy-making processes in government for excluding important voices, commended this process. One activist went so far as to say that she doesn't believe that he missed out any stakeholders (Kuruganti,

2011). By hearing supporters and opponents, and more importantly even, scientists and others on the same platform, Ramesh weakened the deep-rooted notion of experts as being the only legitimate contributors to policy decisions (Kuruganti, 2011). One of the civil society members who participated in several of the consultations summed up his impact on the overall process and outcome when she said, "By nature and by location he was in a position where he could delve better and create a better debate around the issue, and do it in a democratic participatory fashion" (Kuruganti, 2011).[14]

The passionate and heated range of opinions he heard at the consultations may have surprised even the minister. Media and even the host organization, CEE, claim that they were unprepared for the large attendance numbers (CEE, 2010b). Those sceptical of his motivations claim that he orchestrated the meetings merely as a smokescreen to the final approval (Jishnu, 2011). Even those who believe he conducted them out of a true desire to gauge public and technical opinion about the impacts of releasing the crop, however, believe he didn't expect what he got. The number of participants, the range of passionate opinion, the experiences shared by farmers, and the detailed media coverage of the process were all unexpected, and undoubtedly shifted the minister's final outcome, which some believe he was assuming would be an approval (Sharma, 2011; Jishnu, 2011).

The Supreme Court's intervention in the GEAC

Another shift that shaped the final outcome had to do with the composition of the GEAC and public scrutiny of its functioning in the years before the moratorium. This shift was instigated by the decision of the Supreme Court to nominate an independent scientist to sit on the GEAC. The nominee chosen was senior and respected molecular biologist Dr P M Bhargava. His influence played out most significantly in the period before the consultations began, in shifting the

[14] This is not, of course, to indicate that the process was without its critics. Civil society participants felt that the consultations should have been longer and in more locations. Others were upset by the presence of a few people, allegedly supported by industry, who attended all the consultations and monopolized the discussion time. Some farmers were upset because industry actors had allegedly hired large numbers of men from neighbouring villages, and trucked them in to attend the consultations as Bt brinjal supporters. A farmer I spoke with shared a story of asking his neighbour at one of the events where he farmed and why he supported Bt brinjal. The man replied that he was a clerk in a nearby office, and has never farmed, but was offered money to attend the consultation as a supporter. Yet others complained that the minister shut them down, and at one consultation, got into an altercation with one of the participants. Despite these criticisms, however, the overall sentiment towards the process and the minister's conduct has been overwhelmingly supportive.

dynamics at play within the GEAC, and bringing public attention to its composition and functioning. This in turn exposed the imperfection of the wider regulatory process and legitimized public questioning of the institutional context within which the political decisions were later to take place.

Dr Bhargava's appointment to the GEAC was a direct result of two public interest litigation cases filed respectively by Suman Sahai of Gene campaign in 2004, and a group of civil society organizations and individuals in 2005 (see page 41 for more details on these cases). One of the complaints of both PILs was the inadequate approval system used by the GEAC and the need for a more rigorous scientific and political assessment mechanism. While both cases are still pending today, the Supreme Court implemented several interim measures, one of which was to appoint an independent scientist to the GEAC, to monitor the process as well as the outcomes of that committee.

Dr Bhargava was, in his own words, "shocked at the way the meetings were held and shocked at the way that approvals came" (Bhargava, 2011). He went on to make several key recommendations. The first of these was for the committee to require a much larger and more rigorous series of independently conducted safety tests, and not accept company data and studies.[15] Along with these technical inputs, however, he also critiqued the composition and functioning of the GEAC. He claimed that almost all the members of the GEAC had serious conflicts of interest, and most were receiving money from the DBT, from industry, or from the Indian Centre for Agricultural Research (ICAR) (Bhargava, 2011). He pushed for the members of the committee to have to sign No Conflict of Interest agreements before being appointed to the committee, a guideline that was implemented after the Bt brinjal decision in 2011, and led to the resignation of more than one committee member (Misra, 2009; Mukjerjee and Menon, 2011). He also held that very few of the members of the committee came to all the meetings, that those who did usually hadn't prepared adequately, and that the meetings were too short for anything but rubber-stamping approvals (Bharagava, 2011).

[15] Unsurprisingly, the impact of Dr Bhargava's presence on the GEAC spills into other dimensions as well. For his impact on the scientific process itself, see pages 66-7, and for a brief discussion of his role in shifting corporate power in the decision-making process, see page 48.

In December 2009, Dr Bhargava wrote a letter to the prime minister, Manmohan Singh, and minister of environment, sharing a conversation that he had with then-secretary of the GEAC, Arjula Reddy, who confided to him that he was "under tremendous pressure" from the ministry of agriculture, the DBT and industry, to approve Bt brinjal. He also admitted that he agreed that a larger number of tests needed to be conducted before an approval should be given. This letter was released publicly, and was covered extensively by media (Venkateshwarlu, 2009; Bhargava, 2011).

Dr Bhargava's presence on the GEAC had key – if somewhat indirect – impacts on the policy process. Along with initiating some longer-term changes in the functioning of the GEAC, he greatly increased the general attention being given to the committee and the regulatory process at the time. His public letters, which were widely covered in the media, led to the GEAC being watched closely, in the year before the final Bt brinjal decision (Kuruganti, 2011). Public and media attention to the workings of the committee, as well as the larger regulatory context within which it was embedded, was laced with suspicion. This filtered through to the minister's final decision statement as well. In it, he states that "doubts have been raised on the integrity of the GEAC process itself, particularly by Dr. P.M. Bhargava" that, in the absence of an independent regulatory body, could not be entirely ignored (Ramesh, 2010).

Dr Bhargava's opinion held particular sway because, along with being a generally well-respected and senior scientist in the country, he is also considered an impartial observer in the process. He has always been a supporter of GM technology in general, and was one of the people involved in the initial establishment of the DBT in India. This background separates him from other anti-GM activists, and further increases the weight of his opinion, which is already significant in a cultural and regulatory context that highly values scientific expertise.

State Governments

Dynamics between the union and state governments is an important facet of the political system in India. This interaction is made particularly influential in the case of GM crop regulation in the country since agriculture in India is a state subject. Biotechnology and biosafety decisions,

however, are under the jurisdiction of the central government. In the case of Bt brinjal, states played a vital and direct role in shaping the final outcome, primarily because their overwhelming opposition to its introduction made it impossible, politically and strategically, for the central government to ignore.

As part of the nationwide consultation period on Bt brinjal, Ramesh invited state chief ministers in January 2010 to provide feedback on the introduction of Bt brinjal in the country, and in particular in their states (CEE, 2010b). Nine state chief ministers responded in writing, and four verbally (CEE, 2010b). Of these, two requested more time to reach a final decision, while all the others were opposed to the introduction of the crop. Six of these states between them grow a majority (77%) of the country's brinjal. The governments of Kerala and Uttarakhand declared that irrespective of the decision taken at the national level, their states would not be allowing in the entry of Bt brinjal (CEE, 2010b). Kerala went as far as to ban all GMOs from the state: "…Government of Kerala has taken a decision to prohibit all environmental release of GMOs and keep the state totally GM free. We would request the Honourable Prime Minister to reconsider the policy of GM in a national scale and declare a moratorium at least for the next fifty years" (CEE, 2010b).

The opposition from the states was, in part, a response to earlier political tensions between the centre and state governments. State chief ministers and governments were not closely involved in the Bt cotton approval process, and some felt excluded from decision making that directly affected their own state policies. The chief minister of Karnataka, one of the primary cotton growing states and the centre of the biotechnology industry, claimed that he found out about the commercial release of Bt cotton when he read about it in the media (Scoones, 2005). Others believe the tension arises from the fact that although the decision to commercialize Bt cotton was made within the central government, state governments are more directly accountable to their voter bases, and are held responsible for crop collapses or market failures. This is heightened by the fact that a large majority of the population in rurally based states are farmers, many of whom belong to powerful farmer unions (Ramanjaneyulu, 2011). Discontent in rural states can have direct bearing on election results. State governments also tend to be more conservative in their policy making, and may well be less willing to take risks that their voter bases may not respond

positively to. In the case of Bt brinjal, state agriculture and chief ministers adopted a precautionary approach, sensing a controversial issue that there was no need to rush into (Sahai, 2011).

State opposition was directly influential in the final policy outcome around Bt brinjal. Central government ministers cannot, strategically, ignore the interests of state governments and opposition parties, especially not in the context of coalition politics (Kuruganti, 2011).[16] This was underlined by the fact that opposition states and politicians crossed party lines, and even states with Congress-party led governments, came out against introducing it in their states. In his final decision, the minister alluded to this dimension more than once, specifically citing the importance of state opinion in the federal regulatory framework.

The decision had lasting impact that went beyond the release of GM brinjal. The minister also included in his final statement a requirement that all states be given the permission to approve or reject field trials in their states. Although these are not official ministry rules, Ramesh has stuck by them, with interesting implications. In 2011, the GEAC called for ongoing field trials on Bt Maize to be conducted in several states, including Bihar. The state's chief minister, Nitish Kumar, has been resolutely opposed to private sector field trials in the state: "I told the agriculture minister that I have no objection to scientific experiments by scientists of the public-funded Indian Council of Agricultural Research. I am opposed to opening up our state for field trial by MNCs" (Times of India, 2011). Significantly, Ramesh reacted to this statement by overruling the GEAC, and cancelling permission to conduct trials in the state.

International institutional influences

The growing attention being devoted to GMO food crops in the international political arena, and the heated debate that accompanies them, makes it tempting to attribute domestic policy developments to the rapid changes in international institutions, policies and pressures. However, as I have shown above, in the case of Bt brinjal's release in India, domestic institutional

[16] The current government in India consists of a coalition of centre-left parties called the United Progressive Alliance (UPA). The leading party in the coalition is the Indian National Congress, which is supported in the coalition by several other parties.

mechanisms and dynamics were primary factors in shaping policy outcomes. This is not to say, however, that international factors didn't play a role. Pressures from other countries, as well as from multilateral agreements, may not have been the primary motivators of domestic policy change, but they were used strategically to legitimize decisions otherwise based on an interplay of domestic interests.

India was an active participant in multilateral negotiations for the Cartagena Protocol on Biosafety. The protocol lays out guidelines for the transboundary movement of genetically modified organisms, calls for "informed consent" for importing countries, and validates using the precautionary principle for decision making. The ratification of the protocol was followed by much discussion in the scholarly literature of how it would affect national-level policies (see, for eg, (Gupta & Falkner, 2006; Gupta, 2000a; Gupta, 2000b). Gupta predicted that the protocol would be relevant to domestic decision making by legitimizing national biosafety frameworks where they existed, by shifting the responsibility to share information on to the producers (from importers or consumers), and by leaving in place the right for countries to develop their own biosafety regimes. Unlike some of the other countries that ratified the protocol, India already had a national biosafety framework when the protocol was adopted in 2000. Based on this framework, Gupta predicted at the time that the protocol would not change India's biosafety governance, but would be relevant to it in the ways mentioned above (Gupta, 2000a).

India ratified the Biosafety Protocol in 2003, the year after Bt cotton was released for commercial cultivation, and it hence did not come into play in decision making in 2002. However the protocol did play into the broader institutional shift that took place between the two decisions. It was invoked several times in the final moratorium decision and during the consultations on Bt brinjal. Scientists used it to recommend an approach based on the precautionary principle, and to support their claim that there was much uncertainty in the field of biosafety and more testing was needed (CEE, 2010b). It was also cited by civil society in their call for a moratorium on releasing a GM crop in its centre of origin, as brinjal is in India.

Perhaps most importantly however, the minister used it when he faced opposition from other political actors – primarily the ministers of agriculture, and science and technology – to justify

the need for consultations (CEE, 2010b). Both ministers approved the release of Bt brinjal when the decision was originally passed from the GEAC to the union government, and both are vocal advocates of the introduction of GM technology in the country. This support led to conflict between the Minister of agriculture, Sharad Pawar, who did not support the need for consultations, and Jairam Ramesh (Koshy, 2010; Business Standard, 2010). Ramesh used the protocol clause that calls for national-level public consultations before commercial release of any GM crop to justify the need for consultations, and was supported in this by the majority party of the coalition government (Times of India, 2010). In his final decision statement, the minister called attention to the fact that in advocating for the release of Bt brinjal without conducting public consultations, the GEAC had violated the principles of the protocol, as well as having violating adequate testing guidelines of the Rio Declaration and Codex Alimentarius, both of which India is signatory to (Ramesh, 2010).

Other countries and their policies also put pressure on the domestic policy process, directly or indirectly. The US has consistently encouraged and even pushed India to adopt a permissive policy approach to GMOs. In 2005, the two countries signed the "Indo-US Knowledge Initiative on Agriculture," an agreement to join efforts in agricultural technology, research and trade through public-private partnerships. Biotechnology was one of four focus areas in the agreement (USDA, 2005; GOI, 2006). The pressure from the US, however, was balanced by the more restrictive policy advocated by the EU, a major trade partner, and China's policy on public sector research and limited commercialization. Interestingly, the final decision cites only the need to comply with and consider the priorities of these latter countries, and not with those of the US, despite the fact that India has in the past worked closely with US to align agricultural and trade policies and encourage foreign direct investment. Indeed, the minister went so far as to say in his final decision: "True, Bt-corn and Bt-soya is widely available in the USA, but that is no great compulsion for us to follow suit" (Ramesh, 2010).

The pressures from both foreign country policies and multilateral agreements were used strategically by the minister to legitimize his decision to withhold a final decision until he had heard from participants at national consultations, and to call for a precautionary approach to crop trials and approvals. The decision for a moratorium, however, was shaped primarily by the

confluence of key domestic institutional factors, including opposition from state governments and centre-state dynamics, the Supreme Court decision to nominate Dr PM Bhargava to the GEAC, and the approval committee's nesting within the Ministry of Environment, which in turn led to Minister Ramesh being responsible for a final decision.

The Influence of Science and Science Networks

"Sometimes scientists can shape policy, and sometimes they cannot; sometimes consensual knowledge engenders a policy consensus, and sometimes it does not" (Litfin).

In both Bt cotton and Bt brinjal cases, science networks were instrumental in shaping the final policy outcomes, though in very different ways. Bt cotton was pushed through the approval process in India in the context of a limited body of science, and supported by a small network of tight-knit DBT officials and scientists, many of whom also had industry connections (Scoones, 2005). National and international biosafety research undoubtedly advanced in the years in between the two decisions. Interestingly however, this body of science and the scientists associated with it primarily underlined the need for a more thorough evaluation of the risks associated with GM releases (Criigen, 2012). The knowledge power and influence of the science network in the case of Bt brinjal, then, stemmed not from a body of consensual science, but instead from the widespread discussion about a *lack* of consensual science – or in other words scientific uncertainty – and a concurrent call for independent and rigorous research that stemmed, in part, from a growing distrust in the DBT and industry-funded science. This distrust played a role in the overall weakening of the relative influence of the corporate sector in the Bt brinjal decision, and inputs from scientists during the consultation period significantly widened the political process to include scientific risk in ways that went beyond the considerations of the Bt cotton approval process.

Science in the Bt cotton approval

Much of the regulatory process for Bt cotton fell to the DBT, and the group of scientists that make up its various advisory committees. These scientists rely on the department for their research funding, and most consider it prudent to be involved with the department's inner

workings by sitting on one of its committee (Scoones, 2005). The most important of these is the RCGM, which is also made up of scientists, and which is responsible for granting GM research and testing approvals. One member of this committee described well the influence they have on the policy making process: "We are all scientists on the committee. We can mold DBT policy" (Scoones, 2005 p 257). The DBT and RCGM have both been criticized for granting approvals without rigorous process, as well as for relying on a very limited group of scientists who, by being funded by the DBT or by industry, have a clear conflict of interest. One of the members of the committee noted, "Everyone has the same view as me. Agreeing is easy" (Scoones, 2003b). Committee members have admitted that they did not have time to read reports or consider approvals in detail during their half-day meetings in Delhi (Scoones, 2005). Most Bt cotton hybrids were stamped and approved by this small group of tight-knit scientists, without much input from ecologists and health scientists. The time given to studying biosafety reports, as well as field trial visits at which scientists were accompanied by company officials, was very limited (Scoones, 2005). Scientists involved admitted that it was "not an effective or transparent process" (Scoones, 2005).

The close circles of the DBT, and its abbreviated process, led to a sense of distrust of the department and its regulatory process. Scientists from public research institutions, especially those based in cotton growing areas, felt that their expertise has been excluded to instead allow for those of Delhi-based scientists who would be able to push the approvals through sooner. Agricultural and ecological scientists likewise brought up concerns from their subjects that had not been considered in the approval process. Civil society and the scientists working with them critiqued both the science itself, and the process of approval (Scoones, 2005). These critiques and uncertainties collectively led to a growing sense of distrust in the DBT and its scientists in the years just before and after Bt cotton was approved, as well as in the scientific studies being used to back up the Bt cotton approval.

It is worth noting at this point that despite several new studies being published in the past decade, the research on GMOs is still – even a decade after the introduction of Bt cotton in India – a relatively young science, and conclusive data on both agronomic performance and biosafety (human health and ecological impacts) is still limited. Most studies are specific to particular

crops and particular locations, and the results influenced by cultivation conditions. As recently as October 2012, initial results of long-term feeding trials were being published for the first time (Séralini et al., 2012). Such studies represent, for many, the very basic level of testing required before GMOs should be approved, consumed, and released into the environment (Bardocz et al., 2012; Clark, 2012; Sahai, 2011) and these scientists emphasize that current and past approvals of GMOs may well be premature (Criigen, 2012). Others, however, hold that GMOs are safe for both human health and the environment, and the technology effective (Hammond et al., 2006).

The disagreement within the international and domestic science communities on GMOs, paired with research that points to possible biosafety risks associated with them, has in fact emphasized the context of scientific uncertainty that GMO governance is still embedded in. Both underline the need for more, and more conclusive, testing and research on GMOs, as well as the need for a precautionary decision-making regime. This uncertainty is exacerbated by persistently conflicting studies on agronomic performance. While farmers, civil society and the academic literature regularly report the negative impacts of Bt cotton on small-scale farmers in India, occasional reports of staunchly supportive figures also exist. The best example of this is perhaps a controversial paper by Quaim and Zilberman published first in 2003 in the journal *Nature*, and following that in *Science*, in which they claimed that Bt cotton trials fields yielded an 80% economic advantage over non GM crop in 2001 (Qaim and Zilberman, 2003).[17] Despite being widely discredited in the scientific community, and even by several members of industry who believed such hyped reports gave the technology and associated companies a bad name (Scoones, 2005) the article has become one of the most commonly cited GM success stories in the literature (Sahai, 2011).

Scientific uncertainty and Bt brinjal

The uncertainty and inadequacy of existing science was put under the spotlight by two interlinked processes during the period when Bt brinjal was put forward for approval. The first of these was the vocal contribution of influential scientists, both within the country, and those from larger international networks, who were calling for precaution in releasing Bt brinjal into the

[17] MMB was, at the time, promising a 20-30% economic gain from using Bt cotton in their promotional material (Scoones, 2005).

environment. The second was the growing distrust of the DBT, the GEAC, and the scientific reports on which they based their approvals.

By the time Bt brinjal was passed on to the minister of environment for a final release decision, it had been approved for environmental and health safety by both the RCGM and the GEAC. In 2006, when it first reached them, the members of the GEAC appointed an expert committee to assess and report on existing science. This was the ECI report, which was highly criticized by domestic and international scientists for incorrect information, inadequate analysis, and for using company data (Bhargava, 2011; see also comments from scientists in CEE, 2010b). However, the GEAC followed the report's recommendation to allow Bt brinjal to be tested in field trial conditions. This then led to the ECII report, which assessed the trial results. The results of this assessment were shared with all members of the GEAC, who were given two days to read and comment on the 100-page report before the next GEAC meeting (Bhargava, 2011). Scientists such as Dr Bhargava criticized not only this process, which didn't allow for a proper consideration of the report, but also the data and results, which he claimed had numerous inconsistencies and errors (Bhargava, 2011). On his insistence, the time period to consider the report was extended, and the report shared with international scientists, who corroborated Bhargava's critiques, as well as his call for another 14 tests to be completed before approval could be considered (CEE, 2010b).

In his final decision document on the Bt brinjal moratorium, the minister of environment specifically mentioned the importance of considering the feedback he had received from senior members of the Indian scientific community. These included G Padmanabhan, a supporter of Bt brinjal's commercialization, Dr Bhargava, and M. S. Swaminathan. The latter, one of the central figures involved in bringing the Green Revolution to India, is an iconic figure in the country, and his opinion is held in high esteem (Scoones, 2003; 2005. See for example Visvanathan and Parmar, 2010). Along with Indian scientists, several international scientists also provided feedback on the biosafety implications of releasing Bt brinjal during the consultation period. A large majority of these reports advocated a cautionary approach, and called for more testing to be done before the crop was released into the environment. The number of scientists who recommended that Bt brinjal not be released into the environment, as well as the extreme

criticisms that many raised about the "utterly disgraceful conduct" of the scientific community (Sahai, 2011), the tests that had (and had not) been conducted, and the inconsistencies in the results and reports produced in the process of declaring Bt brinjal safe, all played a key role in stalling the approval of Bt brinjal (Ramesh, 2010; CEE, 2010b).

Having many of these well-known scientists, both from India and internationally, take an interest in and speak out about domestic science-policy issues perhaps encouraged other scientists in the country, who had (in part because of connections to DBT funding, as discussed above) not been forthcoming about their doubts in the past, to voice their opinions too. More importantly, the national consultations provided a previously non-existent, collective, and relatively "safe" forum in which to do so. The importance of these comments was underlined by the fact that many of the scientists who spoke in opposition of the commercial release of Bt brinjal were in fact GM researchers or supporters themselves, and clearly not ideologically opposed to GM crops being used in agricultural strategies in the country.

The technical inadequacies and weaknesses pointed out by several scientists in the consultation period cannot be separated from criticisms of the networks that created them. The links between scientists involved in various stages of the approval process and the DBT were exposed by Dr Bhargava, who was very vocal about these issues, both privately to government ministers, as well as publicly through the media. He discovered, in his own words, that "all the members of the GEAC were purchased," and the DBT itself is a "vendor" (Bhargava, 2011). Connections between the science community and industry or the DBT are not new, and have been getting increasing attention for the past years.

Interwoven closely with issues of corporate and institutional influence, this exposure culminated in a call for science that is rigorous, independent of corporate or even DBT influence, and sensitive to a wider range of issues than just agronomic performance. These issues were all particularly compelling, and were given attention outside the scientific community as well, because of the fact that unlike cotton, brinjal is a food crop. It prevalence in the country as perhaps one of the most widely eaten vegetables means that it has not just a strong cultural value, but also that the stakes for risk assessment and human health related concerns were very high.

The public discussion around safety and commercial release of Bt brinjal is one that could not easily gloss over health risks. These concerns were heightened by the fact that India is the centre of origin for brinjal, making the threat of contamination and biodiversity loss a very serious one. Scientists, civil society members and farmers frequently cited past experiences with Bt cotton during the consultations, as a reminder of the possible consequences of contamination (CEE, 2010b).

As seen in the fact that biosafety risks about Bt brinjal carried higher weight due to its value as a popular food crop, the scientific aspects of the debate existed side by side with the socio-economic and cultural values attached to brinjal and to GMOs. Despite the fact that Indian decision making continues to accord high status to scientific and technical knowledge (Gupta, 2011), processes such as the one around Bt brinjal, where the lines between public opinion, politics and science are far from clear, show that "information does not emerge in a void, but is incorporated into pre-existing stories to render it meaningful" (Litfin, 1994). The emphasis on retaining control over food and agriculture, and a strong anti-corporate sentiment (see p 74), overlaps with the scientific dimension of policy making when, for instance, scientists are critiqued for being aligned to corporate interests, and for using data provided by the company for their testing. A public institution scientist, for instance, commented that "if developed by Indian scientists, transgenics may have seen the light of day much earlier" (Scoones, 2003b). This opinion is reflected even by the minister, when he said in a press conference after his decision announcement, that ''had the two genetically modified varieties – Bt Brinjal and Bt Cotton – come from the public sector, the present controversy would not have arisen'' (Indo Asian News Service, 2010). The comment appears to prioritize national and public control of technology over the rest of the reasons – biosafety included – he cites in his decision for the moratorium (Gupta, 2011).

Notwithstanding this and other similar statements, however, Gupta argues that the overall Bt brinjal decision still prioritized scientific information over other values (2011). This "technicalization" trend is one firmly ensconced in wider international politics: "The overall push from global regimes is for domestic GMO trade decisions to be based on narrowly circumscribed, expert-driven, and scientifically assessable notions of risk and safety" (Gupta et

al., 2012). While this is certainly true of existing official regulatory frameworks, both in India and in global policy making arenas, and individual scientific "experts" were undoubtedly very influential in the consultation process, assuming technical prioritization may not reveal the whole picture. Although debates about GMOs in India may often be covered with a "thin veil" of scientific criteria that seemingly makes them centre around technical issues, this may well cover a deeper and more messy mix of political and economic dimensions of influence (Scoones, 2005).

The Bt brinjal decision and consultation process, while arguably – and rightly – according significant attention to scientific concerns, took an important and unusual step in making political space for socio-economic concerns as well.[18] This point is evident, perhaps most clearly, in the minister's final decision document. In his reasons for the moratorium, the minister includes both that "there is no clear consensus within the scientific community" *and* that "the public sentiment is negative." Significantly, he states that the moratorium will hold "for as long as it is needed to establish public trust and confidence" and ends with a statement that he believes his suggested approach is "both responsible to science and responsive to society" (Ramesh, 2010). This latter aspect of the moratorium decision is discussed further in the next section.

Discursive Influence

The institutional, corporate and scientific shifts mentioned above were both shaped and mirrored by an influential discursive shift that took place in the same period. Bt cotton was pushed through the approval process without public participation, and cloaked in a strong pro-poor narrative. By the time Bt brinjal came up for approval, however, a compelling counter-narrative had emerged from civil society, farmers groups and other stakeholders. This new framing contested several of the fundamental claims of the pro-poor narrative of GMOs that had existed before, much of which was shaped by the corporate influence discussed above. It did this by re-embedding the discussion of GMOs – and Bt cotton and brinjal in particular – in the socio-

[18] Activists and scientists who believe that scientific criteria and biosafety testing should form the spine of the assessment process were in fact upset that in his final decision, Ramesh appeared to value the need for more science as highly as factors such as negative public sentiment (Sahai, 2011).

economic and historical realities of rural India, which in turn widened the range of factors that the political process around Bt brinjal took into consideration. In doing so, it may be considered a "powerful discourse" (Epstein, 2008) that helped shape public opinion, as well as the final moratorium decision on Bt brinjal.

The overlap between various dimensions of influence is perhaps most evident in this section. Corporate actors, for example, hold a discursive power that has shaped narratives around the need for GMOs in addressing food insecurity. Scientists and science – itself a kind of discourse in some capacities – have also played an important role in shaping the ways in which GM crops are understood and discussed, and the value of scientific expertise changes, as mentioned above, based on the socio-economic and cultural stories that accompany it.

Bt cotton's pro-poor narrative

As was the case with GM crops in other countries in the global south, Bt cotton was introduced in India cloaked in a strong pro-poor narrative. This framing, however, is not as old as the technology itself. It is perhaps useful then, to consider briefly the birth of this framing, as a context for understanding the narratives with which Bt cotton was introduced in India.

The evolution of the pro-poor narrative of GMOs is closely interwoven with the discursive power of the corporate sector, and specifically tied to the history of giant seed company Monsanto. The company began investing heavily in research on GM crops following environmental backlash and regulatory restrictions against the PCB's and POP's that made up the bulk of its chemical business in the 1970s (Glover, 2008). Their primary GM products were herbicide tolerant crops such as soy and canola, which could withstand their popular glyphosate-based herbicide Roundup. Clearly, given the crops and traits involved, the company was marketing these crops to large-scale commodity farmers in North America and Europe. However, in 1999, Europe declared an unofficial moratorium on GMOs. The company now needed to find a market for its new technology, and justify the billions of dollars being put into research (Glover, 2010b). It did this by linking it to existing, recognized and unavoidable global challenges – hunger, poverty, and environmental degradation.

Soon after this, in 2000, under the auspices of then-CEO Robert Shapiro, Monsanto announced its "New Pledge," which included commitments to "bring the knowledge and advantages of all forms of agriculture to resource-poor farmers in the developing world to help improve food security and protect the environment," (Monsanto, 2000, in Glover, 2005). They also launched their Smallholder Program (SHP), to provide "resource-poor, smallholder farmers" agricultural advice, chemicals, and new GM seed, including in the case of India, Bt cotton seed. The aim was, as one Monsanto official put it, to help farmers move from "subsistence to market" (Glover, 2007), and to a kind of agriculture that (as with Bt cotton) required farmers to buy external inputs. That this shift was driven by commercial interests, and was based on a "market based model of technology diffusion" (Glover, 2005) is most obvious in Shapiro's own words, when he said, "It's difficult, in the short term, figuring out how I am going to make money dealing with people who don't have money. But in practice, the development of agriculture at a village level is something that could make an enormous amount of business sense over time" (in Charles, 2001).[19]

The new rhetoric was not, however, accompanied by new technologies. Existing traits of herbicide tolerance and pest resistance, engineered largely into commodity crops such as corn, canola, soy and cotton, comprise – to this day – a large majority of the GM crops on the market. These traits and crops are developed in the economic and ecological context of North America, and targeted to benefit large-scale industrial farming systems. The Bt cotton technology that was commercialized in India by MMB was the same technology developed and sold by Monsanto in the US, and scientists have argued that it was developed to resist cotton's major pest in the US, the tobacco budworm, and not as well targeted for the Indian bollworm (Sahai, 2005). Bt cotton was, then, essentially taken directly from the North American industrial farming context, and placed, unaltered and disembedded, into a very different socio-economic and ecological one in rural India. The language it came with used poverty merely as a "moral backdrop against which visions of a future are articulated," (Jansen and Gupta, 2009), but neither engaged with, nor truly catered to the needs of the poor people it claimed to be helping.

[19] For a detailed analysis of Monsanto's history and the corporate shaping of GM crops as a pro-poor technology, see Glover 2005, 2008 and 2010.

This pro-poor framing had several effects. Firstly, it shifted the starting point of the debate around Bt cotton to the technology itself, instead of agricultural and food insecurity problems, and the measures needed to address them. This can be seen best in the case of the SHP. By the time the company posted "project officers" in villages across the South, they had been given inflexible packages, determined by sales priorities, that they were to share with smallholder farmers (Glover, 2005). This "technology-induced" process, "driven by a technology push" instead of a "demand pull," (Levidow, 2009) left no room for the farmers, who were essentially now passive actors, to voice whether or not they actually needed the packages they were being given (Jansen and Gupta, 2009).

Secondly, the pro-poor framing of Bt cotton clearly distinguished expert knowledge, which came from the company's scientists, and attached to the new seed, and farmer-held lay knowledge. The SHP, for instance, aimed "to give the update of technical information of agriculture as well as our products" and "keep the farmer on track" (Glover, 2005). This language depicts farmers as ignorant and uninformed, making them passive receivers of knowledge, and further, passive consumers and users – a stark contrast from their more traditional roles as creators, innovators, "owners" of their technologies and knowledge, and in essence, experts in their own right.

Thirdly, Bt cotton's introduction brought with it another fundamental assumption in pro-poor narratives of biotechnology. This is the reductionist notion that "developing new technologies and setting research agendas can be uncoupled from issues of structural inequality, unequal distribution of resources among farming populations, and institutional failure" (Jansen and Gupta, 2009). This technological optimism separates the crops and seeds from the socio-economic and institutional factors that they are inherently embedded within, and that shape the overall wellbeing of agricultural and social systems. As Glover says, "gene splicing is not intrinsically capable of surmounting obstacles like poor roads, inadequate rural credit systems and insufficient irrigation" (Glover, 2010a), and these factors have all been proven, time and time again, to greatly affect the success or failure of GM crops (see for eg., Qayum and Sakkhari, 2005; 2004; 2003; Newell and Mackenzie, 2004).

Socio-economic re-embedding

In the years after the introduction of Bt cotton, a significant discursive shift took place. The counter narrative that gradually developed in this period re-embedded the narratives on GM crops in the socio-economic context of rural and largely smallholder India. This re-shaping played out in several ways.

First, the emerging counter-narrative shifted from being centred around the technology to focusing on the question of need instead. This was particularly applicable in the case of brinjal. Brinjal is not a crop that has historically had great crop losses or low productivity. Neither has it suffered in the past from particularly severe pest attacks. These points were brought up often in the consultations, perhaps most convincingly by a farmer who recounted how he and others in his village in West Bengal feed surplus eggplant to cattle when they have bumper crops (CEE, 2010 p 30). Participants also made the point that eggplant, while an important vegetable culturally, was not an essential element of what anyone could consider the "food security basket" (Radhakrishnan, 2011). As one scientist and activist I spoke to said, *"Kaun bhooka mar raha hai yahan, bina baingan ke?"* (Who is dying of hunger here, for a lack of eggplant?) (Sahai, 2011). The final decision document reflected this sentiment: "There does not seem to be any over-riding food security, production shortage or farmer distress arguments favouring the enormous priority that has been accorded to [Bt brinjal] by private companies, other than the well-known argument on the need to reduce pesticide use" (Ramesh, 2010).

Second, the focus on whether or not GM eggplant was really needed in turn re-directed and widened the discussion towards broader and deeper issues surrounding food security, and the fact that technology-based pest protection did not necessarily translate into higher incomes for farmers. Several participants at the consultations made the point that it was not an emphasis on production that the country needed, but one on distribution and access, and infrastructural and price support. The compiled document that reports the issues raised during the consultations summarized that sentiment well: "GE is not an answer to food security; better storage, distribution, pricing and marketing strategies will eliminate the need for risky GE technologies" (CEE, 2010b).

Third, attention to the question of need in turn created another important shift. Farmers sharing first-hand experiences about their past experiences in the fields and voicing their preferences for future decisions during the consultations shone light on the fact that they, in fact, had knowledge (in the form of farming experience) that the scientific "experts" did not have. Decisions made by the "urban elite" who are relatively disconnected from rural realities, as many claimed happened in the case of Bt cotton (Scoones, 2005), had not always been successful, and the stories recounted during the consultations exposed this divide. It also allowed room for the discussion to consider farmer-based experience and their situated knowledge as a legitimate and important part of a decision-making process.

One of the principal flavours of the counter-narrative, however, revolved around themes of the monopolization of seed by the private sector, and particularly foreign multinational companies. This was, by far, the most frequently cited issue brought up during the consultation process. It is also the issue that those involved in the consultations felt that participants were most committed to (CEE, 2010; Krishnan, 2011). That this sentiment was influential, and filtered through to the final decision can be seen in the Minister of Environment's statement: "I also hope in the moratorium period we give serious thought to the seed industry and how we retain public and farmer control over it" (Ramesh, 2010).

This element of anti-colonial language and opinion is not new in India's civil society history. From their initial introduction, GMOs in India have been discussed in the context of liberalization and the colonial history of resource control (Newell, 2008). Unlike in many other countries, public opinion and civil society resistance have also primarily centred around socio-economic concerns (as opposed to health, biosafety or environmental concerns), and particularly around the threat of the foreign control of seeds (Gupta, 2000a). Campaigns such as "Monsanto Quit India," and the *bija satyagraha* invoke Gandhian civil disobedience and freedom struggle language, as do narratives such as the "second cotton colonization" used by civil society to describe the various effects of the introduction of Bt cotton to the country (in Scoones, 2003, p 27 & 31).

Historical re-embedding

The counter narrative that emerged before and during the Bt brinjal moratorium decision also situated the debate around GMOs in India in the context of the experiences farmers had had in the past 10 years of growing Bt cotton.

The experiences and evidence that farmers had had with Bt cotton helped strengthen the new discourse against Bt brinjal. Concerns brought up by critics of GMOs had often been brushed off in the past as being unfounded and hyperbolical, and farmer experiences of crop losses discounted as being "unscientific" and hence not legitimate. As evidence from multiple seasons of Bt cotton accumulated however, civil society and farmers were able to back up opinions and claims about the risks of GMOs with evidence (see for eg., Qayum and Sakkhari, 2005; 2004; 2003). Even though it was still almost entirely experiential and informal, this evidence became increasingly prevalent in public debates and the media, and hence increasingly hard to discount entirely.

Projects such as the Deccan Development Society's Community Media Trust program, in which women from Bt cotton growing villages documented local experiences with the crop in order to overcome their inability to otherwise publish or expose the losses they were facing played an important role in this process (Periyapatna, 2011). Scientists working with civil society groups likewise undertook studies and published reports on crop failures in their regions (Qayum & Sakkhari, 2005; 2004; 2003) . Both gave voice to farmer's situated experiences and knowledge, and reinforced their right to participate in decision-making processes as experts and political actors in their own right. This "evidence" addressed not only the success or failure of the technology itself, and related issues of pest resistance, crop losses, fertilizer and irrigation use, but also the other accompanying impacts of seed control and market domination by MMB (Radhakrishnan, 2011; for more on market dominance, see page 49).

While there has been and remains disagreement, even within civil society, on the link between Bt cotton and the farmer suicides in India, the issue has undoubtedly brought attention to the plight of small-holder farmers in India. The numbers, as mentioned earlier, are hard to ignore (see page 36).While there is disagreement on how many of these deaths can be directly linked to Bt cotton,

most agree that it has drastically exacerbated existing cycles of debt and poverty in parts of the country, and stands testament to the fact that irrespective of causality, it has not been a panacea technology for all farmers across the country. The central government, despite public pressure, had not investigated or spoken to this link till just recently, when a leaked internal advisory in 2012 acknowledged that Bt cotton farmers are facing a severe crisis, and account for a large number of farmer suicides in the country (Haq, 2012; see p 37).[20]

Civil society's role in creating a discursive shift

Much of the counter narrative I describe above was created and propagated by civil society groups, working with farmers and farming communities. As members of many of the central groups admitted, they were significantly less organized for research, outreach or organized advocacy work in the early 2000s when Bt cotton was approved and introduced (Sharma, 2011; Kuruganti, 2011; Krishnan, 2011; Ramanjaneyulu, 2011). In the following years, however, the number of groups working on GM issues and related agricultural concerns grew, and along with some of the more established and well-known groups, a new network of several organizations emerged, called the Coalition for a GM Free India. Media attention to the issue also grew in these years, and a significant shift in tone can be seen in many of the national media sources, as they mirrored a wider shift from thinking of Bt cotton as the first step of an agricultural revolution for the country, to coverage that highlighted farmer suicides, pest resistance and market dependence issues (Krishnan, 2011; Ramanjaneyulu, 2011).

Although strengthened and organized, the multitude of NGOs involved in GM issues in India are in no way a single or unified whole. Many of them have disagreed about approaches and strategies in the past, creating internal as well as publicly visible divisions (Scoones, 2003b). The groups have used starkly different strategies, which range from public interest litigations and research and reports, to media campaigns and direct action. The central commitments of most these groups, however, were strongly aligned, and the diversity of approaches has served to strengthen the overall message instead of weaken it (Scoones, 2003b). These groups played a significant role in increasing public attention and shaping public opinion to Bt brinjal in the

[20] Others, like activist and researcher Suman Sahai, hold that the technology can and has yielded results for farmers who have access to irrigation. Those who rely on small-scale and rain-fed agriculture do not see these benefits.

country. Perhaps more importantly even, civil society and farmers together were able to legitimize voices that had previously remained unheard in decision-making processes. In doing so, both groups were able to collectively achieve what individually would have been impossible.

This process was strengthened by the fact that the critiques raised in civil society's debates at the time were paired with a narrative that centred around examples of successful alternative models of agriculture in the country. Such case studies legitimized the calls activists were making for a focus away from Bt technology and towards agro-ecology, and addressed the multitude of ecological and socio-economic issues they were raising. Since many of the organizations involved were themselves running such programs, many of which have been widely successful, they were in a strong position to advocate for such change. The best-known example of such a model is perhaps the Non Pesticide Management project, initiated by the Centre for Sustainable Agriculture (CSA) in Andhra Pradesh, which has grown from 225 acres in 2005 to 3.5 million acres, or 15% of the state's area, in 2011 (Ramanjaneyulu, 2011). Further, the minister had seen this initiative in action, and activists believe this played into his final decision (Radhakrishnan, 2011).[21] Civil society and farmers did not have such experiences to situate their resistance within when Bt cotton was introduced in 2002.

NGO presence in the consultations on Bt brinjal was pronounced. They were the second largest group at 20% of the attendees at the consultations, following only farmers, who comprised approximately half of all participants (calculated from CEE, 2010b). In his final moratorium statement, the environment minister specifically mentions the concerns brought up by civil society, as well as a general negative public sentiment, as reasons for his decision. However, this movement did not grow overnight. As Scoones describes, there was already a strong "politics of dissent" developing in 2003, as the first Bt cotton crops were being harvested (Scoones, 2003b).

[21] The minister's final statement specifically made mention of this initiative: "Clearly, Bt-technology is not the only route for reducing pesticide use. … In this connection, it is worth recalling that there are now close to 6 lakh farmers in Andhra Pradesh fully practicing NPM (non-pesticide management) agriculture over an area of about 20 lakh acres. I have myself been seeing this initiative over the past four years. The advantage of NPM is that it eliminates chemical pesticide use completely whereas Bt-technology only reduces the pesticide spray, albeit substantially. Incidentally, one of the eight missions under the National Action Plan on Climate Change is the National Mission on Sustainable Agriculture of which NPM is an integral part. On January 19th 2009 much before I became Minister for Environment and Forests, I had written to the Union Agriculture Minister on the need to evaluate the Andhra NPM experiment from the point of view of replicability on a larger scale."

As international attention to GM issues grew, several of these groups developed strong links with international organizations as well, such as RAFI[22] and GRAIN (Seshia and Scoones, 2003; Scoones, 2008). This nascent movement continued to strengthen and grow over the next decade, and by the time the Bt brinjal debate arose, it was able to effectively channel several years of research and advocacy work into resisting the decision, both politically and publicly. In doing so, it played an important role in shifting the balance of influence away from a corporate-shaped discourse, and widened the political debate and process to consider socio-economic realities that the Bt cotton approval process had effectively ignored.

Conclusion

Two divergent policy outcomes on Bt cotton and Bt brinjal in India can be explained by a number of shifts in four different dimensions of influence. These dimensions are corporate actors, institutional mechanisms, science and science networks, and discourse and narratives.

Corporate interests, working closely with key figures in the political and regulatory processes around GMOs in India, played a major role in the approval of Bt cotton in 2002, as well as in shaping the pro-poor discourse that accompanied it. The influence of the corporate sector was heightened by the fact that even before Bt cotton was introduced, farmers already relied on the market for their cotton seed, and once Bt seed dominated market supply, farmers had limited access to non-GM seed. The approval process around Bt cotton did not involve public participation, or much consultation with state governments or civil society. It was also not restricted by international agreements such as the Cartagena Protocol on Biosafety, which India ratified after Bt cotton's commercial approval. The body of science on the biosafety risks of GMOs was limited at the time, and the approval decision was made by a tight-knit group of scientists associated with the DBT, with limited input from the wider scientific community. Together, these factors led to Bt cotton being given approval for commercial cultivation in 2002.

Over the course of the following years, as Bt cotton spread across the country, so did voices calling for a precautionary approach to approvals, an independent and stringent regulatory process, socio-economic evaluations and sound scientific testing protocols. Specifically, a

[22] Now the Etc Group.

number of shifts took place. First, civil society mobilized, with existing and new groups working to create a counter-narrative that challenged the pro-poor framing of GM crops by re-embedding the GM discourse in the socio-economic and historical realities of small-scale farming in India. Second, unlike in the case of cotton, farmers did not depend on the market, and by extension on the corporate sector, for their seed stock. Public scrutiny of the corporate sector's involvement with the regulatory process had also increased. Third, from an institutional perspective, the GEAC's administrative nesting within the Ministry of Environment meant that Minister Ramesh, and the public consultations he held, played an important role in the final decision, as did the Supreme Court decision to nominate an independent scientist to the GEAC. State governments were strongly opposed to the release of Bt brinjal, which undoubtedly affected decision making as well. These domestic institutional factors were very influential; international mechanisms such as the CPB did not play as central a role, but were used to legitimise decisions based on the domestic influences mentioned above. Fourth, the body of science on the biosafety of GM crops had grown somewhat in the years between the two decisions. Moreover, a number of international and Indian scientists responded to the growing distrust of scientific protocols used for approvals within the DBT by voicing their opinions on the uncertainty of existing science, and the need for more, and more rigorous, testing before GM crops were approved. These factors were underlined by the fact that unlike cotton, brinjal is a food crop, and India is its centre of diversity.

Due to each of these factors, by the time Bt brinjal was put forward for commercial release in the country, the balance of influence had shifted, reducing the relative influence of corporate interests, and widening the political process beyond criteria used in the Bt cotton approval. This process was now situated within discussions of socio-economic well being for small-scale farmers, alternative agricultural models, and the need for independent assessment and decision-making mechanisms. Although this was not in most cases a coordinated effort between the various actors as much as a series of concurrent shifts, the gradual changes in each of the dimensions of influence together explain divergent policy outcomes that neither one of them could individually.

Table 1: Dimensions of influence in the Bt cotton approval and Bt Brinjal moratorium decisions

	Corporate power	Science and Science Networks	Institutional mechanisms	Discursive shifts
Bt cotton	• Well connected to regulatory process • Strong market dominance • Strong discursive influence • Central in approval decision	• Lack of a cohesive body of science • Tight knit scientists of DBT and GEAC primary decision makers • Limited input from wider science community	• DBT and regulatory actors closely connected to corporate sector • No public process • No consultation with state governments • No international guidelines	• Strong corporate-shaped, disembedded narrative of Bt as a pro-poor technology • Weak civil society mobilization
Bt brinjal	• Greater attention to conflict of interest in approval process • Less market dominance for brinjal seed; less farmer reliance on corporate sector. • Equally powerful, but challenged by other dimensions of influence	• Growing distrust of DBT • Input from leading scientists (national and international) on uncertainty of science and inadequacy of testing. • Growing call for independent, rigorous biosafety assessment • Importance given to brinjal as food crop, and crop in its centre of diversity	• GEAC nested in MoEF, leading to Jairam Ramesh holding consultations and making final decision • Supreme Court decision to nominate PM Bhargava on GEAC, and exposure of conflict of interest in approval body • Opposition from state governments • Cartagena protocol used to legitimise consultations and final decision	• Mobilized civil society • Counter narrative to challenge pro-poor framing • Re-embedded debate in socio economic reality of smallholder producers • Situated in context of Bt cotton experiences • Advocating with successful alternatives

Chapter 5

Conclusions and Implications

Conclusions

Genetic engineering is one of the most political technologies in the world today, and the debate about the role of GM foods in addressing poverty and food security an extremely controversial one. While this debate was initially situated largely in richer countries, it is increasingly spreading to include countries in the global south. Interestingly, however, these new players are not necessarily converging into existing policy approaches to GM crop cultivation and regulation, which are largely polarized between the permissive regime of the US, and the more precautionary one of the EU (Busch et al., 2012; Falkner and Gupta, 2009). Instead, they are forging new paths in the spectrum of possible responses to GM crops.

Given that many of these countries, including India, are home to large numbers of those who make up the world's 868 million hungry people, the evolution of domestic policy regimes around GMOs in these countries is particularly significant, in both international and national arenas. India, with its distinctive socio-economic and political environment, and influential role in international and regional politics, stands to be both policy-reflective and policy-shaping, and is hence a particularly germane site for this analysis.

Two policy decisions in India – the 2002 approval of Bt cotton for commercial cultivation in the country, and the more recent moratorium on Bt brinjal in 2010 – offer a useful case study to explore the dynamics of country-level approaches to GM crops. Unpacking the puzzle presented by these two divergent decisions sheds light on various factors that shape decision making in this policy arena. I categorize them in four primary "dimensions of influence" for the sake of analysis. These are corporate actors, science and science networks, institutional mechanisms, and discursive shifts.

While the literature on the international politics and governance of food often attributes policy decisions to one or sometimes two of these elements, the politics and policy of GM crops are, as

I have shown, shaped by all four of these dimensions of influence, as well as by the interactions between them. A conceptual framework that is situated at the interface of all four dimensions, then, highlights not only the multitude of factors that shape decision making, but also creates space for a discussion of the messy but important ways in which they are inevitably interconnected. Even though they do not necessarily work in orchestrated unison, all dimensions of influence together are able to explain political processes and policy outcomes that none could on their own.

Although it is framed specifically for this research project, the conceptual framework I use in this thesis presents a useful structure to analyse the often-complex and multi-causal processes and outcomes related to food and environmental issues. The literatures that each of the dimensions of influence draws on are frequently used to individually explain decision making in these fields. However, in unpacking decisions with multiple stakeholders and multiple influences, any one of these approaches to governance is not always able to capture the complexity that plays out on the ground. The conceptual framework I present in this thesis takes a step back to widen the study lens and include a greater number of interacting variables and influences. In doing so, it provides a more accurate and complete picture of multi-layered policy processes and outcomes. This can be seen clearly in the case of policy decisions on GM crops in India.

In the case of Bt cotton, the corporate dimension plays a central role in shaping political processes and final outcomes, due to market power, close connections to regulatory mechanisms, and discursive influence. In the absence of a mobilized civil society, nuanced public debate, restrictive institutional mechanisms and critical or cautionary scientific influences, the crop was approved without broader public participation, in a process focused on technological performance and cloaked in a pro-poor narrative. In the years after its introduction, however, key actor coalitions brought about several shifts in each of the other dimensions of influence, that were themselves increasingly engaged in the debate on the role of GM crops in India's food security and agricultural strategy.

The body of science on biosafety and risks associated with GM crops grew in the years between the two decisions. More importantly, however, national and international science networks

unified around the uncertainty in the scientific debate, and used this to emphasize a need for more, and more rigorous, independent assessment before GM food crops could be released into the environment and market. Civil society greatly mobilized in the years after Bt cotton was introduced, challenging the pro-poor narrative that accompanied it with a counter-narrative that embedded the debate in the socio-economic and political realities of rural, smallholder India. The debate around Bt brinjal was situated in the context of Bt cotton failures across the country and the potential offered by successful alternative models, and underlined by a broader, often anti-colonial narrative that rejected corporate control of seed and agricultural resources. These factors aligned with opposition from state governments and institutional dynamics that placed key actors, such as the Minister of Environment and Forests and the Supreme Court Nominee on the GEAC in central decision-making roles to create, in essence, a confluence of shifts that changed the context in which Bt brinjal was to be introduced.

The strengthening of other dimensions in this new context effectively reduced the relative influence of corporate interests, and widened the political process beyond criteria used in the Bt cotton approval, situating it instead within discussions of socio-economic well-being for small-scale farmers, alternative agricultural models, and the need for independent assessment and decision-making mechanisms. The participatory political process that emerged in the final stages of the approval process for Bt brinjal was then compelled to consider this wider range of factors and voices. Together, a confluence of shifts in various dimensions of influence led to a divergent policy outcome in this case. It is important to emphasize that although this was not in all cases a coordinated effort between the various actors as much as a series of concurrent shifts, the gradual changes in each of the dimensions of influence together explain what neither one of them could on its own.

Implications

The results of this research, and the events it is based on, have important implications at both national and international levels.

International implications

As with other literature that examines issues related to food security, much of the significance of

this research stems from the gravity and urgency of global hunger levels around the globe. Given that the number of hungry people in the world is estimated to be 868 million, that this figure is not decreasing, and that the future direction of any technology prescribed to address food insecurity stands to affect millions, it is profoundly important to understand the true impacts of any such prescription (and to assess whether or not in fact it is a pro-poor technology). In the case of GMOs, this understanding implies not only the need to examine the effects the technology itself, but also to unpack the knowledge politics and power relations at play in policy decisions that regulate that technology, and amongst the various actors and voices that shape it and are shaped by it.

In my case study, these dynamics become particularly important because India is arguably both norm-reflective and norm-shaping. India is unusual in having "a diverse and multifaceted set of industrial concerns, a vocal and mobilized civil society, and an interesting set of intragovernmental dynamics" (Newell, 2007a). These factors, combined with the country's large population and high level of reliance on agriculture, differentiate it from developed countries in some critical ways, but they reflect the reality of several other developing countries closely. Understanding the policy choices being made in India around food security decisions, and particularly agricultural biotechnology, may help in explaining the political stakes for other countries in the global south. Indeed, given its size and symbolic weight, India's policy decisions stand to significantly influence the rest of the developing world (Newell, 2007a). The recent industry push to introduce GM crops in Bangladesh, for instance, and the civil society efforts to resist it, have both drawn heavily on Indian experiences and rhetoric, and the Bt brinjal process and final decision are invoked often in discussions across the border.

India is not an unimportant player in the wider international arena either. Domestic policy decisions and processes stand to impact other countries through trade patterns, as well as multilateral agreements and understandings. In naming and (as can be seen in the Bt brinjal case) responding to socioeconomic issues related to GMOs, India's regulatory regime has arguably gone a step beyond the requirements of the Cartagena Protocol on Biosafety. This is despite the fact that compatibility of socioeconomic considerations with WTO rules was a point of tension in protocol negotiations, and was finally left out.

This notion raises further implications about the most effective level for biotechnology governance. As Newell and Mckenzie argue, ecological and social conditions and levels of socially acceptable risk differ widely between societies, making global benchmarks and multilateral policy inappropriate in the case of biotechnology (Newell and Mackenzie, 2004). If indeed India's moratorium on Bt brinjal reflects a larger policy direction that is cautionary when considering socioeconomic and ecological risk, and a process that is consultative and transparent, it may present a hopeful example of this theory.

At a more abstract level, the research in this thesis points to several broader issues. It aims to consider "the extent to which developing countries can exercise policy autonomy in a global environment of commercial interest and aggressive political lobbying" (Newell, 2008). Policy divergence, especially if it means that countries go beyond the international regulations such as the CPB in their domestic policies, may lead to a widening of international policy space, and a consequent rise in environmental standards in the international biosafety regime. Alternately, it may indicate that the space is already wider than the international regime alone would indicate. Both possibilities have important implications, and reiterate the question of whether biotechnology governance is in fact most effective at the national level or at the global level.

This widening has another important effect. The fact that a large number of countries agreed on the CPB framework despite the US' refusal to participate in the process and conclude negotiations was an important step in the restriction of US hegemonic power in GMO policy and regulation (Falkner, 2006a). The Protocol, which has now been signed by 164 countries, inevitably impacts the US through its trade relations with signatory countries. In as much as the Bt brinjal decision went against US pressure to adopt a permissive biotechnology regime, India's decision may well be adding to this multilateral shift of power in this policy arena.

Domestic implications

Biotechnology occupies a particularly important space in studies of food security in India. As mentioned earlier, hunger and poverty levels in the country are some of the highest in the world. Despite frequent media headlines announcing the recent economic boom, almost half of the

population of the country still lives under the poverty line (UNDP, 2012a), and 200 million people –the largest national number in the world – are food insecure (Greber, Fritschel and Schofield, 2011). Furthermore, over 60% of the Indian population relies on agriculture for its livelihood (Ministry of Agriculture, 2012). These statists make clear that the importance of studying food security issues in such situations cannot be overemphasized.

The moratorium on Bt brinjal, and the consultations leading to that decision have their own implications. One of the most important of these is the precedent set by the process adopted by Minister Ramesh. Many believe that despite the fact that the minister specified that the points he makes in this decision apply only to Bt brinjal and not all GM crops, and although he will not be responsible for future GMO approval decisions, any regulatory body or mechanism will be hard pressed to pass an approval without any form of public consultation (Kuruganti, 2011; Ramanjaneyulu, 2011). In addition, the process itself gave rise to several questions about biosafety, environmental integrity, and socio-economic well-being that a future request for GM crop releases will have to address, to at least some degree. The impacts of these changes in approval processes may already be showing; in their 114th meeting in December 2011, in responding to an approval request by Dow Agrosciences for their new Widestrike Bt cotton, the GEAC raised questions and requested details that had not been asked in previous committee approvals (Krishnan, 2011; GEAC, 2011).

The most direct implication may be the fact that many hold that Bt brinjal itself was an "gateway crop," and its release by MMB designed not as much for the direct economic benefit the company would derive, as for the strategic value that a food crop approval would give the company in future requests. This theory appears to be well-substantiated when considered in the context of the total acreage of brinjal in the country. Though the crop is grown by a very large number of farmers and growers across the country, the total area under brinjal cultivation is only 550,000 hectares (CEE, 2010a), which represents just about 2% of cultivable land in the country. Even with complete market domination of brinjal seed, the company would be looking at relatively small seed production operations and income generation possibilities (Ramanjaneyulu, 2011).

The spotlight on the flaws of the scientists and scientific process involved also appears to have ramifications beyond the brinjal case. Soon after the moratorium, minister Ramesh called for the leading science academies in the country to compile a report assessing the risks and benefits of GM crops in the particular context of Indian farming. The report was submitted in September 2010, and was heavily critiqued by NGOs, scientists, and the minister himself, all of whom alleged that it was essentially plagiarized from an earlier report by a pro-GM scientist (Times News Network, 2010). Whether or not this attention to scientific rigour in GMO regulation will persist remains to be seen, but it is undeniable that at least in the short term, the decision has significantly raised the bar for what constitutes adequate scientific research and assessment.

Recent Developments

The research presented in this thesis is based on two specific policy decisions and the political processes associated with them. While I have teased out some unique patterns from these experiences, and examined the potential implications of them, these are not *necessarily* predictive decisions. The Bt brinjal moratorium, while sure to be an influential milestone in the evolution of India's regulatory mechanism for GMOs, is neither a certain anomaly amongst other GM approvals, nor a precedent-setter that indicates the beginning of a new regulatory regime.

It is also important to note that this regime is far from being set in stone. India's experience with GM crops is relatively young, and its approach to regulation in constant flux, as it is shaped by the competing forces exerted on it by a diverse and strong range of actors. Even in the period since the fieldwork and interviews used in thesis were completed, several significant developments related to GM crop regulation have taken place in India. Some of these are direct fallouts of the Bt brinjal controversy, consultations or moratorium, while others are independent but related occurrences.

The changes that stand out most predominantly at first glance are related to the involvement of individuals who played significant roles in past decisions. A few months after the he made his moratorium decision, in July 2011, Jairam Ramesh was shifted to a new department, and appointed Minister of Rural Development. He was succeeded by the current Minister of Environment, Jayanthi Natarajan. So far, Natarajan has not had to make any decisions related to

GM crops in the country. She has been reported, however, as saying that "genetically modified foods have no place in ensuring India's food security" (Bagla, 2012). While activists may hope that Ramesh's consultation process has set an unignorable precedent in future approval cases, party and coalition politics are also influential factors, and the approach Natarajan or other political actors choose to take in similar situations is still to be seen. Needless to add, changes in other involved ministries, and influential positions such as the secretary of the DBT, will also directly affect future decision making. A new clause in the requirements for sitting on the GEAC, instigated by Dr Bhargava, calls for all members to declare that they have no conflict of interest. Several members of the GEAC resigned when this guideline was first introduced, soon after the moratorium announcement, and presumably others will not join because of it (Mukjerjee and Menon, 2011). Many also believe that the new chairperson of the GEAC, M. F. Farooqui, is more open to participation and public discussion, aware of potential tensions within the DBT's role as regulator and vendor, and encourages independent science (Krishnan, 2011; Bhargava, 2011).

Other changes have come up in the form of legal and regulatory developments. Most important among these is the proposal to establish the Biotechnology Regulatory Authority of India (BRAI), a re-worked version of an original regulatory framework proposed in 2005 (GOI, 2011). The bill is currently awaiting a decision for approval or rejection in the parliament, and was proposed by the DBT before Bt brinjal was banned. On its initial proposal, the bill caused much controversy, much of which was focused on its clause that threatened anyone who, "without any evidence of scientific record, misleads the public about the safety about GMO organisms" with jail time between 6 and 12 months, and/or a fine up to Rs 2 lakhs (approximately $3500) (Bhargava, 2011b; GOI, 2011). Critics held that the bill is draconian, aims to silence opposition to GMOs, does not make space for public participation, and fast-tracks the approval process (Misra, 2010; Alvares, 2010; Greenpeace India, 2012; Gupta, 2011). The clause has now been removed, but other critiques still remain. Many believe that the future of the bill, at least without significant changes, is very uncertain (Sahai, 2011; Ramanjaneyulu, 2011), but if approved, it will point to a very different future policy direction in India.

When releasing his final decision on Bt brinjal, the minister also made another very important

announcement. This was the requirement that state governments be given a chance to accept or reject a proposal for GM crops to be field trialled in their states. This decision has been upheld in the period since his announcement, with significant ramifications. Most recently, the significance of this rule was underlined when the GEAC approved a variety of Bt maize for ongoing field trials in nine states. The Chief Minister of one of these states, Nitish Kumar, has been resolutely opposed to GM trials in Gujarat in the past, and stood by his position in this case as well. Significantly, Jairam Ramesh overruled the GEAC's decision, cancelling field trials in Gujarat (Times of India, 2011a). If this requirement is upheld, and if other states follow suit in forbidding trials, future GM approvals and state-centre politics around GMOs both stand to be significantly impacted.

Perhaps the most important development in GM regulation since the Bt brinjal moratorium is the conclusion of a two-year long study done by the Parliamentary Standing Committee on Agriculture on the past experiences and future prospects of GM crops in India. The results, presented in August 2012 in a 389-page report, raised several points. Most importantly, the panel called for a complete ban of open field trials of GMOs in all states, until the country was able to develop a better regulatory and monitoring system. This essentially calls a halt on all research and testing of GMOs in the country. The panel also labelled the current regulatory regime as being pro-industry and called for a "complete overhaul" of the system. The proposed BRAI, the panel noted, was "deeply flawed" and should be completely thrown out, and replaced with a new "all encompassing umbrella legislation on bio-safety which is focused on ensuring the bio-safety, biodiversity, human and livestock health, [and] environmental protection" (Standing Committee on Agriculture, 2012). They also called for a "thorough probe" into the regulatory process for Bt brinjal, saying that they suspected that the crop was granted approvals until the final stage due to "collusion of the worst kind." It also added that "after the euphoria of a few initial years, Bt cotton cultivation has only added to the miseries of the small and marginal farmers" (Standing Committee on Agriculture, 2012).

The results and recommendations in the report were passed unanimously by the 31 members of the panel, across party lines. The fact that all members are elected government officials, and cannot be considered to be "anti-GM" stakeholders in any way, further increases the report's

legitimacy. Interestingly, the report was released a day after the state government of Maharashtra took legal action to ban national seed company Mahyco from selling their Bt cotton seed in the state. The charges were filed because the company had been creating artificial shortages of seed to raise prices on the stock market, and selling substandard seed (Deccan Herald, 2012). It is still to be seen what long-term ramifications this case and the report results will have on the national level regulatory regime for GMOs in India, but it is worth noting that if even a few of the panel's recommendations are accepted, the country may be looking at a very different trajectory in GMO regulation.

The number and potential influence many of these recent developments pose is part of what makes a study of responses to GM crops in India both fascinating and germane. Many of these developments stand to directly or indirectly impact the GM assessment and approval process in the country, as it matures over the coming years, and interacts with regulatory regimes from other countries. The results of this study must be considered in this light. Further research on these shifts will undoubtedly help complete the picture of India's evolving and influential policy direction on GM crops.

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Appendix A

List of interviews

Devinder Sharma
Food and Trade Policy Analyst, Columnist
Interviewed in person, New Delhi, 24th October 2011.

Kavitha Kuruganti
Kheti Virasat Missio; Coalition for a GM-Free India; Alliance for Sustainable and Holistic Agriculture (ASHA)
Interviewed on Skype, 25th October 2011.

Dr Pushpa M Bhargava
Founder-director, Centre for Cellular and Molecular Biology; PM Bhargava Foundation. Supreme Court nominee to the Genetic Engineering Appraisal Committee
Interviewed in person, Hyderabad, Andhra Pradesh, 31st October 2011.

Ramanjaneyulu GV
Executive Director, Centre for Sustainable Agriculture (CSA)
Interviewed in person, Hyderabad, Andhra Pradesh, 31st October 2011

Latha Jishnu
Senior Editor, Down to Earth, Centre for Science and Environment
Interviewed in person, New Delhi, 4th November 2011

Suman Sahai
Convenor, Gene Campaign; Scientist
Interview in person, New Delhi, 7th November 2011

Rajesh Krishnan
Campaign Manager, Greenpeace India
Interviewed in person, New Delhi, 14th November 2011.

Sridhar Radhakrishnan
Convenor, Coalition for a GM Free India; Alliance for a Sustainable and Holistic Agriculture
Interview in person, New Delhi, 16th November 2011

Satheesh Periyapatna
Director, Deccan Development Society
Interview in person, Pastapur, Andhra Pradesh, 28th November 2011

Salome Yesudas
Coordinator, South Against Genetic Engineering, Andhra Pradesh
Interview in person, Warangal, Andhra Pradesh on 29th November 2011

List of events

Community and farmer meeting on Bt cotton
Warangal, Andhra Pradesh, November 29th 2011.

Public Consultation on the Biotechnology Regulatory Authority of India (BRAI) Bill 2011.
Hosted by: Delhi Alliance for Safe Food and Greenpeace Delhi
New Delhi, 16th November 2011.

Appendix B

Ministry of Environment and Forests
Decision on Commercialisation of Bt-Brinjal

- Environment minister Jairam Ramesh, February 9, 2010.

1. The Genetic Engineering Approvals Committee (GEAC) was set up in May 1990 under the Environment (Protection) Act, 1986. While it is a statutory body under Rules 1989 of the Environment (Protection) Act, 1986 and as such it is authorised to grant approval for large-scale trials and environmental release of genetically modified organisms, on the issue of Bt-brinjal the GEAC in its 97th meeting held on October 14th, 2009 observed that: "..as this decision of the GEAC has very important policy implication at the national level, the GEAC decided its recommendation for environmental release may be put up to the Government for taking final view on the matter".

2. The GEAC, being located in the Ministry of Environment and Forests, sent its recommendations to me. After receiving the recommendations of the GEAC on Bt-brinjal, I communicated the following to the GEAC on October 16th, 2009:

I have just received the recommendations of the Genetic Engineering Approval Committee (GEAC) on Bt-brinjal. I have studied the recommendations and have decided on the following course of action:

The report of the Expert Committee (EC-II) submitted to the GEAC on October 8th, 2009 that formed the basis of the GEAC'as decision of October 14th, 2009 is being made public with immediate effect. It is being uploaded straightaway on the website of the Ministry of Environment and Forests (www.moef.gov.in). All previous reports and studies on Bt-brinjal are already in the public domain. Comments on this report are being sought by December 31, 2009 and I encourage their submission.

During January and February 2010, I propose to have a series of consultations in different places with scientists, agriculture experts, farmers' organisations, consumer groups and serious-minded NGOs who want to engage in a responsible manner. All points of view will be represented in these consultations.

Strong views have been expressed on the Bt-brinjal issue, both for and against. My objective is to arrive at a careful, considered decision in the public and national interest. This decision will be made only after the consultations process is complete and all stakeholders are satisfied that they have been heard to their satisfaction.

3. Between January 13th, 2010 and February 6th, 2010 public meetings on Bt-brinjal were organised by the Center for Environment Education (CEE), Ahmedabad (a Centre of Excellence supported by the MoE&F) in Kolkata, Bhubaneshwar, Ahmedabad, Nagpur, Chandigarh, Hyderabad and Bangalore. Kolkata and Bhubaneshwar were selected because West Bengal and Orissa account for 30% and 20% of India's brinjal production respectively. Ahmedabad and Nagpur were selected because Bt-cotton has been under extensive cultivation in Gujarat and Maharashtra over the past six years. Chandigarh was selected in order to allow farmers from the two agriculturally-advanced states of Punjab and Haryana to express their views. Hyderabad and Bangalore were selected because these are centres for biotechnology R&D. Almost 8000 people from different sections of society participated enthusiastically in these seven public meetings. Those who attended were farmers and farmer organisations, scientists, state agriculture department officials, NGOs, consumer groups, allopathic and ayurvedic doctors, students and housewives. A summary report prepared by the CEE based on these seven meetings is at Annex-I to the electronic version of this note available at www.moef.nic.in and video-recordings of each of these interactions will also be available very soon on the same website.[1]

4. Letters were sent to the chief ministers of West Bengal, Orissa, Bihar, Maharashtra, Andhra Pradesh and Karnataka since these are the major brinjal cultivating states accounting for 30%, 20%, 11%,6%, 6% and 4% respectively of India's brinjal production. Copies of these letters to the CMs and the responses I received from them are at Annex-II to the electronic version of this note available at www.moef.nic.in that also contains letters received

from the state governments of Kerala, Madhya Pradesh and Chattisgarh. A letter received from the Chairman of the Committee on Agriculture of the Lok Sabha and other political leaders, including a former Prime Minister of India is also included in this Annex.

5. Opinions were also sought from a number of scientists both from India and abroad. These opinions are at Annex-III to the electronic version of this note at www.moef.nic.in.

6. In addition, a very large number of emails from research institutes, NGOs and concerned individuals were received. A representative sample is at Annex-IV to the electronic version of this note available at www.moef.nic.in.

7. I should like to make clear at the very outset that my concern is with Bt-brinjal alone [2] and not with the larger issue of genetic engineering and biotechnology in agriculture. The issue before me is limited to what to do with the GEAC recommendation on the commercialisation of Bt-brinjal.

8. All states which have written to me have expressed apprehension on Bt-brinjal and have called for extreme caution. Because this is extremely important in our federal framework and agriculture is a state subject, I summarise below the views of the state governments that have been submitted in writing to me by the Chief Ministers/Agriculture Ministers:

· Andhra Pradesh: "It is clear that the data generated, the tests conducted and the information disseminated by GEAC are not sufficient for suggesting the commercial release of Bt-brinjal....Until safety parameters in terms of environment, human and animal health are clearly established, release of Bt-brinjal for commercial cultivation is to be deferred"

· Kerala: " Considering all this, Government of Kerala has taken a decision to prohibit all environmental release of GMOs and keep the state totally GM free. We would request the Honourable Prime Minister to reconsider the policy of GM in a national scale and declare a moratorium at least for the next fifty years".

· Chattisgarh:" Before giving permission for commercial cultivation of Bt-brinjal, all tests to establish full impacts, including negative impacts, on human and animal health and on the environment should be carried out".

· Karnataka: "The commercial release of Bt-brinjal should be deferred till the issue is thoroughly examined from all the angles by taking into account the views of all stakeholders and conducting a long-term research for its bio-safety and its consequent contributions to food security and farmers well-being".

· Bihar: "The Rajya Kisan Ayog is not in favour of the introduction of Bt-brinjal in the state at this point of time. The recommendation of the Rajya Kisan Ayog has been considered by the state government and the state government fully endorses the view of the Ayog".

· West Bengal:" I have got the report of the Expert Committee of the GEAC downloaded. I feel that the matter needs thorough examination by the experts in the field. I am requesting some members of the erstwhile State Agriculture Commission to examine the report and forward their views to the government to enable us to take a holistic view on the subject".

· Orissa: "The Government of Orissa does not support the introduction of Bt-brinjal at this stage and until sufficient trials are made and interests of small and marginal farmers of the state are safeguarded".

In addition, the CM of Uttarakhand has spoken to me and conveyed the decision to ban Bt-brinjal in that state. The Chief Secretary of Tamil Nadu has informed me that the state of Tamil Nadu is not in favour of commercialisation of Bt-brinjal now. The Madhya Pradesh Chief Minister has told me that Bt-brinjal should be introduced "only after all doubts and fears have been properly dispelled". The Himachal Pradesh Chief Minister has told me that the HP government will take a view after all trials have been completed and after the Government of India has decided.

9**. Clearly, Bt-technology is not the only route for reducing pesticide use**. That pesticide use can have deleterious public health impacts is already visible in places like Bhatinda which, as the Chief Minister of Punjab himself told me a couple of days back, has emerged as a major cancer-afflicted region. How to reduce pesticide use

without compromising on food security at the macro-level and returns to farmers at the micro-level is an urgent public policy in our agriculture. In this connection, it is worth recalling that there are now close to 6 lakh farmers in Andhra Pradesh fully practicing NPM (non-pesticide management) agriculture over an area of about 20 lakh acres. I have myself been seeing this initiative over the past four years. The advantage of NPM is that it eliminates chemical pesticide use completely whereas Bt-technology only reduces the pesticide spray, albeit substantially. Incidentally, one of the eight missions under the National Action Plan on Climate Change is the National Mission on Sustainable Agriculture of which NPM is an integral part. On January 19th 2009 much before I became Minister for Environment and Forests, I had written to the Union Agriculture Minister on the need to evaluate the Andhra NPM experiment from the point of view of replicability on a larger scale.

10. **The issue of safety tests** has been raised repeatedly by critics of Bt-brinjal. The plant family Solanaceae to which brinjal belongs appears to be more problematic than others because it contains several natural toxins that can resurface when metabolism is disturbed. The kind of testing done, it is being said, is not specific or stringent enough to detect toxins. This is an important issue since brinjal is an item of almost daily consumption for most of us. While there may be a debate on the nature and number of tests that need to be carried out for establishing human safety, it is incontrovertible that the tests have been carried out by the Bt-brinjal developers themselves and not in any independent laboratory. This does raise legitimate doubts on the reliability of the tests, doubts that I cannot ignore. The fact that brinjal is very largely a cross-pollinated crop[3] according to the generally accepted scientific consensus makes the threat of contamination with the use of Bt-brinjal on other varieties a particularly worrisome issue.

11. Very serious fears have been raised in many quarters on the possibility **of Monsanto controlling our food chain if Bt-brinjal is approved**[4]. Indeed it would not be an exaggeration to say that public concerns about Bt-brinjal have been influenced very heavily by perceptions of Monsanto itself. I have no bias whatsoever. Monsanto has made substantial investments in India, including in R&D. Many Indian-origin scientists work in Monsanto. As a country, we must learn to derive full benefit of Monsanto's expertise and capabilities, without jeopardising national sovereignty and also develop countervailing power to it. Unfortunately, we do not seem to have a large-scale publicly-funded biotechnology effort in agriculture. Had there been one, there would have been competition to Monsanto. It is true that Mahyco an Indian company is involved in the development of hybrid Bt-brinjal. But 26% of Mahyco is owned by Monsanto itself. It is also true that two government-owned agricultural universities—Tamil Nadu Agricultural University, Coimbatore and the University of Agricultural Sciences, Dharwad—have developed Bt-brinjal varieties. [5]. But doubts have been raised on how Bt-related research in these two institutions has been funded. Further, the Material Transfer Agreement between TNAU and Monsanto in March 2005 has raised worrisome questions on ownership (both of products and germplasm) and what TNAU can do and cannot do.[6]

12. Apart from being **the world's largest producer of brinjal, India is undoubtedly the country of origin as far as brinjal is concerned as testified by Vavilov in 1928**. Data that has been made available to me by the National Bureau of Plant Genetic Resources of the ICAR reveals that there are 3951 collections in the Bureau and the number of diversity-rich districts is 134. The Bureau also points out that diversity-rich regions are likely to be affected by the introduction of Bt-brinjal due to gene flow. The loss of diversity argument cannot be glossed over especially when seen in light of the experience we have had in cotton where Bt-cotton seed has overtaken non-Bt seeds.

13. **Bt-cotton is not comparable to Bt-brinjal no doubt but it is nevertheless necessary to review our experience with it.** Undoubtedly, Bt-cotton has catapulted India into second position in the world as far as cotton production is concerned, up from number three after the new technology took root. Over 90% of cotton farmers in India cultivate Bt-cotton. It is also true that many farmers in the public consultations vociferously expressed their support to Bt-cotton on economic grounds. But a number of farmers also expressed doubts [7]. **More than that, the Central Institute of Cotton Research, Nagpur has done a comprehensive review of Bt-cotton in India[8**] and this review has thrown up a number of questions. The Director of the Institute (that has produced a Bt-cotton variety—Bikaneri Nerma—whose seeds can be kept by farmers for planting during the next season unlike hybrids where farmers have to be buy seeds every year) while expressing his clear support for Bt-brinjal technology, has said the following based on the Bt-cotton experience:

· Resistance development is a very serious concern for monophagous pests. There is a need to develop baseline susceptibility data of Cry toxins on the fruit and shoot borer populations from all the Brinjal growing states in a Government Institute Laboratory known for its expertise in resistance management. The data available thus far is

only from Mahyco. There is also a need to set up a main resistance monitoring laboratory to monitor the changes in baseline susceptibility changes of the fruit borer to Cry proteins after releasing the technology.

· Resistance Management Strategies are essentially developed based on output profiles of stochastic models which integrate toxicological, ecological, genetic and biological parameters. Stochastic models for resistance should be developed to calculate resistance risk and devise pro-active Insect Resistance Management (IRM) strategies. The structured refuge strategy of 5% conventional Brinjal within the ecosystems of Bt-Brinjal proposed by Mahyco is based on basic simplistic assumptions and not through defined algorithms and modeling.

· There is a need for a consolidated report on ecology, biology, genetics and population dynamics of insect pests of Brinjal that are available thus far. Based on the ecology, biology and population dynamics, simulation models should be developed so that appropriate strategies can be formulated to prevent the emergence of new pests and delay development of resistance in key pests.

This only points to the need for more tests that are well-designed, widely-accepted and independently conducted. The Bikaneri Nerma also demonstrates the importance of strengthening public good research.

14. A number of **doubts have been raised on the integrity of the GEAC process itself,** particularly by Dr. P.M. Bhargava, one of India's most eminent biotechnologists who arguably was amongst the earliest to coin the very term "genetic engineering" and who is a nominee of the Supreme Court on the GEAC. He has provided a detailed point-by-point critique of the Expert Committee-II (EC-II) report that has formed the basis of GEAC's recommendation to commercialise Bt-brinjal. Dr. Bhargava has claimed that the Chairman of EC-II had agreed with his assessment that eight essential tests had not been conducted by Mahyco. Another fact brought to my attention is that an expert committee set up by the GEAC in 2006 (EC-I) had asked for several tests to be conducted but one-third of the EC-II members who were also members of EC-I chose to discard the need for these studies while evaluating Bt-brinjal as EC-II. I do not propose to do a post-mortem on the way the GEAC has functioned [9]. Many have called for an independent genetic engineering regulator. A National Biotechnology Regulatory Authority has been on the anvil for almost six years now but it has yet to come into being. Such an Authority has to be professional and science-based, independent of the government that should have facilities for conducting all essential tests with integrity and impartiality. In the absence of such a body, arguments that have been made on the limitations of the GEAC cannot be ignored [10]

15. Many countries, particularly in Europe, have banned GM foods. I have spoken with my counterpart in China and he has informed me that China's policy is to encourage research in GM technology but to be extremely cautious when it comes to introduction in food crops. In any case, China's Bt-cotton is entirely indigenously developed, in marked contrast to the case in India. China has a very strong publicly-funded programme in GM technology unlike India. True, Bt-corn and Bt-soya is widely available in the USA but that is no great compulsion for us to follow suit.

16. Some scientists and civil society organisations have pointed out that the GEAC process has violated the Cartagena Protocol on Biosafety to which India is a signatory, particularly the provisions pertaining to public consultations prior to the release of GM food crops and also the broad principles governing risk assessment. It is pertinent to also recall Article 15 of the Rio Declaration on Environment and Development (1992) which echoes the precautionary principle when it states " where there are threats of irreversible damage, the lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". Further, Section 45 of Codex Alimentarius "Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants" says "The location of trial sites should be representative of the range of environmental conditions under which the plant varieties would be expected to be grown. The number of trial sites should be sufficient to allow accurate assessment of compositional characteristics over this range. Similarly, trials should be conducted over a sufficient number of generations to allow adequate exposure to the variety of conditions met in nature. To minimise environmental effects, and to reduce any effect from naturally-occurring genotypic variation within a crop variety, each trial site should be replicated. An adequate number of plants should be sampled and the methods of analysis should be sufficiently sensitive and specific to detect variations in key components." It does appear that the current standards by which the GEAC has formulated the decision to approve Bt-brinjal do not match these global regulatory norms to which India is a party.

17. I have received a number of emails from scientists in the USA, France, Australia, UK and New Zealand raising very serious doubts on Bt-brinjal and also on the way tests have been conducted in India [11]. Amongst them, I should mention communications received from (i) Professor G.E. Seralini from France who in a detailed report has pointed out several flaws in the EC-II report and concludes that "the risk on human and mammalian health is too high for authorities to take the decision to commercialise this GM brinjal"; (ii) Dr. Doug Gurain-Sherman of the Union of Concerned Scientists, Washington DC which says that "the record compiled over a 13-year period shows that the 4% yield enhancement contributed by Bt-corn varieties constitutes only 14% of overall corn yield increase. Further, Dr. Gurain-Sherman highlights serious flaws in the EC-II report on evaluation of gene flow risks from Bt-brinjal; (iii) Professor Allison Snow and Professor Norman Ellstrand of the Ohio State University that identifies several shortcomings in the EC-II report concerning gene flow from Bt-brinjal to wild and weedy relatives; (iv) Dr. Nicholas Storer of Dow AgroSciences (a private US company much like Monsanto) who does say that Bt-brinjal does not pose unreasonable adverse risks to the environment or to human and animal health but who calls for careful implementation of resistance management strategies and points out that Bt-technology should not be seen as a silver bullet to managing lepidopteran pests in brinjal; (v) Dr. Jack Heinemann of the University of Canterbury, New Zealand who questions the consistent yield increases claimed for Bt-cotton and says that the Bt-brinjal tests conducted in India would not meet careful international standards; (vi) Dr. David Andow of the University of Minnesota, USA who says that his reading of the EC-II report is sufficient to lead him to question the adequacy of environmental risk assessment but it is not sufficient for him to conclude that the environmental risk assessment is erroneous; and (vii) Dr. David Schubert of the Salk Institute of Biological Studies, USA who says that Bt-brinjal should definitely not be introduced in India since it poses serious environmental and health risks, will increase social and political dependence on private companies and will entail higher costs at all levels of the food chain; and (viii) Dr. Judy Carman of the Institute of Health and Environmental Research, South Australia who has analysed Mahyco's biosafety dossier of 2008 in great detail and who says that her doubts and questions have not been answered at all in the EC-II report.

18. Some suggestions have been made that **we could consider limited release of Bt-brinjal** hybrids in limited areas and ensuring that its sale would be monitored through mandatory labelling. The President of the Indian National Science Academy, Dr. M.Vijayan of the Indian Institute of Science, Bangalore and a noted microbiologist himself has made the suggestion of limited release. My view is that while this offers a possible compromise route, it would be extremely difficult to ensure such a "quarantine". Mandatory labelling is indeed required in countries like the USA but this is somewhat impractical here because our retail market is fundamentally different than that of the USA and also because it is extremely difficult to monitor limited usage in practice[12]. Another scientist Dr. N.S. Talekar, who has worked on the brinjal shoot and fruit borer at the World Vegatable Centre, Taiwan and is now with the Mahatma Phule Krishi Vidyapeeth, while justifying the use of Bt-technology, has strongly warned against the use of Bt-brinjal in its present form saying that the manner in which the proponents of the product are recommending to farmers to use this technology is faulty and unscientific and would lead to disaster.

19. Some eminent Indian scientists have written expressing their support for the commercialisation of Bt-brinjal. Prominent among them is Dr. G. Padmanabhan of the Indian Institute of Science, Bangalore who debunks several domestic and international criticisms of Bt-brinjal, makes a strong plea for commercialisation but also makes the point that we need a statutory body with regulatory authority and R&D capabilities to govern all aspects of GM crop cultivation in the country once they are released for commercialisation. Specifically, Dr. Padmanabhan argues that such an autonomous institution should address issues such as: (i) choice of GM crops and traits relevant for commercialisation in the country; (ii) registration of GM crops for a finite period and reassessment of their performance and the ground situation, before extending the registration for another finite period; (iii) inputs for determining the price of GM seeds sold to farmers; (iv) technical help and advice to farmers on a continual basis; (v) positioning of Bt crops with Integrated Pest Management (IPM) strategies and also handling of secondary infections; and (vi) education of the public on the pros and cons of the use of GM technology in agriculture. The agenda sketched out by Dr. Padmanabhan is both ambitious and necessary but will take time to implement in an effective manner. Another eminent scientist who has supported GEAC's decision to release Bt-brinjal for general cultivation is Dr. Deepak Pental, Vice Chancellor of Delhi University but he has also said that two realities must be understood—one, that as India is centre of origin of cultivated brinjal, transgenes can move to the wild germplasm though this should not unduly alarm us and two, that we will not be able to differentiate between Bt-brinjal and non-Bt-brinjal, making labelling impossible. Dr. Raj Bhatnagar of the International Centre for Genetic Engineering and Biotechnology, New Delhi has sent a highly technical communication which, in simple language, implies that there is no health risk whatsoever by eating Bt-brinjal.

20. I have had a discussion with both the Director-General of the Indian Council of Medical Research as well as with the Drug Controller to the Government of India. Both have recommended that chronic toxicity and other associated tests should be carried out independently. The parallel has been drawn with drugs where during the crucial clinical trials phase, independent testing is carried out on human beings instead of relying on just the data generated by the developer companies themselves. The DG-ICMR told me that in the face of contradictory evidence of the health effects he would advocate more caution and further tests. Doctors for Food and Safety, a network of around 100 doctors across the country have sent a representation on the health hazards related to GM foods in general and Bt-brinjal in particular. They have drawn attention to the recommendations made by the American Academy of Environmental Medicine that GM foods have not been properly tested for human consumption and that there are substantial risks associated with the use of GM foods. I have also been informed that the Indian Systems of Medicine including ayurveda, siddha, homeopathy and unani use brinjal as a medicinal ingredient, both in raw and cooked form, for treatment of respiratory diseases and that the entire brinjal plant is used in such preparations. There is fear that Bt-brinjal will destroy these medicinal properties due to loss of synergy, differences in the alkaloids and changes in other active principles. In the opinion of this network of doctors, these factors have not been considered by EC-II.

21. The Indian Council for Agricultural Research (ICAR) and the Department of Biotechnology have also given their unqualified support to Bt-brinjal. Some farmers' organisations like the Bharat Krishak Samaj and Shetkari Sanghatana and farmers' spokespersons like Bhupinder Singh Mann and Sharad Joshi have come out fully in support of Bt-technology[13] in general and Bt-brinjal in particular on the grounds that we should not be denying modern technology to farmers and that this will improve incomes of farmers. As I have mentioned earlier, many farmers at the public consultations argued that Bt-cotton has been very profitable for them.

22. I have stressed the **importance of public investment in biotechnology for agriculture**. But Indian private investment in this area is already a reality. Mahyco is one example. Between 2007 and 2009, the GM crops approved for field trials by the GEAC include insect-resistant cotton and rice developed by Metahelix Life Sciences, Bangalore and hybrid-rice developed by Avesthagen, Pune, both companies run by a new generation of Indian scientists. Clearly, such science-based companies launched by Indian entrepreneurs need to be encouraged and the regulatory process should not stymie such innovation[14]. Apart from this, even publicly-funded institutions like the Indian Institute of Horticulture Research, Bangalore too need encouragement since I have been informed that trials using a Bt-brinjal variety using the Cry2A Bt gene are at an advanced stage. Scientists at another publicly-funded institution—the Indian Institute of Vegetable Research, Varanasi---have developed Bt-brinjal using Cry1Aaa3 gene in their own cultivar IVBL-9. These public sector products need to be introduced first, if at all, going by the Bt-cotton experience.

23. I have had the benefit of extended conversations with Dr. M.S. Swaminathan, MP who is, without doubt, India's most distinguished and senior-most agricultural scientist who was one of the scientific architects of the Green Revolution. Dr. Swaminathan, whose own research foundation is working on GM technology, has said that we need to be concerned with three issues here: (i) chronic toxicity since brinjal is an element of such frequent consumption in India; (ii) independent tests that command credibility and not depend only on data provided by the developers themselves; and (iii) the need to have an independent regulatory system that will be in a position to study all aspects of GM technology in agriculture and arrive at a measured conclusion. Dr. Swaminathan has also agreed with the view since brinjal itself contains natural toxins, we have to be extra-careful on Bt-technology. In view of his great stature both in India and abroad, I would like to place below his most recent communication to me on this subject in full:

Dear Jairam:

I am glad you had wide ranging consultations, and something useful should emerge from such unprecedented churning of minds and experience. Both benefits and risks are now well known. There are unquestionable benefits in the short term, but also potential risks to human health and our brinjal heritage in the long term. What is the way forward?

1. Conserve India's genetic heritage in brinjal:

My post-graduate thesis at IARI in 1949 was on Brinjal and non-tuber bearing Solanum species. I have studied our rich genetic wealth in this wonderful crop. What will be the long term impact of numerous local strains being replaced with one or two varieties with Cry1Ac gene from Monsanto? I suggest that during 2010, ICAR (the National Bureau of Plant Genetic Resources) along with Dr Anil Gupta of the Indian Institute of Management, Ahmedabad (he maintains a national data base on indigenous knowledge and farmers' innovations) should both collect, catalogue and conserve the existing genetic variability in brinjal. Such a collection must be carefully preserved, before we permit the extinction of the gifts of thousands of years of natural evolution and human selection.

2. Assess the chronic effects of consumption of Bt Brinjal:
The second step which needs to be taken is to ask the National Institute of Nutrition, Hyderabad, and the Central Food Technology Research Institute, Mysore to undertake a careful study of the chronic effects of Bt brinjal on human health. This is analogous to the studies carried out on the impact of tobacco smoking on the incidence of lung cancer in human beings. It will be in national interest to complete these two steps before a decision on the release of Bt brinjal for commercial cultivation and human consumption is taken.

24. It also bears mention that the Supreme Court has been hearing a PIL filed in early 2005 seeking to put in place a comprehensive, stringent, scientifically rigorous and transparent biosafety test protocol in the public domain for Genetically Modified Organisms (GMOs), for every GMO before it is sought to be released into the environment. The Supreme Court has given six Orders so far in order to ensure transparency and accountability in the functioning of the GEAC. The PIL has yet to be finally disposed and the latest Order of January 19th, 2010 asks the Union of India to respond in four weeks to the question of what steps have they taken to protect our traditional crops. Clearly, the decision on Bt-brinjal has to take note of this PIL that has already been filed. In addition, the Supreme Court has invoked the precautionary principle as a guiding instrument in environmental decisions (A.P. Pollution Control Board vs. M.V. Nayudu<1999(2)SCC718> by relying on the following:

"There is nothing to prevent decision-makers from assessing the record and concluding there is inadequate information on which to reach determination. If it is not possible to make a decision with 'some' confidence, then it makes sense to err on the side of caution and prevent activities that may cause serious or irreparable harm. An informed decision can be made at a later stage when additional data is available or resources permit further research".

25. **I am also persuaded that the studies being demanded by responsible civil society groups before release of Bt-brinjal should be conducted as a measure of our sensitivity to public opinion.** A couple of scientists and civil society groups have also pointed out (i) things that are problematic with the protocols of the studies already conducted; (ii) things that are problematic with the analysis of the data submitted; (iii) things that are problematic with the interpretation of the results; (iv) things that are problematic with the reporting by Mahyco; (v) things that are problematic with the procedures adopted. It is incumbent upon us as an accountable and transparent administration to respond to these concerns (presented in Annex-IV to the electronic version of this note available at www.moef.nic.in) in a serious manner.

26. Based on all the information presented in the preceding paragraphs and **when there is no clear consensus within the scientific community itself, when there is so much opposition from the state governments, when responsible civil society organisations and eminent scientists have raised many serious questions that have not been answered satisfactorily, when the public sentiment is negative and when Bt-brinjal will be the very first genetically-modified vegetable to be introduced anywhere in the world and when there is no over-riding urgency to introduce it here,** it is my duty to adopt a cautious, precautionary principle-based approach and impose a moratorium on the release of Bt-brinjal, till such time 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, including the rich genetic wealth existing in brinjal in our country.

A moratorium implies rejection of this particular case of release for the time being; it does not, in any way, mean conditional acceptance. This should be clearly understood.

27. This decision should not, however, be construed as discouraging on-going R&D in using tools of modern biotechnology for crop improvement and for strengthening national food and nutrition security, since issues of this

kind have to be examined and decided necessarily on a case-by-case basis. I hope the moratorium period will be used to build a broader consensus so that as a country we are able to harness the full potential of GM technology in agriculture in a safe and sustainable manner.

28. The moratorium period should also be used to operationalise the independent regulatory body in its entirety as being recommended by many scientists as well as civil society organizations. I also hope in the moratorium period we give serious thought to the strategic importance of the seed industry[15] and how we retain public and farmer control over it even as we encourage private investment in agricultural biotechnology. I would also recommend that the moratorium period be used to have a detailed debate in Parliament and also a comprehensive discussion in the National Development Council (NDC) on this subject.

29. I believe the approach outlined above is both responsible to science and responsive to society. In arriving at this decision, I have also kept in mind what the Prime Minister Dr. Manmohan Singh himself had said on this subject in his speech at the Indian Science Congress on January 3rd, 2010 at Thiruvananthapuram:

Developments in biotechnology present us the prospect of greatly improving yields in our major crops by increasing resistance to pests and also to moisture stress. BT Cotton has been well accepted in the country and has made a great difference to the production of cotton. The technology of genetic modification is also being extended to food crops though this raises legitimate questions of safety. These must be given full weightage, with appropriate regulatory control based on strictly scientific criteria. Subject to these caveats, we should pursue all possible leads that biotechnology provides that might increase our food security as we go through climate related stress.

30. I expect the GEAC to take follow-up action on the matter of further studies and tests with appropriate protocols and in appropriate laboratories. I also expect the GEAC to carefully study all the material I have received and am turning over to it. I would like the GEAC to engage and interact with all those scientists, institutions and civil society groups who have submitted written representations to me. The GEAC should consult with scientists like Dr. M.S. Swaminathan, Dr. P.M. Bhargava, Dr. G. Padmanabhan, Dr M. Vijayan, Dr. Keshav Kranthi, Dr. Madhav Gadgil and others to draw up a fresh protocol for the specific tests that will have to be conducted in order to generate public confidence. **Under no circumstances should there be any hurry or rush. The moratorium will continue for as long as it is needed to establish public trust and confidence**. Meanwhile, I also intend to change the name of the GEAC from Genetic Engineering Approvals Committee to Genetic Engineering Appraisal Committee.

31. Meanwhile, in order to ensure complete transparency and public accountability, I am making my decision on the GEAC recommendation regarding commercialisation of Bt-brinjal public right away.

Jairam Ramesh
MOS(I/C)E&F; February 9th, 2010

[1] A wholly unjustified controversy was generated by two individuals at the Bangalore consultations on February 6th by their claim that a Gazette Notification of October 30th, 2009 exempting trade in 190 agricultural commodities from the ambit of Section 40 of the Biological Diversity Act, 2002 made these Bt-brinjal consultations a sham. This Notification has nothing to do whatsoever with the functioning of the GEAC and has absolutely no impact on genetic engineering issues. The Notification, in the making for five years, was done at the behest of the Ministry of Commerce and other organisations so that the export of these commodities is not adversely affected. In case the species listed are used as bio-resources, permission of the National Biodiversity Authority is still needed before exports take place.

[2]I leave aside the basic issue of "why Bt-brinjal?" in the first place since there does not seem to be any over-riding food security, production shortage or farmer distress arguments favouring the enormous priority that has been accorded to it by private companies, other than the well-known argument on the need to reduce pesticide use.

[3] A point made forcefully by Dr. Madhav Gadgil one of India's most distinguished eco-scientists.

[4] At the Bangalore public consultation on February 6th a former Managing Director of Monsanto (India) came out strongly against Bt-brinjal on this ground and on the grounds that profits should not drive seed supply. Eminent

government scientists have confirmed to me that a vast proportion of Bt-cotton seed currently being used in India is controlled directly and indirectly by Monsanto.

[5] At the Bangalore consultations on February 6th, Dr. G.K. Veeresh, a former Vice-Chancellor of the University of Agricultural Sciences, Bangalore, a sister organisation of UAS, Dharwad expressed his strong opposition to the commercialisation of Bt-brinjal.

[6] K. Vijayaraghavan Regional Incharge of College of Agriculture and Life Sciences, Cornell University-led research programmes in the South Asian region who crafted this agreement has, however, categorically asserted that public interest has been fully protected

[7] Studies done by the Tata Institute of Social Sciences, Mumbai challenges the popular NGO belief that there is a link between Bt-cotton and persistence of farmer suicides especially in Maharashtra.

[8] This review is to be published shortly in Current Science but an advance copy has been made available to me and it is included in Annex-IIIA to the electronic version of this note available at www.moef.nic.in

[9] Dr. S. Parasuraman, Director of the Tata Institute of Social Sciences, Mumbai has written to me saying that the questions he raised as member of EC-I were never answered.

[10] Apart from scientific criticisms of the EC-II report, qualified statisticians have raised doubts about it and about the biosafety dossier from a statistical point of view as well.

[11] 17 noted scientists from different countries have addressed a joint letter to the Prime Minister on February 8th, 2010 giving scientific reasons against the release of Bt-brinjal.

[12] I am informed that the Food Safety and Standards Authority of India set up under the Ministry of Health and Family Welfare is now considering the issue of mandatory labelling. The import of GM products without an accompanying declaration that they are GM products is liable to penal action under the Foreign Trade (Development and Regulation)Act, 1992.

[13] Although there are farmer organizations like the Bharatiya Krishak Samaj and the Karnataka Rajya Raitha Sangha and some others from Tamil Nadu that have opposed to the commercialization of Bt-brinjal.

[14] I have received a representation from the Bangalore-headquartered Association of Biotechnology-led Enterprises (ABLE) arguing for the commercial cultivation of Bt-brinjal on various grounds including the fact that it is “India’s first locally developed agri-biotech product”.

[15] The Seeds Bill, 2004 was introduced in the Rajya Sabha in December 2004 and is awaiting Parliament’s approval. Transgenic seeds needs to be looked at carefully in the context of this legislation.