

**Making a Bioempire:
The Indian Encounter with *Bt* Technology**

Sunita Raina

Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State
University in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

In

Science and Technology Studies

Saul E. Halfon (Chair)

Daniel Breslau

Ellsworth R. Fuhrman

Timothy W. Luke

January 27, 2011

Blacksburg, VA

Keywords: *Bt* Technology, Neoliberalism, Bioempire

Copyright 2011, Sunita Raina

Making a Bioempire: The Indian Encounter with *Bt* Technology

Sunita Raina

ABSTRACT

This dissertation contributes to an understanding of the relationship between the new political-economic configuration of neoliberalism and the commercialization of *Bt* (*Bacillus thuringiensis*) cotton in India. Situated against an intensified agrarian crisis in India, it explores the dynamic relationship among the triad of a neoliberalizing Indian State, global neoliberal regimes and transnational corporations. This study shows that *Bt* technology and the neoliberal order were internally connected in a system of power relations that I call 'bioempire'. Examining the dynamic of the making of a bioempire—how it emerged, how it was contested, and how it was stabilized—I focus on four processes involved in the formation of the bioempire in India. It is through these interconnected, mutually reinforcing processes—rationalization, standardization, privatization and mobilization—that we understand the dynamic—the foundation, introduction, extension and reconfiguration—of the bioempire.

Using an approach that combines the idiom of co-production, discourse analysis, and a socio-technical network perspective, the study explores the dynamics of the introduction of *Bt* technology into India from the time the Indian state embarked on a path of liberalizing its economy in the early 1990s through 2002, when the Indian government first gave approval to this transgenic crop. I focus on *Bt* technology as operating politically in several different registers—as a material technology, as a metaphysical device, as a discourse, and as an institution of governance—in order to show how this technology activated, and was activated by, a new political economy, new governance regimes and new forms of political struggle. The mutually reinforcing relations among varied elements—including technologies, institutions, policy instruments, regulatory regimes, and activist networks—form the heterogeneous network constituting a bioempire. The dissertation highlights that the conflicts and contradictions emerging at the interfaces of various political arenas were negotiated and reconciled in order to create a hospitable technological, institutional, political-economic and discursive space for the bioempire to emerge within India.

DEDICATION

To

Sai Baba of Shirdi.
My strength and refuge

ACKNOWLEDGEMENTS

This dissertation is a product of many transitions, and the debts I incurred are correspondingly various. Several people provided crucial intellectual, institutional, emotional and spiritual resources at key moments in the project's development, and it is a pleasure to acknowledge some of them here. In particular, my adviser and dissertation committee chair, Saul Halfon, has guided my graduate studies from the very beginning and was instrumental in the successful completion of this project. Our weekly meetings were helpful in clarifying my thoughts and keeping this work within the field of STS. Besides providing his incisive comments and valuable suggestions on my drafts, Saul gave me the required space to shape this project along my line of interest. In addition to his intellectual inputs, I remain profoundly grateful to him for his help and support in countless other ways. Thank you, Saul, for everything.

Other members of my committee shaped my research in important ways. Daniel Breslau painstakingly read my drafts, and provided crucial insights and invaluable comments that helped me improve my research and writing. Skip Fuhrman provided support and encouragement all through my graduate life, and gave useful comments from time to time. Tim Luke set me on the intellectual path to this project in his graduate seminar on Modern Political Thought, which laid the foundation of my theory. I sincerely thank my committee members for their suggestions and comments.

My professors in the departments of Sociology and Science Policy at JNU, New Delhi, shaped this work indirectly. I extend my gratitude to my mentors, Avijit Pathak, C.V. Venugopal, Dipankar Gupta, Nasir Tyabji and T.K. Oomman for teaching me the power of critical thought that makes the bedrock of this work.

Various scholars, activists and government officials whom I met during my fieldwork in India provided their insights and ideas. Among others, I am particularly thankful to Ian Scoones, Peter Newell, Sachin Chaturvedi, Biswajeet Dhar, P.K. Ghosh, Jayati Ghosh, Utsa Patnaik and Shiv Vishwanathan for enriching my understanding of the issues related to biotechnology in the Indian context.

Throughout my graduate life, the support staff at Virginia Tech provided invaluable help. The STS departmental manager, Karen Snider, went out of her way on many occasions to bail me out of administrative troubles. I am immensely grateful for her friendly help and consistent support. Crystal Harrell, the STS graduate coordinator, kept me afloat with paperwork. The immigration specialist at Virginia Tech, Ruth Athanson, sorted out my immigration issues with meticulous care. The staff at Newman Library offered their courteous and prompt help throughout this work. The friendly environment and stimulating beverages at Mill Mountain Café enabled me to write this dissertation in time. Thanks much to all of them.

I sincerely thank Karen DePauw, Ennis McCrery, Jason Ustin and Jennifer Quijano Sax for their guidance during some moments of crisis that marked my graduate life. But for them, I may not have found my way around those obstacles in the way of this project.

Very special thanks to my friends—Amit Arya, Anusha Rao, Alan Duchovnay, Anbumani Subramanian, Badri Raina, Bradley Hertel, Brent Jesiek, Gopal, Jonson Miller, Kavita Yadav, Madan Yadav, Madiha Shakeel, Masanori Wada, Matthew Goodrum, Ramesh Ramnani and Shawna Carr—for their help and support along the way.

My grandmother, parents and sisters kept me going with their unconditional love all through my graduate career. Despite her failing health, my grandmother kept me motivated by her frequent reminders that completing this project was a prerequisite to our reunion. Without

really knowing the details behind the delay in getting this work done, my parents never lost faith and confidence in me. They continued to encourage me with love and care that only they are capable of giving. My sisters Veena and Gayatri firmly stood by me and shared my moments of highs and lows with equal involvement. My nieces Ridhima, Saisha and Jeshna brought me hope and joy when things looked bleak. Words cannot convey my sense of regret that all of them had to wait for more than five years to see me. What their patient waiting meant to me and this work, the word gratitude cannot begin to cover.

I am deeply indebted to my late grandfather, Shri Lakshman J. Raina, for setting me on an intellectual journey of which this dissertation marks a crucial milestone. He remains the best teacher I have ever had.

Finally, I dedicate this work to my spiritual guru, Shri Sai Baba of Shirdi. His unique teachings in humanism helped me cope with numerous challenges in a different culture. Given his incomparable contribution to my inner growth, which enabled me to complete the project against all odds, this dissertation solely belongs to him.

TABLE OF CONTENTS

ABSTRACT	iii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
LIST OF TABLES	ix
LIST OF ABBREVIATIONS	x
CHAPTER 1: INTRODUCTION	1
1.1. The Project	5
1.2. Building a Theory of Bioempire	9
1.2.1. <i>The Concept of Bioempire</i>	10
1.2.2. <i>Bioempire: An ‘Empire,’ ‘empire(s),’ or ‘empire’?</i>	13
1.2.3. <i>Bioempire as Socio-Technical Imperialism</i>	15
1.2.4. <i>Biopolitical Nature of Bioempire</i>	17
1.2.5. <i>Bioempire as a Heterogeneous Network</i>	19
1.2.6. <i>Stabilizing an Emerging Bioempire</i>	21
1.3. Methodology and Approach	25
1.4. Chapter Summary	28
CHAPTER 2: RATIONALIZING <i>Bt</i> TECHNOLOGY: CONSTRUCTING A DISCURSIVE AND INSTITUTIONAL SPACE FOR <i>Bt</i> COTTON	30
2.1. Rationalizing Technological Irrationality	32
2.2. Co-evolution of <i>Bt</i> Cotton and the Neoliberal Regime in India	35
2.3. Discursive Struggle around <i>Bt</i> Technology	39
2.4. Simplifying a Complex Agrarian Crisis	45
2.5. Birth of the Agbiotech Industry	51
2.6. Conclusion	56
CHAPTER 3: A REGULATORY REGIME FOR <i>Bt</i> COTTON	58
3.1. Building the Local Regulatory Apparatus	59
3.2. The Regulatory Community	65
3.3. A Corporatist Turn in Regulation	72
3.4. Legitimizing Field-Trials	74
3.5. Tales of Deception and Desire	80
3.6. Empire of Standardization	84

3.7. Conclusion	90
CHAPTER 4: FROM NATIONAL AGRICULTURAL RESEARCH SYSTEM TO GLOBAL AGBIOTECH INDUSTRY	92
4.1. Historical Shifts in Power/Knowledge	94
4.2. Capitalizing Agricultural Knowledge	97
4.3. Changing the Paradigm of NARS	101
4.4. Transforming the Local Patent Regime.....	106
4.4.1. Globalizing US Patent Law	108
4.4.2. Challenging the Indian Law.....	111
4.4.3. Translating the Global Patent Laws	112
4.4.4. Expropriation of the Commons	116
4.5. Emergence of a Global AgBiotech Industry	119
4.6. Conclusion	123
CHAPTER 5: EMERGENCE OF A COUNTER-EMPIRE OF RESISTANCE.....	126
5.1. Symbolic Struggle against <i>Bt</i> Cotton.....	128
5.2. Mobilizing the Terminator Gene Against <i>Bt</i> technology.....	134
5.3. Constructing a Counter-Expertise	137
5.4. Framing the User-Technology Relationship.....	144
5.5. Mobilizing Submerged Networks	148
5.6. Conclusion	155
CHAPTER 6: CONCLUSION: MAKING A BIOEMPIRE.....	157
6.1. Summary of Findings	157
6.2. Contributions	164
6.3. Limitations and Future Work.....	165
BIBLIOGRAPHY.....	168

LIST OF TABLES

Table 1. Dynamics of the Bioempire	6
Table 2: Timeline of Field Trials and Commercial Release of <i>Bt</i> Cotton	75

LIST OF ABBREVIATIONS

Bt	<i>Bacillus thuringiensis</i>
CBP	Cartegena Biosafety Protocol
CBD	Convention on Biological Diversity.
CCI	Cotton Corporation of India
DOA	Department of Agriculture
DBT	Department of Biotechnology
EPA	Environment Protection Act
FDI	Foreign Direct Investment
GATT	General Agreement on Tariffs and Trade
GEAC	Genetic Engineering Approval Committee
GE	Genetic Engineering
GEOs	Genetically Engineered Organisms
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
IISc	Indian Institute of Sciences
IMF	International Monetary Fund
INGOs	International Non-Governmental Organizations
IPA	Indian Patent Act
IPM	Integrated Pest Management
IPR	Intellectual Property Rights
KIA	Knowledge Initiative on Agriculture
KRRS	Karnataka State Farmers' Association (<i>Karnataka Rajya Ryota Sangha</i>)
MAHYCO	Maharashtra Hybrid Seeds Company Limited
MMB	Monsanto-Mahyco Biotech India Limited
MOEF	Ministry of Environment and Forests
MOST	Ministry of Science and Technology
MRC	Monsanto Research Centre
MSP	Minimum Support Price
NARS	National Agricultural Research System
NES	National Extension Service
NGOs	Non Governmental Organizations
OGL	Open General License
PVPA	Plant Variety Protection Act
R&D	Research and Development
RCGM	Review Committee on Genetic Manipulation
RFSTE	Research Foundation for Science, Technology and Ecology
SPS	Sanitary and Phytosanitary Measures
STS	Science and Technology Studies
TBT	Technical Barriers to Trade

TMC	Technology Mission on Cotton
TNCs	Transnational Corporations
TRIPS	Trade Related Intellectual Property Rights
USAID	United States Agency for International Development
USPPA	United States Plant Patent Act
USTR	United States Trade Representatives
WTO	World Trade Organization

CHAPTER 1: INTRODUCTION

In recent years, a large number of farmers committed suicide in cotton growing states of central and southern India. Although suicide among the impoverished farmers is not a new phenomenon in the country, the rate went up dramatically since India embarked on the path of economic liberalization in the early 1990s.¹ The epidemic of farmer suicides presents us with a curious situation. On the one hand, it is clear that the changed political economic conditions of agriculture facing cotton-growing farmers provided the context in which they committed suicide. On the other hand, the coincidence of cotton farmer suicides with the commercialization of *Bt* cotton in India suggests an important role for that technology in the rural crisis. The epidemic of farmer suicides represents a visible marker of an underlying and ongoing dynamic around agriculture, neoliberal order and *Bt* technology.

During the 1980s, under the leadership of the successive Prime Ministers Rajiv Gandhi and V.P. Singh, the government of India chose to finance its fiscal deficits principally by borrowing from the International Monetary Fund (IMF) and from other commercial banks in the US. As India's external debts² mounted, its reserves of foreign currency dwindled at home thereby making it difficult for the government to repay the loans. It was at this point in 1991 that the IMF and the World Bank, the main agents of the US-backed neoliberal political-economic

¹ According to some official statistics, between 2001 and 2007, more than 4,500 cases of farmer suicides were reported in four states of Andhra Pradesh, Karnataka, Kerala and Maharashtra (Mukherjee, 2007). Other sources report much higher figures. The National Social Watch, a coalition of civil society organizations, reports 11,387 farmer suicides in the same period in these four states (The Statesman, 2007). The National Crime Records Bureau of the Ministry of Home Affairs reports more than 16,000 farmer suicides every year over this period (NCRB, 2006). While this study acknowledges such contradictory figures, the NCRB figures are consistent across states and over years. Several authors writing on the farmer suicides have used the NCRB data, including Nagaraj (2008), and journalists such as P. Sainath (2007a and 2007b) in *The Hindu*, and Sengupta (2006) in *The New York Times*.

² In 1982, India's total external debt stood at 7.94 billion dollars. By 1990, the total external debt had shot up to 70.12 billion dollars (Corbridge and Harriss, 2000).

policies, imposed structural adjustment on India.³ The advocates of the structural adjustment promised to roll over the debt in return for economic reforms, which required setting up an institutional framework characterized by strong private property rights, free market and free trade (Harvey, 2005).

The debt crisis was used as a reason by the US treasury-IMF-World Bank coalition to force the Indian government to adopt neoliberal policies of deregulation, privatization, and withdrawal of state intervention from many areas of social provisions including agriculture. Initiated in 1991, the neoliberal reforms began to integrate the Indian economy into the global market, and set in a phase of declining sovereignty of the Indian State. The role of the Indian government in the economic reform package was to create and preserve the institutional and discursive space appropriate to free-market ideology and practices.

In the agricultural sector, the new political economic configuration of laissez-faire proposed a major departure from the earlier protectionist and inward-looking policies. Firstly, the reforms allowed Foreign Direct Investment (FDI) in the seed sector, and loosened the restrictions on the activities of transnational corporations (TNCs) through abolishing licensing in the seed sector. Secondly, the economic reforms created space for an automatic approval to foreign technology agreements and to Indian subsidiaries with up to fifty one percent foreign equity. This facilitated the privatization of the seed sector and opened up the seed market to external investment by the TNCs. Thirdly, the neoliberal policies aimed at increasing exports from the agricultural sector in order to earn higher foreign exchange. The logic of the export-oriented economy induced changes in crop cultivation, whereby millions of farmers made a sudden

³ During the 1980s and 1990s, policy based lending by the U.S. government, the IMF and other multilateral organizations had a tremendous impact on national policies of developing countries. For a discussion on the debt crisis and economic reforms in developing countries, see, for instance, Stallings (1992); Kahler (1990 and 1992); Williamson and Haggard (1994); Babb (2001).

switch from food crops to cotton cultivation. And lastly, under the new political-economic regime, subsidies on agricultural inputs and low-cost institutional lending to farmers were also withdrawn. Through neoliberal policies, an increased vulnerability of cotton farmers was thus systematically constructed. The vagaries of the unregulated global market, the withdrawal of state protection to cotton cultivation, and the increased costs of the inputs for cotton farming could be one possible explanation for the epidemic of suicides in the cotton growing regions.

The introduction of *Bt* cotton⁴ into Indian agriculture could provide another possible explanation for the intensified agrarian crisis. In the case of *Bt* cotton, a toxin producing gene from the soil bacterium *Bacillus thuringiensis* was introduced into cotton seeds. The Indian government approved the commercial release of *Bt* cotton in 2002 under a pretext that it would provide protection against cotton pests that caused heavy losses to the farmers. The commercial approval of *Bt* cotton was preceded and followed by a huge controversy around this technology. Much of the public dispute around *Bt* cotton was centered around the issue of safety of this transgenic crop.⁵ Many claims and counter-claims were made on what risk⁶ meant in the context of *Bt* technology. The media reported mainly two positions within the debate: first, the position

⁴ *Bt* cotton was the first transgenic crop to be introduced in India. The term ‘transgenic’ is synonymous with ‘genetically engineered’. A transgenic crop is one that has been bred following the insertion of a foreign gene, and which exhibits the characteristics conferred by that gene. Enabled by the 1953 discovery of the structure of DNA in living cells, genetic engineering is one of the techniques of biotechnology. The latter includes other techniques, such as gene splicing, cell fusion, cell culturing etc., carried out at sub-cellular levels in plant and animal cells

⁵ In this heated and much-publicized controversy, another set of issues related to the science of biotechnology was also raised. Speaking in defense of *Bt* cotton, the proponents argued that the technology was simply the latest in a seamless continuum of biotechnologies practiced since the origin of human civilization, from bread and wine making to selective breeding. This position held that the “new” biotechnology was merely much more precise, as genes were individually isolated and transferred as desired. This view, however, did not find favor with the critics of *Bt* cotton. They maintained that the so-called “old” biotechnology involved only an external manipulation of organisms, like altering temperature, acidity or nutrient, and did not intervene in the finer structure of internal controls of a living cell; whereas in *Bt* technology the external and internal controls of life forms were imposed simultaneously. They went on to argue that while the conventional breeding methods shuffle different forms of the same gene (alleles), genetic engineering enabled completely new genes to be introduced with unpredictable effects on physiology and biochemistry of the resultant transgenic seeds. The argument that biotechnology was as old as yeast making was thus questioned.

⁶ For some seminal work on risk and uncertainty, see Beck (1992), Douglas and Wildavsky (1984), Hiskes (1998), Wynne (2005).

of the proponents of *Bt* cotton, who claimed that the technology was safe for the environment and human health;⁷ second, the opposition of critics who denounced the policy decision as anti-people and pro-industry.⁸ The latter mainly focused on the broader definition of risks, which included socio-economic implications of this technology.

Within this highly contested field of agbiotechnology,⁹ the implications of the 2002 policy decision had far-reaching implications for cotton cultivation. Whether *Bt* technology actually helped eliminate the attack of cotton pests on Indian farms or not, something that remains contested, the technology did not offer a respite to the farmers from the capital intensive inputs needed for cotton farming. Because of the withdrawal of the agricultural subsidies and opening up of the market to the agbiotech TNCs, the farmers were left at the mercy of private moneylenders to buy expensive cotton seeds. Following the failure of cotton crops, the heavily indebted farmers were unable to repay the loans, leading to increasing numbers of suicides.

Against this background, this study explores the relationship between the new political-economic configuration of neoliberalism and the commercialization of *Bt* cotton in order to understand the intensified agrarian crisis in India. I start with an assumption that the new technology of *Bt* cotton cannot be understood in purely technical terms, but the whole scheme of the political economy of this technology must be explored in order to understand the set of relationships underlying the agrarian crisis. I argue that *Bt* technology and the neoliberal order were internally connected in a system of power relations that I call 'bioempire'. Both possible explanations of farmer suicides discussed above are the dimensions of a single process of incorporating Indian agriculture into this new form of empire. Developed and marketed by a transnational corporation, Monsanto, *Bt* cotton embodied a dynamic relationship among a triad

⁷ See, for example, "Biotechnology is safe, says Monsanto official," *Hindu*, 25 May 2005.

⁸ See, for instance, "India becoming a GM trash bin," *Deccan Herald*, 12 April, 2004.

⁹ Agbiotechnology refers to the application of biotechnology to agriculture.

of the neoliberalizing Indian State, global neoliberal regimes, and transnational corporations. It is this relationship between *Bt* technology and neoliberal order that I explore in this dissertation.

1.1. The Project

The study examines the dynamic of the making of a bioempire—how it emerged, how it was contested, and how it was stabilized. In the chapters that follow, I focus on four processes involved in the making of the bioempire in India. It is through these interconnected, mutually reinforcing processes—rationalization, standardization, privatization and mobilization—that we understand the dynamic—the foundation, introduction, extension and reconfiguration—of the bioempire. I focus on *Bt* technology as operating politically in several different registers—as a material technology, as a metaphysical device, as a discourse, and as an institution of governance¹⁰—in order to show how this technology activated, and was activated by, a new political economy, new governance regimes and new forms of political struggle.

In Table 1, I outline how each of these processes relates to an overall exploration of the bioempire, and the socio-technical network that constitutes it. I argue that these processes, while often underplayed or neglected by other analysts, are crucial to an understanding of the Indian encounter with *Bt* technology and its implications for the state-technology nexus that had characterized the postcolonial Indian experience. I situate the policy decision of commercialization of *Bt* cotton in 2002 within a changing policy culture that was based upon a complex melding of neoliberal economics and hegemonic politics—a significant aspect of the emergent bioempire that is emphasized throughout this dissertation.

¹⁰ As material technology, the transgenic seeds are seen as new instruments for warding off disorder in nature, and to redesign it to perform new tasks in new environments. In this sense, biotechnology is concurrently a metaphysical device. It brings new entities into the world and through that process orders our normative sense of both nature and society. As a discourse, biotechnology allows diverse frames: to some, it is a technology of progress, improvement and emancipation, and to others, of risks, invasiveness and domination from afar. Such divergent narratives carry political and cultural weight. Lastly, biotechnology is an institution of governance. It shapes forms of social order, and, at the same time gets shaped by it (Jasanoff, 2006).

Table 1. Dynamics of the Bioempire

Chapter Number	Focus of the Chapter	Bioimperial Dynamic	Relation to Bioempire	Process	Technical Practices
Two	Rationale	Justifying	Foundation	Rationalization	Development of Discourses and Institutions
Three	Regulation	Governing	Introduction	Standardization	Development of biosafety framework and regulatory standards
Four	Public-Private Alliance	Transforming	Extension	Privatization	Development of new relations of knowledge and patent regime
Five	Resistance	Subverting	Reconfiguration	Mobilization	Development of counter discourses, and illegal submerged networks

I focus on the process of rationalization in order to understand how the foundation of the bioempire was laid down in India. Justifying the policy decision of 2002, a network of technocrats and their corporate partners articulated the need for *Bt* cotton through a range of discursive frames and institutional strategies. In order to explore this process, I focus on policy agencies that were central to rationalization of *Bt* cotton. The government agencies, such as the Department of Biotechnology (DBT), the Cotton Corporation of India (CCI), the Indian Council of Agricultural Research (ICAR) and the Ministry of Textiles (MOT), provide important political arenas in which the need for *Bt* technology was articulated into discourses and interventions. The transnational corporation, Monsanto, constitutes a central actor in this analysis. As a primary mover and shaper of the development and governance of *Bt* cotton in India, through its discourses and technical strategies, Monsanto provides a strategic node in the emerging socio-technical network that constitutes bioempire.

In order to understand the process of standardization that characterized the governance of *Bt* cotton, I explore the development of regulatory standards by the regulatory community lodged in different ministries, such as the Ministry of Science and Technology (MOST) and Ministry of Environment and Forests (MOEF). I examine the manner in which a risk-promotion paradigm was advanced and continually negotiated by the neoliberal technocrats, who were the advocates of the neoliberal policies, as a way to speed up the introduction of *Bt* cotton in India. In the new political-economic space, non-state actors began to influence *Bt* technology related policies to a greater extent; something that was in clear contrast to the pre-reform era. Three emerging global regimes—the Cartagena Biosafety Protocol (CBP), the World Trade Organization (WTO) and the Trade Related Intellectual Property Rights (TRIPS)—exerted a hegemonic influence on *Bt* cotton related policies and practices at the local level. The global regimes introduced a standardized culture of policy rationality, including the adoption of standardized biosafety laws and intellectual property laws, which forms the basis of a global convergence of policy and institutional models. At the same time, it highlights the reduced effectiveness of government control over technological flows in a rapidly globalizing world.

The process of privatization set in motion the transformation of the public sector National Agricultural Research System (NARS) and the emergence of a globally linked agbiotech industry. The institutional transformation, such as the shift from the NARS to a global agbiotech industry, resulted in a convergence of institutional patterns that favored transnational investors in the seed sector. The role of *Bt* technology in the extension of the expansionist project of transnational corporations, such as Monsanto, is linked to the alliance between public and private actors. Through an initiative of capitalizing agbiotech knowledge production in public institutions, such as the Indian Institute of Sciences, and forging strategic alliances with local

seed firms, such as Mahyco, the technical practices of Monsanto led to the development of new kinds of alliances between the public and the private research domains. The transformation of the patent laws under the influence of the emerging global patent regime further signaled the emergence of a new form of knowledge relations that provided a competitive edge to the transnational corporations in the seed sector.

The process of mobilization against *Bt* cotton created a space for the emergence of a counter-empire of resistance—an alternative hegemonic political organization of transboundary knowledge flows and exchanges. I focus on the elite local activists, such as Vandana Shiva and Najundaswamy, who led a struggle towards the reconfiguration of the policy decisions related to *Bt* cotton and the user-technology relationship. Their transboundary counterparts constituted significant allies in their political struggle against *Bt* technology and transnational corporations, such as Monsanto. The political task of the activists was not simply to resist *Bt* technology, but to redirect and reorganize the policy agenda. At the same time, a section of farmers resisted Monsanto's *Bt* cotton in a novel way. They subverted the hegemonic forces, including the authority of their elite spokespersons, through constructing a subterranean, illegal relationship with *Bt* cotton. This dissertation, thus, focuses on both the productive and subversive dimensions of the process of mobilization against *Bt* technology. I highlight how the activists and farmers developed counter-discourses and submerged networks of resistance to *Bt* technology.

Finally, the mutually reinforcing series of relations, these varied elements—technology, institutions, policy instruments, regulatory regimes, activist networks—form important nodes of the heterogeneous network constituting bioempire.¹¹ I explore how the conflicts and contradictions emerging at the interfaces of various political arenas were negotiated and

¹¹ For an elaboration of the relational effects in heterogeneous networks, see, for instance, Hughes (1983), Law (1986), Latour (1987), Callon (1986).

reconciled in order to create a hospitable technological, institutional, political-economic and discursive space for the bioempire to emerge within India.

1.2. Building a Theory of Bioempire

While there have been a number of attempts to explain the emergence of international regulation of biotechnology and biosafety (Falkner, 2000; Newell and Mackenzie, 2000) and the evolution of particular national and regional systems of regulation of biotechnology in the Euro-American contexts (Gottweis, 1998; Levidow et al., 2000; Jasanoff, 2005), the policy and politics of agbiotechnology in a neoliberalizing, postcolonial state, such as India, remains sketchily drawn. Some scholars have investigated the policy and politics of biotechnology, in general, in India (Scoones, 2007; Newel, 2003, Vishwanathan and Parmar, 2002), and around *Bt* cotton in particular (Scoones, 2005; Herring, 2006, 2007, 2009; Yamaguchi, 2004). But, their analyses focus on the local actors and their politics, highlighting some aspects and ignoring others. More specifically, they downplay or neglect the crucial global aspects—actors, regimes, politics and economics—that shaped the content and the context of *Bt* cotton in India. Some other scholars have studied the regulatory framework of biotechnology in India without addressing the political-economy of this technology. They restrict their analysis to general policy aspects of biosafety regulation and do not problematize the power relations around this technology (Chaturvedi, 2002a, 2002b; Dhar, 2001, Gupta, 2000). These studies, thus, do not provide a thorough theoretical understanding of the relationship of *Bt* technology with the changing political-economic context of India. In this dissertation, I develop a more robust theory of bioempire, which explains the dynamic of the global and local forces that shaped the content and the context of this new technology.

1.2.1. The Concept of Bioempire

Like all other key concepts in the social sciences, I shall assume throughout this study that the concept of empire carries considerable historical baggage, as this category is constantly contested and reaffirmed in the present with reference to the past. Rather than discard this historical load and approach the term from a purely analytical standpoint, I start from the premise that not only does the meaning of empire vary throughout time and space, but its deployment as an explanatory concept requires sensitivity to the historical particularity of different imperial experiences.

Social scientists have thought about empires in different, yet similar, ways. In historical literature, empire implies conquest, rule and exploitation of foreign populations and territories (Bush, 2006; Abernethy, 2000; Doyle, 1986; Kennedy, 1988; Mann, 1986). For political scientists, empire implies a specific form of global sovereignty and legality (Hardt and Negri, 2000; Passavant and Dean, 2004). For scholars in globalization studies, empire constitutes an episode in a long-term historical trend of worldwide connectedness; as a part of the globalization process, empire is seen as an emergent configuration of unequal power relations (Pieterse, 2004). In the field of science and technology studies (STS), empire is viewed as a social technology that enables power to extend beyond its original spatial and cultural location (Jasanoff, 2006), or an ecological system stressing the interconnections among politics, economy and nature (Drayton, 1993). Common to the conceptualizations within these disciplines is the focus on global aspect of an empire and the unequal power relations that underlie it; which, in turn, suggests a dynamic that involves a struggle between the hegemonic power and the resistance against it. I base my concept of bioempire on this commonly held premise.

I conceptualize ‘bioempire’ as a socio-technical formation that enables transboundary capital accumulation through market exploitation and resource extraction. As opposed to the concept of ‘global governance’, the concept of bioempire represents a form of power that assumes the possibility of desired political and economic effects for a range of actors at socio-technical sites. The concept is an appropriate term to capture the internal connection between *Bt* technology and the neoliberal global order, and to help us think about different expressions of imperial power. The term best captures the expansive and coercive forms of power summarized in the terms ‘domination’ and ‘control’ embodied in a nexus of *Bt* technology and neoliberal ideology and practices. It suggests that the struggles over *Bt* technology are simultaneously struggles over state-market relationships, the organization and control of knowledge, and the self-determination of local communities. The concept contributes to our understanding of the processes and practices by which the projects of *Bt* technology and the new global political-economic configuration merge to activate wholly new mechanisms of capital accumulation by dispossession, and the resistance against it.

In conceptualizing bioempire, I build on the idea of Harvey (2003) whereby he suggests that ‘accumulation by dispossession’ has been the central feature of global capitalism, with privatization as one of the key elements of the process.¹² Harvey’s theory of ‘capitalist imperialism’ suggests that the empire of the capitalist sort is distinct from other conceptions of empires based on a territorial logic. The ‘territorial imperialism’ is a distinctively political project on the part of actors whose power is based on command of a territory and a capacity to mobilize its human and natural resources towards political, economic and military ends. The ‘capitalist imperialism’ is a diffuse political-economic process in space and time in which capital

¹² Harvey builds on the Marxian description of ‘primitive accumulation’ as a defining characteristic of capitalism’s historical geography (Marx, 1976). For Marx, primitive accumulation entailed appropriation and co-optation of pre-existing social and cultural structures by the Capital.

accumulation takes primacy. Harvey argues that the capitalist logic of accumulation typically dominates over the territorial logic of power. However, he recognizes that they could intertwine in complex and sometimes contradictory ways. I build on these ideas of Harvey to suggest that in bioempire the capitalist logic of imperialism takes primacy over the territorial logic of empire formation. And, that the hegemonic power of bioempire is exercised through a combination of a manipulation of the governed, both plants and publics, and domination of the local policy regimes through coercion by global neoliberal actors, institutions and regimes. Thus, I take a departure from the Gramscian interpretation of ‘hegemony’ as consent of the governed, or an alternative interpretation of ‘hegemony’ as a particular mix of coercion and consent.

While Harvey argues that the process of privatization is a cutting edge of accumulation by dispossession, I go one step beyond his formulation. I suggest that in bioempire the capitalist logic of accumulation works through a whole new range of socio-technical processes around *Bt* technology—rationalization, standardization, privatization and mobilization—that have opened up new sites for capital accumulation. The commodification of nature through an array of manipulative techniques that constitute agbiotechnology; the withdrawal of state support to farmers through subsidies and extension services in agriculture because of free-market policies; the rolling back of a regulatory framework designed to protect the environment and livelihoods of farmers through a hasty policy decision in 2002; the corporatization of regulatory practices; the privatization of hitherto public assets, such as the agbiotech research institutions and research practices; the emphasis upon intellectual property rights through the TRIPS agreement to benefit agbiotech TNCs over the traditional knowledge holders, such as farmers; the subterranean networks of illegal *Bt* cotton market—these are some of the ways in which the nexus of *Bt*

technology and neoliberal policies entail an appropriation of commons and a wholesale dispossession of the rights of local farmers, scientists, and civil society.

1.2.2. Bioempire: An 'Empire,' 'empire(s),' or 'empire'?

In their influential theory, the political philosophers in the Marxist tradition, Hardt and Negri, conceptualize 'Empire' as a decentered and deterritorialized apparatus of global rule that transcends the sovereignty of nation-states (Hardt and Negri, 2000). Composed of a series of national and supranational political organizations united under a single logic of rule, they argue, the Empire has brought about a decline in the sovereignty of nations-states, and thus a loss of state power to regulate the transboundary flows of forces of production, including technology. While they bring to our attention the emergence of this new global order that reduces the regulatory power of the states, they seem strikingly inattentive to the hegemonic doctrine of 'neoliberalism' that constitutes the central guiding principle of the new political-economic configuration characterizing this new empire. While their notion of Empire is an important contribution to help us understand this contemporary phenomenon of global power, their subsequent analysis falls short of capturing some of the crucial nuances that my concept of bioempire captures well.

Firstly, while they think of the 'imperial machine' as constituted by political and sovereign elements, they do not include technologies and techniques by which specialized agencies contribute to the making of this new empire. Their theory of a unitary and monolithic Empire disregards the microprocesses of agency and governance at the local level. Secondly, their totalizing theory does not explain the context-specific expressions of this new empire. Thirdly, and most importantly, their notion of a decentered and deterritorialized apparatus of global rule overlooks the imperialist dimensions of the contemporary empire. Because of these

reasons, I step off from the concept of ‘Empire’, as used by Hardt and Negri, in order to address these issues through my exploration of the dynamic of bioempire, which uses the concept of empire with a small case ‘e’.

The recent work in STS literature by Jasanoff (2006) suggests that instead of a monolithic and totalizing Empire we have many ‘empires’ held together by mutually inclusive mechanisms of ‘imperial governance’. While I build on her idea of empire as a heterogeneous construct, I do not agree with Jasanoff’s notion of many ‘empires’ operating at the same time. The bioempire is a heterogeneous, socio-technical construct, as it inextricably links *Bt* technology to the neoliberal political-economic elements—such as ideology, regimes, actors, institutions, and practices. But, instead of relying on the notion of multiplicity of ‘empires’, I suggest that a globally emerging phenomenon of empire is expressed differently in different contexts. And, bioempire is one specific expression of this system of power relations in a particular context.

In this dissertation, I characterize the mutually constitutive relationship between the projects of *Bt* technology and ‘neoliberalism’ as a new form of empire. The bioempire instantiates globalization of a technological system or epistemic knowledge across territorial boundaries; at the same time it carries elements of domination and control within it. The imposition of neoliberal policies in agriculture to create a hospitable environment for transnational corporation (TNCs), the creation of a need for an imported *Bt* technology for maximizing profits, the standardization of biosafety and patent laws through coercive and normative measures, the convergence of institutional patterns through a process of privatization for capital accumulation, and the transboundary linkages of corporations and activists to weave the connective fabric of the emerging socio-technical order—all these elements in the story of *Bt* cotton in India suggest that this technology became a site for the exercise of a new form of global

hegemonic power. This power was translated into institutional and discursive practices, regulatory standards, new knowledge relations and political struggles at the local level.

1.2.3. Bioempire as Socio-Technical Imperialism

The historical literature has explored the role of science and technology in European imperialist projects. This body of literature demonstrates that the western project of Enlightenment and its legacy of scientific rationality, order and progress provided justification for Europe's global hegemony. Some scholars within this field show that technology facilitated the exercise of transboundary domination and control of non-western populations (Adas, 1989; Diamond, 1999), while others argue that the European colonizers used scientific knowledge, such as human and biological sciences, to rule the colonized territories and populations effectively (Cohan, 1996; Philip, 2004). Yet others show the linkages of science and technology to the early discourses of development in erstwhile colonies like India (Prakash, 1999; Headrick, 1988). The literature points out that the colonial state used agricultural development as a method to transform the production system in the colonies in order to increase the profits of the domestic industry in Europe. This included forcing mono-crop plantations and growing commercially useful plants in nonnative habitats. The standardization of agricultural practices was used to control the colonial economies from a distance (Porter, 1995). I push this literature beyond a focus on the role of science and technology in the European imperialist project in the bygone era to look at the processes by which *Bt* technology was moved to the center stage in the most salient struggle within a context of an emerging neoliberal order.

The Marxist literature on imperialism provides crucial insights into the nature of technoscientific imperialism. Beginning with Lenin, who suggested that imperialism is the highest stage of capitalism (Lenin, 1916), Marxist theoreticians maintain that imperialism is a

necessary stage in capitalist expansion. Following this line of thought, Marxist social historians, such as Kloppenburg (1988), have argued that agricultural biotechnology emerged as a means of capital accumulation. Their analytical framework relies on the interaction of scientific development with three themes of political economy: progressive commodification of seeds, the changing division of labor between public and private science, and asymmetries in patterns of seed commerce and exchange between the North and the South. They point out that the logic of capital shapes the relationship between technology and agriculture, often putting profits and markets over people and ecological systems.¹³ I borrow from this tradition of thought to suggest that *Bt* technology, driven by the life sciences industry, became a means to expand the control of Capital over the Indian agricultural system, and that capitalist agriculture led to a specific form of social relations. Some of the Marxist theorists working at the interface of science studies and political economy suggest that life sciences represent a new phase of capitalism, and, consequently, biotechnology is a form of enterprise inextricable from contemporary capitalism (Sunder Rajan, 2006).¹⁴ Although the ideas of these theorists become an important strand in my discussion, I challenge most of these authors on their reliance on a totalizing Marxist approach that would overlook context-specific variations in the capitalism-technology-agriculture nexus.

My perspective on imperialism differs from Hardt and Negri (2000) who argue that imperialism is over and that there are no national focal points to global power relations. On the contrary, I argue that the US occupies a central position in the constitution of bioempire. The life sciences have played a commanding role in America's strategies of economic and imperialist

¹³For a discussion on how capitalism manifests in agriculture see, for example, Kautsky (1899), Mann and Dickinson (1978), Goodman and Watts (1997), Mann (1990), Boyd, Prudham and Schurman (2001), Goodman, Sorj and Wilkinson (1987), Kelso (2000, 2003), Kloppenburg (1988), Lewontin (1998), Prudham (2003), Wilkinson (2002).

¹⁴ For an analysis of "biocapital," the relationship between capitalism and biotechnology, through a Marxist framework coupled with the idiom of coproduction, see Sunder Rajan (2006). The work is a comparative investigation of postgenomic drug development marketplaces in the United States and India.

self-invention (Cooper, 2008). Over the past few decades, the US government has been at the center stage in the constitution of global debt and the structural adjustment program (Harvey, 2005). It has also been at the center of efforts to reorganize global trade rules and intellectual property laws along lines that would favor its own agbiotech TNCs.

I conceptualize bioempire as a socio-technical imperialism exercised through the nexus of *Bt* technology and the triad of US-led global neoliberal regimes, transnational corporations and the neoliberalizing Indian state. Going one step beyond the formulation of the theorists of empires and imperialism, I propose that in bioempire *Bt* technology and political-economic configuration of neoliberalism are coproduced,¹⁵ which in turn opens up the space for capitalist imperialism. The bioempire emerged as an imperialist project in the sense that it activated the imperial myths of the inevitability and beneficial nature of *Bt* technology across territorial boundaries, and legitimated the control of a totalizing and universalist neoliberal order within which this technology was introduced. Some political theorists, such as Forbes (2006), directly address the issue of imperialism of knowledge, which leads to the development of forms of power that occupy and organize the key knowledge sites. The corporatization of regulatory processes, the capitalization of key knowledge sites, such as the Indian Institute of Sciences and Mahyco, by Monsanto, the privatization of National Agricultural Research System through neoliberal policies, and the changes imposed upon the local biosafety and patent regimes are illustrative of this process.

1.2.4. Biopolitical Nature of Bioempire

To understand how the bioimperial machine was actually set into motion, I recognize the biopolitical nature of the new paradigm of rule. Foucault saw biopolitics as an essential

¹⁵ In STS, Jasanoff's (2004) idiom of "coproduction" has been used by various scholars. For instance, see Halfon (2007a) and Sunder Rajan (2006).

technology with which modern states control their populations. The concept of biopolitics, the way in which biological life itself becomes a central political preoccupation, is closely linked to power over life, bio-power—another term introduced by Foucault (1976). Foucault (1976 & 1980) identifies biopower as the power over life, which regulates the individual and social life from its interior. He conceptualized biopower as a form of ‘power-knowledge’ (Foucault, 1980, pp 109-133) that links “the various political technologies of the body, discourses of the human sciences, and the structures of domination” (Dreyfus and Rabinow, 1983, p184). Central to the exercise of biopower, then, is the state’s characterization of human bodies and behaviors in ways that rationalize and justify that state’s policies. In particular, the spread of bio-power from the 17th century onwards, saw the human sciences evolve in a mutually constitutive relationship with the administrative capacity of the state and the requirements of industrial capitalism. The human body became an object of disciplinary power—an object to be manipulated and perfected (Dreyfus and Rabinow, 1983)—whose goal was to be docile and productive.

During the early stages of industrial capitalism, biopower was an essential element in the production and reproduction of Capital. The concept of biopower can be extended to the management of nature, as embodied in cotton plant populations, at the molecular level (Jasanoff, 2006; Brooks, 2005). In this study, I use biopower as a concept to show how neoliberal forms of power took charge of cotton plant populations, and how *Bt* technology facilitated this shift in the organization of power. The theory of bioempire builds on the idea that the new phase of the alliance of neoliberal capitalism and *Bt* technology legitimized the accelerated reproduction of Capital, along with the production and reproduction of transgenic plant life itself. Central to understanding the bioempire are the powerful transnational corporations, such as Monsanto, that

form the connective fabric of its biopolitical world.¹⁶ Because *Bt* technology operates politically in several different registers, the control is exercised not only at the plant molecular level, but at the levels of discourse and governance as well. In this way, a paradigmatic form of biopower came into existence that helps us understand the “revolutionary” nature of the agbiotech era.

While Foucault (1976 & 1980) offers a perspective on the biopolitical dimension of the bioempire, the analysis of Scott (1998) provides a comprehensive account against the “imperialism of high-modernist, planned social order” (Scott, 1998, p. 6). Although Scott gestures toward rather than expands upon his understanding of imperialism, his theories are compatible with the account of theorists who analyze contemporary empires and imperialism. Within the framework of bioempire, modern statecraft that consists in taking “exceptionally complex, illegible and local social practices” and creating “a standard grid whereby it could be centrally recorded and monitored,” (Scott, 1998, p 2) could help us understand the simplifications involved in the process of creating legibility in the case of economically valued plant populations, such as cotton. In this sense, the theory of Scott meshes with that of Foucault, and can be fitted in the frame that insists that the modernist Indian state was party to imperial regimes to facilitate, if not control, the development and governance of *Bt* technology. Drawing on the perspectives of political theorists, such as Foucault (1976 & 1980) and James Scott (1998), I look at the ways in which the Indian state and its body of experts bought into the bioimperialist project of which they increasingly formed a part.

1.2.5. Bioempire as a Heterogeneous Network

The field of science and technology studies (STS) provides a number of tools to the study of bioempire formation. The field takes as its subject the actual content of technology, and opens

¹⁶ For some literature in social sciences that explores the role of transnational corporations in the processes of globalization, see Dicken (2003), Hardt and Negri (2004), Sklair (2002), Robinson (2004) and Bush (2006)

up the black boxes in order to reveal the meanings, social constructions, inscriptions and discourses. A black box contains what no longer must be considered, and stabilizes situations of meaning (Callon and Latour, 1981). This sociology of scientific knowledge (SSK) helps to explore black boxed aspects of the bioempire from the inside, as a technoscientific system inextricably linked to society and politics (Pinch and Bijker, 1987; Latour, 1987).

Rather than seeing the elements of the network of bioempire as objective givens, this constructivist approach suggests that bioempire is a dynamic and complex networked production that allows contestation on basic assumptions, terms, strategies and goals. It is through this process of complex social constructions within a particular policy environment that the bioempire emerges and stabilizes. Actor-network theory provides crucial insights into the process of empire making. The approach looks at the construction of networks of facts, tools, inscriptions, institutions, people, and non-human actors that get linked together and hold each other to create knowledge and social worlds.¹⁷

The approach transcends analytical binaries of nature/culture, human/non-human, technical/political that characterize modern thought. Instead, it suggests that we must follow socio-technical networks wherever they take us—through various labs, institutions, artifacts, human and non-human actors—rather than attempting to purify such hybrids into discourses, politics, sociology and technology (Latour, 1993). Thus, the approach emphasizes the interconnected nature of the social and the technical. This is a relational view of actors and things. The notion of the mutually constitutive relation of the technical with the social order highlights the coproductive nature of network theory (Halfon 2007a).

¹⁷ Actor Network theory grew largely out of the work of Latour (1987), Law (1986 & 1999); Callon (1995), Callon, Law and Rip (1986).

By studying processes and practices that form and extend the global networks of power, I talk about ‘action at a distance’ or domination, and ‘knowledge at a distance’ or surveillance of the bioempire (Jasanoff, 2006). However, the metaphor of network as used in Actor-Network Theory cannot be applied in this research without caution. ANT, based on a sociology of translation (Latour, 1987; Callon, 1986), approaches the question of technoscience and power in a unidirectional and teleological way. Such a process implies a reduction of discretion of the actors who get enrolled into a network. Some scholars in STS like to believe that *Bt* technology is enrolled into empire making (Jasanoff, 2006), but the metaphor of enrollment assumes passive human and nonhuman actors. I ask instead how networks of interests are constituted and reproduced through the actors’ varied strategies and practices.

1.2.6. Stabilizing an Emerging Bioempire

The historical literature provides us with a perspective on the formation of an empire through a process of political-economic expansion, incorporation and subjection of populations by a central hegemon. Contemporary political theory, however, suggests that empire emerges as a decentered and deterritorialized apparatus of global rule through modulating networks of command. These two perspectives reflect on different historical moments—the latter being more about the contemporary world than about historical empires. As shown in the discussion above, I push this body of literature to suggest that the hegemonic bioempire emerges as a network stabilized as a heterogeneous socio-technical construct through a series of overlapping technical processes and practices. This process builds the cohesion of the emerging bioempire, while staving off its dispersion (Jasanoff, 2006).

The neoinstitutionalist literature in sociology gives us a mechanism to think about the stabilized heterogeneity of the bioempire through a process of institutional isomorphism, which

suggests a convergence of institutional patterns via shared technical practices. This approach is also known as world-society theory.¹⁸ The central premise of this theory is that contemporary nation-states share a common culture of rationality, a rationalized world culture. This common culture leads to shared values, thereby forming the basis for an ongoing process of imitation and the international spread of organizational and institutional models. However, Meyer (Meyer and Scott, 1994) also insists that the world society is decoupled from local social organization and practices, which remain local and heterogeneous. Although world-society theory has an uneasy relationship with the political economic approaches to the study of empires, I borrow the concept of 'isomorphism' from the former to make sense of the convergence of the global and local intellectual property regimes.

The neoinstitutionalist approach of DiMaggio and Powell (1983) particularly discusses how organizational fields, such as nation-states and universities, become alike over time. To explain why this happens, they identify three sorts of institutional isomorphisms: mimetic, coercive, and normative. Mimetic isomorphism essentially corresponds to the processes identified by world-cultural theorists: organizations in the same line of business, such as nation-states, which share common values and organizational structures, often imitate one another as a way of minimizing uncertainty. The coercive and normative isomorphisms are fundamentally about power: the power of external organizations with resources, in the former, and the power of certified experts, in the latter. Coercive isomorphism occurs when organizations conform to the standards of powerful external actors, under the pressures of resource dependence. Normative isomorphism occurs among organizations, such as technical universities, that are staffed by technoscientists. Often such organizations will converge because of pressures that support them,

¹⁸ Some of the scholars working within this tradition are, DiMaggio and Powell (1983), Meyer and Scott (1994), Boli and Thomas (1997), and Boli and Thomas, eds., (1999).

such as the trend towards a university-industry nexus, led by the transnational corporations. I have chosen to refer to the dominant mode of normative isomorphism in the contemporary world as neoliberal technocracy throughout this work, since I believe that this term is more recognizable as related to the power of technocrats advocating neoliberal ideology and policies.

For the purposes of examining the coproduction of neoliberal technocracy and *Bt* technology, the latter two categories have great potential utility. Unlike mimetic isomorphism, the categories of coercive and normative isomorphism have the potential to incorporate power and resource inequalities between core and periphery. Such inequalities have become particularly salient since the occurrence of the debt crisis that provided a critical impetus to neoliberal reforms in 1990. In this sense, coercive isomorphism in DiMaggio and Powell's sense played an important part in the paradigm shift in the policies in India. Since 1990, the Indian government adopted liberalizing reforms in part to gain access to the resources of powerful external actors, most importantly multilateral institutions and foreign investors. However, coercive isomorphism is only a part of the explanation for India's neoliberal transformation, which constitutes the context for the emergence of bioempire. What is more striking is the extent to which the neoliberal paradigm shift has been brought about through the expert-driven or normative isomorphism—pressures exerted on the state by both external economic experts (foreign investors and the IMF) and technocrats within. Even as I appropriate the concept of 'institutional isomorphisms' in my study of bioempire, I challenge the distinction between normative and coercive isomorphisms, and suggest that these are two ways of looking at the same process.

This discussion, then, leaves us with a complex understanding of the phenomenon of bioempire—its emergence and stabilization in India. **First**, bioempire came into existence as a result of an alliance between *Bt* technology and neoliberal policies and practices. As part of a

new rationality of capital accumulation, the neoliberal actors used *Bt* technology to control cotton plant populations, and thus the agricultural sector, from the interior. **Second**, this globalized biopolitical machine activated *Bt* technology politically on all registers of social order—as a material technology, as a metaphysical device, as a discourse, and as an institution of governance. In this sense, *Bt* technology came to inhabit the very world that it created. *Bt* technology acted as an agent through which the transboundary power of the harmonizing policy regimes was exercised, which in turn created a hospitable environment for the technology. **Third**, bioempire emerged as a decentered network of governance of *Bt* technology, in which the state apparatus and global neoliberal institutions acted as significant nodes. The declining regulatory powers of the state made the local regulatory apparatus ineffective in controlling the technological flows; thus creating a space for the emergence of a highly contentious political field around *Bt* technology. **Fourth**, composed of a series of socio-technical elements linked in a heterogeneous network, bioempire was held together by the dominant rationale of capital accumulation along with the high-modernist goals of the Indian state and agbiotech corporations. The institutional isomorphism that characterized the bioempire helped in holding its heterogeneity together. **Fifth**, the bioempire emerged as an imperialist project. It continued the historical alliance between biological sciences, the state and hegemonic global actors. And **finally**, the bioempire also included a counter-empire of a resisting multitude that struggled against the hegemonic forces; thereby opening up a space for contestation and alternative networks in the technoscientific policy and politics.

1.3. Methodology and Approach

Given that *Bt* technology is a quasi-object—simultaneously material, social and discursive—the methodology for this project draws largely on the interdisciplinary area of science and technology studies (STS). By linking up the metaphor of network to the idiom of coproduction, I seek to avoid simple explanations to the emergence of bioempire; instead, I trace it as a heterogeneous network that links the local with the global, the micro with the macro, and the social with the technical. In this effort, I focus on the coproduction of technology and imperial order (Jasanoff, 2004), the inclusion of both human and non-human actors in the hybrid network (Latour, 1987; Callon, 1986), and the collapse of the micro-macro and global-local distinction (Hughes, 1983; Law, 1986; Latour, 1987; Callon, 1986). In line with the dominant STS theory, I avoid *a priori* causal categories and divisions of various kinds; instead, I allow them to emerge from the empirical findings as effects of the phenomenon. I focus on the practices of construction of the network that links artifacts, institutions, discourses, governance and epistemic mechanisms.

This dissertation uses a number of qualitative methods to investigate the strategies, practices, and institutions described above. The methods I use include analysis of discursive and textual sources, interviews, and archival research, focusing primarily on statements and practices in central policy institutions, relevant academic spaces and activist settings. This diversity of methods—the idiom of coproduction, discourse and textual analysis, and the socio-technical network perspective—provided access to many different sites of the *Bt* technology network, which because of its heterogeneity cannot be explored using a single method. I studied the dynamics of the emergence and stabilization of the bioempire from the time the Indian state

embarked on a path of liberalizing its economy in the early 1990s through 2002, when the Indian government first gave approval to *Bt* cotton.

The seeds of this project were sown during my MPhil study at JNU, New Delhi. Because of some unfavorable events during my doctoral studies, I had to shelve this work for more than four years. I returned to this project at a time when my student visa to the US had already expired. The inability to travel to India for thoroughgoing fieldwork was to some extent compensated by detailed interview notes that I had taken from 2000-2002 as part of my MPhil work. I originally intended to supplement interviews and documentary analysis with ethnographic field study at various institutions and cotton growing villages. Following a tradition of work in STS that focuses on detailed daily technical practices of people, I intended to spend a few months following specific actors at a couple of policy institutions, agbiotech industry sites and cotton growing farmers in villages (Latour and Woolgar, 1979; Collins, 1985; Knorr-Cetina, 1981 and 1995; Lynch, 1985; Pinch, 1986). I was unable to carry out the original plan as a result of my expired visa status to the US. I had to rely, instead, on written material, interview notes, and the worldwide web to gain access to relevant data.

During my fieldwork in Delhi, from 2000 to 2002, my focus was to gain understanding of issues of significance related to *Bt* cotton in India. My activities primarily involved collecting policy documents, annual reports and pamphlets of various actors, such as the Department of Biotechnology (DBT), the two regulatory committees (the RCGM and the GEAC) and Monsanto. I also attended seminars, conferences and workshops to observe the ways in which people engaged in discussion around this technology. This helped me in locating key actors, and identifying main issues and concerns related to agbiotechnology. I conducted semi-structured, exploratory, face-to-face interviews with actors in the *Bt* cotton debate to gain insights into their

interpretations of the commercialization of *Bt* technology. I interviewed across categories of actors; and, these actors were purposively selected in an effort to provide a balanced range of views. I included actors from environmental NGOs, research scientists from both a public crop research institute and companies involved in the development of transgenic cotton seeds, and senior technocrats at the central regulatory agencies. An iterative approach was taken whereby the data from one interview could feed into another in order to clarify different positions upon an issue or to investigate criticisms that one actor may have made of another. Besides providing directed data for discourse analysis, the interviews provided in-depth information for understanding how *Bt* technology was rationalized, regulated, commercialized and resisted by various institutions and actors. At this level I could begin to see how actions led to the emergence and stability of the network. I paid close attention to histories, modes of justification, interactions between actors, the process of policy development and implementation, and ultimately the resistance at various sites. I guaranteed anonymity to all interviewees, and have withheld names wherever interviews are cited. The interviews were conducted without the use of a recorder, and with a set of questions relevant to another project on *Bt* technology. Because of a lack of word for word transcripts, and due to slightly different set of questions asked in this dissertation, I have not used direct quotes from those interviews; rather, I have paraphrased the responses of the interviewees.

The absence of farmers from the above list of interviewees is an acknowledged limitation of this research, which can be accounted for by reference to practical and methodological issues. Firstly, the time and resources available limited my ability to travel to India to spend any period of time in rural areas. I also lacked financial resources to make long-distance phone calls to informers located in India, who could have provided me more information than I had. Secondly,

I had significant concerns regarding the validity of using an informer who could be herself enmeshed in the local power relations of the area concerned. Spending a significantly extended period of time in the field and using a reflexive ethnographic approach could have gone some way towards substantively addressing these issues.

Detailed analysis of published literature, available at good research libraries and on the World Wide Web, forms the basis of this work. Textual analysis provides access to how policies were framed and implemented at different nodes of the network and at different times. The framing, the assumptions, and the definitions used by different institutions and actors provide a map to the contours and complexity of the network of bioempire. I draw on a diversity of documentary sources, as cited in the bibliography, to provide a historical, political and policy context for my study. This project also uses numerous articles from the Indian newspapers and newsmagazines. I focus on the following issues: the rationale that was provided for the commercial introduction of *Bt* technology in India, the regulatory framework that was put in place and the manner in which it was justified, the shifts in state policies that created a hospitable environment for the technology, and the ways in which the bioempire itself created space for the emergence of a counter-empire of resistance.

1.4. Chapter Summary

The chapters that follow provide a multifaceted exploration of the Indian encounter with *Bt* technology within a neoliberal context. In Chapter 2, I provide an analysis of how a discursive and institutional space was created as part of the rationalization of *Bt* biotechnology, laying a foundation for the bioempire to emerge. In Chapter 3, I explore various aspects of the regulation of *Bt* cotton in order to understand how the regulatory framework facilitated the emergence of a new form of empire. I begin by exploring a range of issues related to the introduction of *Bt*

technology in India, and how biosafety standards around the technology were developed, implemented and contested. In Chapter 4, I trace how bioempire was extended and consolidated further into India through a transformation of the institutionalized agricultural research system, the privatization of agbiotech knowledge, and a convergence of institutional patterns via globally dispersed agbiotech knowledge production practices and intellectual property regimes. In Chapter 5, I explore the political struggles that characterized the emergent empire of resistance. The manner in which the multitude was mobilized to subvert or reconfigure *Bt* technology is highlighted. The concluding chapter pulls the preceding analysis together to take a combined look at the four processes of rationalization, standardization, privatization and mobilization that led to the emergence and stabilization of the bioempire. I synthesize the preceding chapters in order to show how each contributes to our understanding of the making of a bioempire in India.

CHAPTER 2:
**RATIONALIZING *Bt* TECHNOLOGY: CONSTRUCTING A DISCURSIVE AND
INSTITUTIONAL SPACE FOR *Bt* COTTON**

In 2002, the commercial release of *Bt* (*Bacillus thuringiensis*) cotton in India signified a landmark policy decision related to technology and agriculture. With this crucial policy move, the historical alliance between biological sciences and the state, which first emerged under the imperial British rule, was transformed into a new form of biopolitics. Central to this biopolitics was the ability of a network of actors, such as the global neoliberal institutions, the Indian state and the technoscientists, to characterize certain crops as sick and failing, thereby creating a need to heal them through biotechnology. For more than a decade before this policy decision, a discursive and institutional space was gradually created as part of the rationalization of agbiotechnology. As the politics around *Bt* cotton became increasingly contentious, the policymakers along with their corporate partners used discursive and institutional strategies to justify the need for *Bt* cotton in India.

This chapter explores the mechanisms through which various actors constituted a “cotton pest problem” during the decade preceding the policy decision of 2002. It analyses the way in which the problem was articulated by the actors, thereby placing the *Bt* cotton policy decision in a broader political economic context. The concern of decreasing yields of the cotton crop due to the attack of cotton pests is located at the intersection of other issues related to the rationalization of this technology, such as the ‘modernization’ of cotton production in order to compete in a global market. Exploring these issues will help to place the controversial *Bt* cotton policy decision of 2002 in a broader perspective. In the later chapters we will see that the creation of such discursive and institutional space is bound up with the practices of agbiotech governance

within the context of the new world order. Although an analysis of discursive strategies does not provide a full picture of the emerging bioempire, the emphasis on discourse in this chapter provides a useful starting point for thinking about how the “cotton pest problem” and the issue of cotton yields was understood and engaged by various actors.

In the **first** section of this chapter, using the history of the development of *Bt* cotton by a transnational corporation, I show how the troubling aspects of this new technology were carefully black boxed with an aim to maximize profits. The process of black boxing involved reducing a complex pest problem to a single gene, overlooking multiple factors that could influence the expression of the selected gene, and choosing a misleading nomenclature in order to capture the market. In the **second** section, I explore the discursive and institutional mechanisms by which the neoliberal regime linked the cotton cultivation in India to the global cotton market. I specifically explore the manner in which the envisioned “revolution” in cotton productivity led to a revamping of the old development apparatus to suit the neoliberal goals of market expansion. In the **third** section, I contextualize the creation of a discursive and institutional space for *Bt* cotton within a broader policy context. Tracing the history of the state-sponsored, technology-led modernization process, I highlight the discursive struggle around *Bt* cotton, and its rationalization as a pest control strategy, within a field of competing policy narratives. In the **fourth** section, I explore the process by which different actors framed their arguments for and against *Bt* cotton, using the issue of intensified agrarian crisis as a common discursive resource. By assigning the reason behind the decreased cotton yields to a “cotton pest problem”, as opposed to the effects of neoliberal policies, the policymakers framed the argument in favor of *Bt* cotton. Finally, the **fifth** section focuses on the rationale and strategy behind the birth of agbiotech industry in India. The transnational corporation holding the patent on *Bt* cotton

engaged in institutional and discursive strategies to further its project of transnational expansionism through agbiotechnology. This included an alliance with the biggest local seed company, the decision of backcrossing the selected gene to the Indian varieties, the strategic alliances with a prestigious local research facility and prominent seed enterprises, and its aggressive promotional strategies.

2.1. Rationalizing Technological Irrationality

The roots of the story of *Bt* technology in India can be traced back to 1911, when in the province of Thuringia in Germany a scientist named Ernst Berliner discovered that a commonly occurring bacterium of the region, *Bacillus thuringiensis*, could act as an insecticide against the local flour moth. This led to the commercialization of an insecticide using this bacterium in France in 1938 and in the USA during the 1950s (Ramani, 2008). Subsequent generations of the product were marketed in the form of a bacterial spray (Bharathan, 2000). Around 1982, scientists in Monsanto¹⁹ succeeded in isolating a gene from *Bacillus thuringiensis* (*Bt*) that is responsible for the production of a toxin that kills plant pests by blocking their mid-gut receptors, which leads to their loss of appetite and subsequent death. They managed to insert this gene, *CryIAc*, into cotton seeds, thereby creating a product that was named by Monsanto ‘*Bt* cotton’. The transgenic seeds were supposed to provide protection from the potentially devastating American bollworm (*Helicoverpa armigera*), which would die upon ingesting any part of the transgenic crop.²⁰ As a result of this genetic intervention, the cells of cotton plants would act as virtual pesticide factories. Having thus introjected (Marcuse, 1964) the pest control mechanism into plant cells, a technology of genetic biopower came into existence that had a self-reproducing

¹⁹ Monsanto was a leading agrochemicals company in the US then, and a global leader in agbiotechnology now.

²⁰ The term “transgenic” is synonymous with “genetically engineered” as it is commonly used. A transgenic crop is one that has been bred following the insertion of a gene from another species, and which exhibits the characteristics conferred by that gene.

potential. As the capability to kill *lepidopteran* pests²¹ would be reproduced with every crop cycle, Monsanto claimed that the agricultural productivity and the entailing profits would be maximized through controlling crop pests and eliminating pesticide sprays.²²

In this new form of technological rationality, the elements of irrationality were cleverly camouflaged. Instead of naming this technology after the specific gene (*CryIAc*) that was introduced in cotton seeds, the scientists at Monsanto chose to use the blanket term of *Bt* to hide troubling aspects of the technology. Through such a rhetorical strategy, the process of genetic reductionism inherent in *Bt* technology was concealed, whereby a complex problem of cotton pests was reduced to a single gene. *CryIAc* is one of a large family of *Cry* genes producing protein toxins that act on a range of pests (Bharathan, 2000). The generic name used by Monsanto hid the fact that the toxic protein created by the *CryIAc* gene would have no effect on a host of pests that thrived in different agro-climatic zones. Also, the genotype of transgenic cotton would behave differently in different areas and seasons, and the expression of the gene would be influenced by the cultivation and management practices of a particular region.²³ Given that the expression of the *CryIAc* gene would be influenced by several factors inherent in the environments in which cotton was cultivated (interview),²⁴ the effectiveness of *Bt* cotton is dependent on the interaction of a range of genotypic and phenotypic variables. As the technology using *CryIAc* gene was originally developed in the US, using the American cotton variety

²¹ Notably, the American bollworm

²² See, website of Monsanto India <http://www.monsantoindia.com/monsanto/layout/products/default.asp> (accessed on June 21, 2008).

²³ Monsanto website, <http://www.monsanto.com/biotech-gmo/asp/> (accessed on May 12, 2008)

²⁴ a) The physical and chemical characteristics of the soil, b) the quantity, periodicity and distribution of rainfall and/or irrigation facilities, and c) the range of temperature--these are the factors that have a direct and indirect influence on the expression of the *CryIAc* gene. These factors, which vary from country to country and even within a country from region to region, are very critical to the success of the transgenic cotton seeds.

Cocker 312, it is less suitable for the cotton varieties cultivated outside the US.²⁵ The suitability of *Bt* cotton for the 15 agro-climatic zones and 120 sub-zones in India would depend on careful consideration of these variables.

Besides the genetic reductionism, a pure marketing logic influenced the labeling of this technology as *Bt*. Since the bacterial spray that was used previously had found a market niche, the generic name of *Bt* would allow Monsanto to capitalize on the familiarity and acceptance of the previously existing technology in public perception. This would also deflect attention from the potential of the new technology to increase the resistance of the *lepidopteran* pests to *Bt*. While the bacterial spray is applied at specific points in the crop cycle, and the toxic protein mostly degrades quickly in the soil, the insects are faced with the toxin in large concentrations for short periods of time. This makes it harder for *Bt*-resistance to evolve in the insect. With genetically engineered cotton, the toxin is produced at all times, thereby increasing the selection pressure on the insects. The pests respond to the persistent exposure to the toxic cotton plants by increasingly evolving their resistance against *Bt* toxins. Thus, the potential for failure of *Bt* technology was carefully hidden behind the selected generic nomenclature, and problematic issues were blackboxed in this new technological package. Having done that, Monsanto set out to commercialize this technology using the brand name of Bollgard I, first in the US and later across the world. Meanwhile, in India, the cotton pest complex that includes 160 species of insects (Manjunath, 2004; Dhawan and Simwat, 1996) became an overriding problem for the

²⁵ “Transgenic *Bt* technology: Variations in gene expression,” available at http://www.monsanto.com/biotech-gmo/asp/biotech_blogs.asp?yr=2009&newsId=nr20090102 (accessed on April 20, 2009).

Highlighted by Dr. C. Kameswara Rao, a botanist associated with the Foundation for Biotechnology Awareness and Education, Bangalore, on the Monsanto website.

policymakers around the time when the Indian state embarked on a path of liberalizing its economy in the early 1990s.

2.2. Co-evolution of *Bt* Cotton and the Neoliberal Regime in India

Faced with a fiscal crisis, and under the compulsions of the global financial institutions such as the IMF and the World Bank, the state adopted a policy of structural adjustment to link its economy to the emerging global market (Bagchi, 1994; Patnaik and Chandrasekhar, 1998).²⁶ The productivity of Indian cotton was problematized within this historical moment of the rise of neoliberalism, a political-economic doctrine that has a free market and free trade as its main characteristics. Under the rules of the global deregulation institutions, such as the WTO, there was a dismantling of the state-controlled price-fixing in agriculture, an abolition of subsidies for agricultural inputs, and the liberalization of trade in agricultural products. These policy instruments were designed to decrease the state regulation of transboundary flows of agricultural technologies and agricultural products. And, riding on this opportunity for market expansionism, Monsanto offered its *Bt* cotton package as a technical instrument for fulfilling the neoliberal ambition of maximizing profits in the cotton sector.

The beginnings of the neoliberal reforms are often dated to such iconic events as the presentation of the first union budget speech of the then finance minister in the Congress government, Manmohan Singh,²⁷ to the federal parliament in 1991 (Corbridge and Harris, 2000). As the architect of the economic reforms, Manmohan Singh represented a breed of economists trained by elite educational institutions abroad in the philosophy of market liberalism. Ushering in the new political-economic configuration of *laissez-faire*, the finance minister proposed a

²⁶ For a broader discussion on the debt crisis and economic reforms in developing countries, see, for example, Nelson (1990), Haggard and Kaufman (1992), Stallings (1992), Kahler (1990 and 1992), and Babb (2001).

²⁷ "Profile: Manmohan Singh," available at http://news.bbc.co.uk/2/hi/south_asia/3725357.stm (accessed on April 30, 2010)

major departure from the earlier protectionist and inward-looking import substitution policies. By loosening restrictions on the activities of transnational corporations through abolishing licensing in the seed sector, and by giving automatic approval to foreign technology agreements and to Indian subsidiaries with up to fifty-one percent foreign equity, the government facilitated the growth of a private sector seed industry (Seshia, 2002).²⁸ The privatization of the seed sector and opening up of the market to external investment were accompanied by induced changes in crop cultivation. In the early 1990s, the global costs of commercial crops such as cotton were rising due to trade liberalization under the emergent WTO regime. Since the policy of the government was also to increase exports from the agricultural sector, with an aim to earning higher foreign exchange, unregulated export of raw cotton²⁹ was allowed. This set in a period when millions of farmers made a sudden switch from food crops to cotton to make quick profits as the global price of cotton was on the rise (Patnaik, 2002, 2004). The logic of an export-oriented economy led to a phenomenal expansion of areas growing cotton, and a change from cultivating food crops, such as *jowar* and *ragi*, to growing cotton took place.

As cotton cultivation was increasingly linked to the political economy of the new global order, the Cotton Corporation of India (CCI) reported that the quality of Indian cotton was far from satisfactory to compete globally. According to the CCI, the Indian cotton fiber would fail in the global market because it had a large number of contaminants, such as pesticide residues,

²⁸ The government restrictions on the production of hybrid seeds imposed through a licensing policy was relaxed in 1987. And, in 1988, the import of seeds was freed from government control under the Plants, Fruits and Seeds Order. The National Seed Development Policy in 1988 allowed firms based in India to enter into collaboration with foreign firms to import seeds. The Indian seed companies thus became the subsidiaries of these large TNCs. The period from 1987 to 1989 laid the foundation for the development of a strong private sector seed industry in India during the 1990s. The program of economic liberalization launched in 1991 served to hasten the process remarkably. Private sector seed investment in India more than tripled between 1993 and 1997.

²⁹ Three years before 1990-1991, about 34,000 tons of raw cotton was being exported. The moment this sector was opened up, in a single year there was a jump of 3, 74, 000 tons in the export of raw cotton – that is, more than a tenfold jump in a single year (Patnaik, 2004). On an average, for three or four post-reform years, it was over two lakh tons a year.

besides being inconsistent in thickness and length. The policymakers were particularly concerned about the pesticide residues in cotton because of the regulation of the World Trade Organization (WTO). The WTO imposed restrictions on trade in agricultural products bearing traces of pesticide through the instruments of non tariff barriers³⁰ or sanitary and phytosanitary measures (SPS).³¹ The CCI was also concerned that even though India ranked third globally in cotton production, following China and the U.S, its cotton yields per hectare were one of the lowest in the world. Furthermore, the cotton crop was reported to consume approximately half of all the pesticides used for agricultural purposes in India, even though it occupied only around five percent of the total cultivated area in the country (CCI, 2000; ISCI, 1999).

By linking pesticide consumption with the yields of cotton, the CCI created a discursive space for the incorporation of the *Bt* gene into major varieties of cotton. The latter promised to cut down by half the use of insecticides and to save cotton worth five to ten billion rupees, approximately 100 million to 200 million US dollars, annually (BBC, 1992). The important raw material for this narrative of improving the quality of cotton and increasing the efficiency of cotton cultivation came from the dominant discourse of bringing in a “revolution” in cotton productivity. The idea of a revolution in cotton cultivation came from the policymakers higher up in the government, and was considered necessary to confront the challenges posed by the new world trade order under the WTO regime. In this discourse, *Bt* cotton acquired the meaning of a technology that could not only contribute to economic progress by harmonizing cotton cultivation with the requirements of the global market, but also to help increase the competitiveness of the country in the emerging global economy.

³⁰ Under the WTO, non tariff barriers are all measures other than normal barriers, namely trade related procedures, regulations, standards, licensing systems, and trade defense measures such as antidumping duties etc.

³¹ See: “Pesticide Applications in *Bt* cotton Farms: Issues Relating to Environment and Non Tariff Barriers,” available at, <http://www.ecoinsee.org/fbconf/Sub%20Theme%20E/Lalitha.pdf> (accessed on May 5, 2009)

Registered under the Companies Act of 1956, the CCI emerged initially as an agency that saw itself in welfare-statist terms, assuming a responsibility of “equitable distribution of cotton among different constituents of local industry, and to serve as a vehicle for the canalization of imports of cotton.”³² As a nodal agency of the government, it was set up to undertake the price support operations of *kapas* (cotton). Under this strategy, the agency would purchase cotton from the farmers under the Minimum Support Price (MSP) operations without any quantitative limits. Before the export-oriented economy of cotton took root, the technical practices of the CCI were deliberately dovetailed to benefit the cotton growers on the one hand and to supply cotton to the textile mills on the other.

With a shift in the economic goals, the agency geared itself to develop and modernize cotton in order to make it saleable in the global market. Since exports of cotton were now placed under the OGL (Open General License) rules and regulations of the WTO (World Trade Organization),³³ the feasibility of export from the country was viewed as directly linked to producing surplus cotton with parity in prices and quality of international standards. Using the technical devices of harmonization and standardization in cotton cultivation and exports, the agency played a central role in characterizing cotton as problematic through its narratives of productivity, efficiency and competitiveness in the emerging global market, and constructed a discursive normativity (Gottweis, 1998) that articulated a strong need for *Bt* cotton (Choudhary, 2001).³⁴

³² CCI website: <http://www.cotcorp.gov.in/objectives.asp> (accessed on Aug 9, 2008)

³³ India is a signatory to the WTO.

³⁴ Also see: “Area under cotton may rise 12 pc-- *Bt* cotton coverage likely to treble” at <http://www.thehindubusinessline.com/2003/09/06/stories/2003090601021100.htm> (accessed on Sept 20, 2009)
And, CCI website, available at <http://www.cotcorp.gov.in> (accessed on Aug 8, 2008)

Dissatisfied with the development apparatus that the agency had deployed since the early 1990s, the CCI held that the agricultural extension services were inadequate to meet the goals of economic profitability and competitiveness in the new global market. As a result, the agricultural extension practices such as Cotton Crop Surveillance, Integrated Pest Management and Integrated Cotton Cultivation³⁵ in various cotton growing states were reconfigured to improve yields and reduce the costs of cotton cultivation. By 2000, these services were subsumed under an ambitious project of the Technology Mission on Cotton (TMC), which linked the Indian Council of Agriculture Research (ICAR), the Department of Agriculture (DOA), and the Ministry of Textiles (MOT) into an institutional apparatus to bring about “tangible improvements in the productivity and quality of cotton in the country.”³⁶ The battery of experts started designing developmental programs and strategies on behalf of poor farmers to radically simplify cotton cultivation so that it could be more directly apprehended, managed and controlled by the agencies (Scott, 1998). Under the Mini Missions III and IV of the TMC, and as one of its implementing agencies, the CCI sought to deploy *Bt* cotton in its developmental interventions to meet the laid down targets. And, a growing will to link *Bt* technology to the goal of economic progress became hegemonic in the network of power represented by the experts in CCI, ICAR, DOA and MOT.³⁷

2.3. Discursive Struggle around *Bt* Technology

While the conceptual apparatus of neoliberalism was mainly guided by market rationality, the political space for *Bt* technology was partially constructed within the traditional policy goal of state-led modernization. After independence in 1947, science and technology

³⁵ CCI website, available at <http://www.cotcorp.gov.in/developmental.asp> (accessed on Aug 10, 2008)

³⁶ See: CCI website, <http://www.cotcorp.gov.in/developmental.asp> (accessed on Aug 10, 2008)

Also, <http://www.kapasindia.com/tmconline/root/common/news.asp> (accessed on Aug 20, 2008)

³⁷ CCI website, <http://cotcorp.gov.in/developmental.asp> (accessed on Aug 10, 2008)

became central to the Nehruvian project of modernizing India (Prakash, 1999). Technology based projects were hailed as the temples of modernity, while science and technology were linked to the central planning process that focused on large-scale industrial development. The advent of the Planning Commission led to a centralized, state-led institutional framework for delivering the products of science and technology, with the central government seen as initiator and promoter in such nationalist initiatives. The path of development was defined by the project of nation-building, inspired by ideals of *swaraj*(self-rule) and *swadeshi* (of one's own country) drawn from the independence movement against the British. These ideals were re-interpreted in the post-colonial context to mean attaining self-sufficiency in food production. Following Nehru's death in 1964, the focus of the metanarrative of modernization gradually shifted from heavy industry to agriculture (Subramaniam, 1979), and over time the agricultural modernization emerged as a technical enterprise led by western educated experts.

The potential of biotechnology to modernize agriculture caught the imagination of the Indian policymakers within a specific political discourse of developmentalism. Following the celebration of the supposed success of the Green Revolution,³⁸ the policymakers tried to justify the adoption of agbiotechnology against the technological paradigm of the Green Revolution. The contestation around the outcome of the green revolution was largely ignored in the agbiotech policy discourse.³⁹ The technological paradigm of the Green Revolution was based on the capitalist values of an efficient extraction of natural resources for the maximization of agricultural output and profits, mainly under the state supported material framework of

³⁸ In India, the Green Revolution era lasted from the late 1950s to approximately 1970. It was a technology package involving modern seeds, termed "high-yielding" varieties, controlled irrigation and high doses of fertilizers and pesticides.

³⁹ Various analysts had shown that green revolution was not neutral in terms of its socio-economic impact, which created an income cleavage between farmers with large landholdings and better access to inputs like agrochemicals and water. The water and chemical intensive production technology of the green revolution had also led to degradation of soil and groundwater resources (Murgai, Ali and Byerlee, 2001). In addition, it was responsible for a significant loss of bio-diversity and an increased dependence of farmers on expensive agro-chemicals (Shiva, 1989).

agricultural research and extension infrastructure, coupled with a policy representation of increasing food security. The introduction of *Bt* technology was justified under the same technological paradigm (Shah, 2005), which asserted that any life form in cotton fields, be it plant or organisms, that did not increase agricultural production was pathological, thus worthy of extermination.

With the vision of development guided by the notions of technical progress and modernization through the application of scientific knowledge, the government set out to write the institutional framework of biotechnology under its sixth five year plan in the early 1980s. In this plan, an agency called the National Biotechnology Board (NBTB) under the Ministry of Science and Technology was constituted to identify needs and priorities in biotechnology. The NBTB was upgraded in 1986 into a full-fledged Department of Biotechnology (DBT) in recognition of “the need for a focal point in the administrative structure of the government for planning, promotion and co-ordination of biotechnological programs” (Chaturvedi, 2002, p 3). Gradually, the DBT came to play an important coordinating role in creating a space for biotechnological research and development (R&D), and subsequently provided legitimacy to the policies related to *Bt* technology. With time, six other major agencies⁴⁰ were enrolled to finance and support research in biotechnology in public sector universities and laboratories. Within this institutional network, the experts defined agbiotechnology and economic growth as intrinsically related to each other, thus reinforcing the desirability of *Bt* technology in the cotton sector.

As the high-modernist agencies such as CCI and DBT rationalized *Bt* technology as a sustainable pest control strategy, essentially two narratives were woven to promote agbiotechnology among the apprehensive publics. In the first rhetorical strategy, technoscientists

⁴⁰ These are Department of Science and Technology (DST), Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian council of Agricultural Research (ICAR), University Grants Commission (UGC), and Department of Scientific and Industrial Research (DSIR)

like M.S. Swaminathan⁴¹ represented the Gene Revolution as succeeding and improving upon the earlier Green Revolution. By assimilating the new and the old narratives, *Bt* technology was framed not only as a new technology, but also as a continuation of the technologies of the green revolution. Experts following this line of argument claimed that since the gains of the green revolution had reached stagnation, and the salinity of green revolution lands had reduced the productivity of crops, agbiotechnology would repeat the success of the green revolution. Connecting the narratives of the green revolution and agricultural sustainability, the economists and scientists advocating neoliberal policies constructed *Bt* technology as a natural and necessary outcome of the green revolution, hence a part of an “evergreen revolution.”⁴² Some commentators assumed that a gene revolution would revive the stalled green revolution, in spite of the institutional and geopolitical differences that would make the new revolution different from its predecessor (Parayil, 2003; Seshia and Scoones, 2003). There was, however, a good deal of continuity between the two eras in terms of the shared technological culture and the agrarian social structure (Shah, 2008).

Notwithstanding the common technological paradigm, the agbiotech revolution was ushered in against a very different set of political economic forces. Unlike the green revolution, which was a public sector initiative coordinated through an international network of national and international agricultural research and policy initiatives,⁴³ the gene revolution was mainly a

⁴¹ M.S. Swaminathan is an influential scientist who is seen as the father of the Green Revolution in India, and a statesman of sustainability; and now a strong advocate of agricultural biotechnology. Hailed as a green revolution hero, Swaminathan got a doctorate at Cambridge (UK) and a post-doctorate at Wisconsin (USA). Beginning his illustrious career in Central Rice Research Institute in Cuttack (India), he moved on to become the director of the International Rice Research Institute at Philippines, and eventually retired to Chennai (India) to create the MS Swaminathan Research Foundation (MSSRF).

⁴² This term is borrowed from M.S. Swaminathan, who is regarded the father of India’s green revolution (Swaminathan, 1996).

⁴³ In particular, the CGIAR (Consultative Group on International Agricultural Research)--an international network of national agricultural research institutes, such as International Maize and Wheat Improvement Centre (CIMMYT)

private sector led process. As a global project to penetrate and discipline markets, the agbiotech revolution reflected a changing balance of power between the states and markets in a neo-liberal era (Goodman and Redclift, 1991; Strange, 1996; Brooks, 2005). As a result, the developmental goals of self-sufficiency were increasingly replaced by the logic of global competitiveness based on comparative advantage. This rhetorical strategy overlooked the fact that the making of a *Bt* technology revolution would have fewer characteristics of a national project. Although a department of biotechnology exists at the centre, its influence in the regulatory realm or on the R&D efforts became increasingly small over the years, compared to the private sector.

In line with the modernization discourse, national politicians at the centre, from the Prime Minister down, regularly proclaimed the benefits of agbiotechnology in transforming India into a “modern, technologically-advanced country” (Ex-Prime Minister A.B. Vajpayee’s Speech, 2001). Underlying the rhetoric of promoting a scientific revolution in agriculture was recognition of the increased dependence of biotechnology on experts networking across diverse skill bases and between disparate geographical sites. Biotechnology, like the IT sector, is dominated by a global elite that moves between global spaces with ease. For instance, biotechnology labs and institutions in cities like Bangalore⁴⁴ are linked globally to flows of finance, expertise and technology, and are connected to each other by an entrepreneurial and influential diaspora, as well as by multinational corporations (Scoones, 2007). *Bt* technology was introduced in India within this context of an emergent new economy that is decentered, diffused, fragmented and network-based (Castells, 1996), so different from the economy within which the green revolution took place.

in Mexico, International Rice Research Institute (IRRI) in the Philippines, and Indian Agricultural Research Institute (IARI)--with a strategic direction provided by the International Food Policy Research Institute (IFPRI) in Washington, USA (Brooks, 2005)

⁴⁴ Bangalore is the capital city of the state of Karnataka in Southern India.

Thus, some politicians such as S.M. Krishna,⁴⁵ who belonged to the political party of Congress that had ushered in the economic reforms, pushed the idea that biotechnology is a natural successor, or complement, of information technology (IT) in a liberalized, globalized economy. Rejecting the alternative discourse in which biotech succeeds or continues the green revolution, the slogan of “IT to BT”, not “Green Revolution to Gene revolution”, was sold to the public. By labeling biotechnology as an information technology, *Bt* technology was represented as an innocuous technology⁴⁶ that would help achieve agricultural sustainability by changing genetic information into material products. In some southern states like Karnataka, such an image of *Bt* technology was created within a broader context of the linkage between biotechnology and the acceptable and well-known IT model of contract research and bioinformatics (Scoones, 2005). As the reaction against GM foods in the West started reverberating through media commentaries and public protests by farmers’ groups and environmental activists, the core biotechnology policy network in some states such as Karnataka realized that going down the Gene Revolution line would be politically risky. Instead, they framed *Bt* technology as a part of the IT technology revolution, which had brought the middle-classes and software professionals unprecedented benefits, and would impart the former a greater public acceptability.

Within such a discursive economy, the process of rationalizing *Bt* cotton took on a theatrical character with the two policy narratives competing for dominance. While the technology captured the imagination of the policymakers and the public, these discourses represented the domestication of anxiety and a semiotics of desire (Vishwanathan and Parmar, 2002). After a protracted discursive struggle, *Bt* technology started emerging as a technology of

⁴⁵ S.M. Krishna was the chief minister of the state of Karnataka in 1999.

⁴⁶ Representation of agbiotechnology in such a way obscures its potentially negative ecological and health effects.

choice for the technocrats over the technologies of the green revolution. The latter were increasingly regarded as scientifically outdated, politically controversial, and economically unviable. The modernization of cotton farming had already culminated in intense pest infestation, besides pushing the farmers into huge debts of merchants to invest in expensive, certified hybrid seeds, pesticides and other chemicals necessary for cotton farming.

2.4. Simplifying a Complex Agrarian Crisis

As the economy-related protectionist policies of the welfare state started weakening, the state-led experts defined and applied more sophisticated technical criteria to create legibility for a cotton sector in which certain entities, such as cotton pests, were targeted for systematic erasure (Scott, 1998). The incorporation of cotton into the emerging system of global capital had already created a powerful rationale for a huge leap in the scale in which nature in the form of cotton pests came to be subjected to technoscientific control. The network of experts started to justify the need to adopt *Bt* cotton as a cutting edge technology that could have a great potential to solve the problem of quality, productivity, and production costs in cotton. This form of agriculture relied on a simple production and profit model of agricultural research and extension, which would become the guiding rationale for the adoption of *Bt* cotton.

The market oriented legitimization of *Bt* technology did not take into account the role of the neoliberal agricultural policies that had led the cotton sector into a period of acute crisis by the mid-1990s. The new policies focused on encouraging private sector investment in agricultural research and extension. Historically, agricultural research and extension had been sectors where the welfare state invested heavily, as these were considered domains of public good. The widespread network of specialized research laboratories under the Indian Council of Agricultural Research (ICAR) and the publicly funded agricultural universities, working with

and through the National Extension Service (NES), contributed significantly to developing and diffusing agricultural inputs and practices (Vaidyanathan, 2000). Under the trade liberalization regime, the Indian state had to withdraw its subsidies on seed, pesticide and fertilizer supply (Gulati and Sharma, 1995; Gulati and Bathla, 2001), and to wind up its agricultural extension services due to the neoliberal doctrine of giving a free rein to the market (Reddy, 2008).

With the increasing privatization of the public domain of agricultural research and extension, the supply emphasis of the earlier NES was gradually replaced with demand-driven and competitive extension network. However, concurrent with the weakening of the public sector, an increasing control of private industry over agricultural research and extension could not substitute for the public extension service. The general malady of the new agricultural research and extension service was noted by the distinguished agricultural scientist and the architect of Green Revolution in India, M.S. Swaminathan, in an interview to *Frontline*. Reminiscing about the nation-building efforts of scientists of the 1950s and 1960s, Swaminathan explained that “the success of agricultural research depends on the effectiveness of co-operation and linkage between research, extension, input delivery systems and an assured remunerative marketing policy.” However, he argued that the “strands of cooperation and linkages among various actors are getting weakened.”⁴⁷ Such views were echoed in the recent Planning Commission review, that highlighted that the sluggish growth in Indian agriculture in the 1990s was mainly due to “weakened support systems,” and in particular, “unresponsive agricultural research, nearly broken down extension and inadequate seed production, distribution and regulation” (GOI, 2005, p 197). The decline in the quality of NES and the weakening of the public institution of the State Seed Corporation were critical factors associated with the failure of

⁴⁷ See: “For an evergreen revolution,” available at: <http://www.hinduonnet.com/fline/fl1627/16270940.htm> (accessed on May 20, 2009)

the cotton crops. With no regulation and overseeing of the quality of the inputs that went into cotton cultivation, the yields of cotton started going down.

For millions of farmers who had not practiced cotton cultivation traditionally, but made the switch to earn higher profits, the capital intensive and market-driven cotton farming necessitated taking loans to buy expensive and unregulated inputs. From 1996 onwards, the global prices of cotton started crashing and practically fell to half by 2001. So, a situation was created where farmers went in for a heavy level of indebtedness to *sahukars*, the private moneylenders, at a high cost due to a withdrawal of low-cost institutional lending by the state under the new economic regime.⁴⁸ As the input prices of cotton cultivation went up and output prices crashed, an agrarian distress occurred that caused thousands of farmers to commit suicide because they were unable to repay the loans to the private moneylenders (Patnaik, 2004; NCRB, 2006). The critics of *Bt* technology claimed that the liberalization of the seed sector had given rise to a new kind of corporate feudalism (Shiva, 2000), which had brought global market forces together with the worst forms of feudal control. This was in reference to the removal of state protection to farmers and the reemergence of the feudal power of landlords and moneylenders, who provided credit to poor farmers to buy high cost inputs from global corporations sold through them. Development economists and anti-globalization activists added that the unprecedented rise in the suicide of cotton farmers was an indicator of the extreme policies of market freedom (Ghosh, 2003; Patnaik, 2004), and that the liberalization of the seed sector had led to the disempowerment of farmers, leading them to death (Shiva et al., 1999; Shiva, 2000; Sharma, 2002a, 2002b; SciDevNet, 2006).

⁴⁸ Before 1990s, farmers were inside the ambit of institutional credit which included the banking sector and the cooperative societies. But, after the financial sector reforms, they were thrust outside the protection of the institutional credit. The number of beneficiaries in development programs like the Integrated Rural Development Program (IRDP) also came down sharply in the post-liberalization period (Patnaik, 2004).

Meanwhile, some opponents of *Bt* cotton argued that much of the crisis afflicting cotton was due to the indiscriminate use of pesticides. And, that a need for excessive sprays of pesticides on cotton had been created by agricultural experts to benefit the chemical pesticides industry (Sharma, 2002a & 2002b). Since the tiny insect develops resistance to the pesticide cocktail, it ends up resisting as many as fifteen to twenty sprays. As cotton crop is susceptible to both bollworm and sucking pests, cotton alone consumed nearly 55 to 60 percent of the total quantity of pesticides sprayed in the country (APCoAB Report, 2006). Generally, farmers use pesticides as a precautionary measure or on noticing any pests on plants without any regard to the threshold limits of the pests. Hence the cost of the insecticide is greater than the benefits it provides (Dev and Rao, 2007). In this sense, the critics claimed, the American bollworm turned out to be a boon for the pesticide industry, and later became one for the biotechnology corporations. And yet, the villain was not the American bollworm alone. The abundance of benign insects available in the cotton fields get killed when the first pesticides are sprayed in a crop season. Bereft of its natural enemies, the cotton bollworm tends to appear stronger after each pesticide spray. As the pesticides disturb the delicate equilibrium of nature, many of the little known pests of cotton such as the white fly, *Bemisia*,⁴⁹ also emerge as major threats to cotton crops. While the adoption of *Bt* cotton was supposed to give protection against the bollworm, it would not offer protection against the sucking pests.⁵⁰

Ignoring the critique against the new agricultural policies and *Bt* technology, the neoliberal cadre of scientists and economists invoked an image of pests posing serious threat to cotton production. They maintained that the crop failure resulting from the resurgence of the

⁴⁹ *Bemisia* is a non-*lepidopteran* insect.

⁵⁰ See: "Pesticide Applications in *Bt* cotton Farms: Issues Relating to Environment and Non Tariff Barriers," available at, <http://www.ecoinsee.org/fbconf/Sub%20Theme%20E/Lalitha.pdf> (accessed on March 11, 2009)

dreaded American bollworm was responsible for the intensified agrarian distress. Some of them highlighted that the Indian cotton production was third in the world in quantity, but it was substantially low in productivity due to damage caused by insect pests, notably *Helicoverpa armigera* (Barwale et al., 2004). And, others maintained that among the bollworms, *H. armigera* was the most dominant and difficult to control chiefly due to its widespread insecticide resistance, and prolific pattern of breeding and high polyphagy. It was considered to be a highly destructive and wasteful feeder in the sense that a single larva could damage many squares and bolls (Manjunath, 2004). They also made a case against chemical pesticides that were used extensively on cotton crop for control of insect pests, which, they claimed, had led to financial losses to the farmers.⁵¹ This, they argued, had frustrated the farmers, scientists and policy makers alike. So, for them, *Bt* cotton came at a time when they were desperately looking for an alternative and dependable pest control measure.

To lend force to this narrative struggle, the suicides of farmers was invoked as a discursive resource by both the supporters and opponents of *Bt* cotton in order to ethically justify their stand for or against *Bt* technology. Through this regime of representation, the tiny pest (American bollworm) came into public visibility and a protracted contestation over its relationship to the use of pesticides followed. This representation overlooked the fact that *Bt* cotton, developed to provide resistance to American bollworm in the context of the North American agriculture, might not work in the Indian agro-climate. The transfer of this technology to India to control an entirely different pest complex was mainly guided by market logic, and created a synoptic view of the complex agrarian crisis. Through this process of simplification

⁵¹ Though the main losses in cotton are reported to be due to its susceptibility to about 160 species of pests and a number of diseases that hit the tropical crops (Manjunath, 2004), the policymakers targeted cotton bollworms⁵¹ as the only cause for the annual losses of around 300 million US dollars (APCoAB Report, 2006).

(Scott, 1998), the high-modernist, neoliberal actors intended to privilege an imported technology over the evolutionary, ecological and organismic aspects of indigenous agriculture.

By creating an image of the belligerent pest complex as the cause behind the reduced cotton yields, the neoliberal apparatus constructed the need for *Bt* technology as a new technological fix for the pest menace. Using a process of geneticization (Gottweis, 1998), the issue started to be framed in terms of genes and genetic resources. Challenging the view that transgenic crops require fewer agrochemicals, the critics argued that instead of controlling pests, weeds and diseases, genetic engineering increases chemical use, and could produce “superpests, superweeds and superviruses” for the plants due to the resistance developed by the pests (Shiva, 2001). Subsequently, researchers observed that bollworm larvae of a particular size and age indeed need supplemental treatment of chemical insecticides, so *Bt* cotton could only reduce the pesticide consumption and not eliminate it completely (Kranthi et al., 2005; Narayanamurthy and Kalmkar, 2006).⁵² It is possible that the policymakers were genuinely concerned and motivated by their desire to reduce pesticide use even as they favored the neoliberal policies, which were linked to the prospects of improving trade in cotton in a globalizing economy. While the adoption of *Bt* cotton provided them a different calculus to balance the benefits and costs of the policies, the governance of *Bt* technology ended up favoring the interests of the agbiotech industry more than those of the farmers (refer to chapters 3 and 4).

While the 2002 policy decision was hailed by the agbiotech industry, claiming that farmers were clamoring for *Bt* cotton, the critics and the organic farmers wanted the decision

⁵² Also see: “Transgenic *Bt* technology: Benefits,” available at: http://www.monsanto.com/biotech-gmo/asp/biotech_blogs.asp?yr=2009&newsId=nr20090102 (accessed on Feb 20, 2009)

Dr. C. Kameswara Rao, a botanist associated with the Foundation for Biotechnology Awareness and Education, Bangalore, expresses this view on the Monsanto website. However, this position may not be representative of the opinion of the corporation.

reversed. The latter argued that the introduction of *Bt* cotton was a sell-out to the transnational corporations, and was not in the interest of small farmers.⁵³ The strongest evidence supporting this claim came from a major experiment conducted by the National Centre for Integrated Pest Management, New Delhi, a couple of years prior to the commercial release of *Bt* cotton. Using 200 hectares of farmers' land in the state of Maharashtra, the scientists of the institute produced 1000 kilogram of cotton per hectare—three times the national average—without the use of pesticides or transgenic seeds (Jayaraman, 2002). Despite the astonishing result of this experiment, the government did not promote the integrated pest management (IPM) approach on a large scale; and, instead, succumbed to the pressure of the pro-agbiotech lobby to commercialize *Bt* cotton.

2.5. Birth of the Agbiotech Industry

The birth of the agbiotech industry in the country was facilitated by a combination of neoliberal market-oriented policies and greater global political economic integration. This enhanced the legitimacy of the global agbiotech corporations, such as Monsanto, and provided them with greater room for market maneuver. Upon getting a patent on *Bt* cotton in the US, Monsanto incorporated *Bt* technology in its project of transnational expansionism. In 1990, the corporation started negotiating a technology transfer arrangement with the Indian government, which would be India's first import of technology for genetic engineering to create improved plant species. By this time, the neoliberal technocrats in India had already started to construct the discursive and institutional space for *Bt* technology. Talks with Monsanto broke down in 1993 after the negotiating parties failed to reach an agreement on the financial terms of the transfer (Serageldin and Persley, 2003). Explaining the reasons behind the failed negotiation, the

⁵³ Small-holdings are common in India, with 65 to 70 percent of cotton farmers holding between 1 and 1.5 hectares (Jayaraman, 2002)

Department of Biotechnology (DBT) claimed that the technology transfer fee was too high, as the government was asked to pay about four million dollars to Monsanto to get the gene transfer know-how (interview).

At this point, the corporation approached the biggest Indian seed company Mahyco,⁵⁴ which was established in 1964 in the Indian state of Maharashtra by a plant scientist, B.R. Barwale. The corporation convinced the company to import its transgenic cotton seeds as part of a license agreement.⁵⁵ Under the terms of this alliance, Mahyco applied to the DBT and got permission to import 100 grams of Monsanto's *Bt* cotton seeds in 1995. To consolidate its position in the market, Monsanto bought a 26 per cent stake in Mahyco and went on to create a joint venture Mahyco-Monsanto Biotech India Limited (MMB) with 50 percent equity holding for each. This was a strategic move for Monsanto given that Mahyco's director Dr. Barwale is a well respected member of the Indian agricultural industry, who has been honored by the Indian government for his contributions to the agricultural sector (Gupta, 2000). And, his connections within the government extend beyond the DBT to many of the key agencies involved in biosafety regulation (Newell, 2003).

Following the strategic alliance with Mahyco, Monsanto expanded the strategy from selling *Bt* cotton to capturing the Indian agbiotechnology market. It opened a research facility with one of the best schools in India, the Indian Institute of Sciences (IISc) in Bangalore. Apart from the purchase of the state-of-the-art center for research for 20 million dollars, the corporation spent roughly 4 billion dollars to acquire several leading seed enterprises so as to improve access to the Indian market, including Mahyco (Assayag, 2005). In 1998, Monsanto

⁵⁴ Mahyco stands for Maharashtra Hybrid Seeds Company Limited.

⁵⁵ "*Bt* cotton through the backdoor" available at, <http://webcache.googleusercontent.com/search?q=cache:NFhoWj8AJcoJ:www.indiaenvironmentportal.org.in/files/BT%2520COTTON.doc+technology+transfer+terms+Bt+cotton+monsanto+government+India+failed&cd=3&hl=en&ct=clnk&gl=us> (accessed on March 20, 2009)

planned to take over Delta and Pine Land Company, the largest cotton seed company in the world, for 1.8 billion dollars. With the acquisition of the company, Monsanto would acquire ownership of Delta and Pine's patented terminator technology, which makes it possible to create sterile seeds, so that the farmers would not be able to utilize cotton seeds from the previous harvest. This would make the farmers totally dependent on the corporation, thereby giving the latter a monopoly control over the seed market. Though there were protests in India regarding the incorporation of terminator gene into *Bt* cotton seeds, the anti-agbiotech activists could not corroborate such allegations (for details about terminator gene controversy, see chapter 5).

After importing 100 grams of *Bt* cotton seeds, MMB incorporated the gene *CryIAc* into the local Indian varieties through backcrossing. This process of backcrossing represented a traditional breeding program with the stated disadvantages of multiple effects of unknown interactions in the genome. Therefore, the rapid, predictable and efficient transfer of a specific gene into an established variety did not hold in this case. Since India had the technical expertise to incorporate the appropriate gene directly into the local varieties, the rationale behind approving the MMB project is not clear. In an article to *Current Science*, Geetha Bharathan (2000) raised various technical issues regarding the backcrossing process. She sought clarification as to which Indian varieties were used in the backcrossing program, the way in which these varieties were chosen, and finally, whether the two years of backcrossing was a sufficient time to evaluate stability of the back-crossed varieties before the field trials began. Taking a lead from this article, the critics of *Bt* cotton challenged various aspects of the MMB project, mainly the science, project design, and bio-safety regulations underlying the decisions that led to the commercial release of this technology. These questions were not seriously

considered by the policymakers during, and after, the field trials of *Bt* cotton (refer to chapters 3 and 5).

Meanwhile, in order to capture the public imagination, Monsanto weaved together a range of rhetorical narratives to promote its technology. Through its publicity material and Indian website, Monsanto claimed that it can directly tackle the issues of food security since “India has to increase food production by 105 million tons by 2020...and biotechnology can grow more food without affecting the environment.”⁵⁶ The corporation went on to argue that “with advanced life sciences, we help feed the world and sustain and nurture the environment.”⁵⁷ The corporation further claimed that, “the major objective of the centre is to develop technologies aimed at meeting India’s food security needs in the next millennium.”⁵⁸ Such strategies of invoking the images of hunger have existed throughout the development era, whether it was the period of Green Revolution or Integrated Rural development programs. By bringing hunger to public awareness, a whole economy of discourses and unequal power relations get encoded in the body of the malnourished (Escobar, 1995). And, by representing itself in environmentalist terms, the corporation apparently made a paradigm shift from an economic rationality to ecological rationality. But, the two rationalities were intricately linked, since the transformation of nature into environment is integral to western economic thought and its project of the capitalization of nature.

The two central frames used by Monsanto of food security and environmental sustainability were embedded in myths or narrative constructions devised by the corporation in order to expand its reach into the Indian seed market, gain consumer confidence and facilitate

⁵⁶ See, website of Monsanto India <http://www.monsantoindia.com/monsanto/layout/products/default.asp> (accessed on June 20, 2008).

⁵⁷ Ibid.

⁵⁸ ibid

regulatory approval. These myths, as evident in the publicity material of the corporation, portrayed *Bt* cotton as a functional imperative and a technological fix to the pest menace of cotton crops. The corporation emphasized improved efficiency of seeds to construct a position in support of *Bt* technology. The narrative depicting *Bt* technology as a sustainable, environmentally friendly and developmental technology emerged in part from the frames used by global biotech industry. Many consumers and environmentalists suspect that the real intention of corporations, such as Monsanto, was to take control of food and farming, and believed that transgenic crops would undermine the sustainable livelihood of farmers in the country (ActionAid, 2003; Shiva et al, 2000).

In response to the backlash, Monsanto redoubled its efforts to depict transgenic crops as a technology that would benefit the poor (Glover, 2009). The narrative of “pro-poor technology” involved the radical simplification of the complex agronomic and livelihood contexts into which *Bt* technology was inserted, thus undermining the usefulness and relevance of the information that was presented to both policymakers and farmers. The ‘food security’ frame, though not directly applicable to *Bt* cotton, located the causes of hunger and malnutrition in low crop productivity; and, thus conceptualized gene technology as a solution to want and deprivation afflicting poor cotton farmers struggling in the Indian countryside. All these frames used by the corporation attempted to discursively construct a need for *Bt* cotton in ways conducive to the interests of agribusiness TNCs. Measured against Monsanto’s expansionist ambition and rhetoric of transforming the Indian agriculture, the introduction of *Bt* cotton opened up the avenue for a wave of mergers and acquisitions by the agbiotech TNCs (refer to chapter 4). The large life sciences corporations, such as Monsanto and DuPont, pursued these acquisitions as part of a broader strategy of integrating crop development, agricultural production and seed distribution.

This gave them greater control over the seed and agrichemical business and put them in a strong commercial position as suppliers of transgenic seeds to farmers as compared to the local seed firms.

2.6. Conclusion

This discussion has provided a layered reading of the rationale behind the introduction of *Bt* cotton in India. A reconstruction of the mechanisms that created a discursive and institutional space for *Bt* technology shows that in the genesis of bioempire the logic of capital accumulation guided the justification of the new technology. The technoscientific rationality, which had constituted the guiding principle for the modernist Indian state on the path of developmentalism for decades, was redefined and recast as a new rationality of economic efficiency of the agricultural sector in the neoliberal era. While the new paradigm of *Bt* cotton opened up the space for universalizing technoscientific solutions to cotton pest problem across territorial and agronomic boundaries, the mechanisms by which the actors justified, as well as contested, the rationale behind adopting agbiotechnology localized the global solution. And, in doing so, a mixed rationality was invoked that had both hidden and visible elements.

The political agency and economic power of the transnational corporations, backed by the global neoliberal institutions, such as the IMF, World Bank and the WTO, played a decisive role in situating agbiotechnology at the heart of contemporary biopolitics. With a shift in the commitment of the high-modernist state from an ideology of developmentalism to that of neoliberalism, a situation was created whereby the logics behind these approaches merged to create an environment for the new biopolitical system to emerge. The new form of biopower that used agbiotechnology to control the plant population from its interior emanated from a nexus of

state-corporation power.⁵⁹ In this process, the neoliberal actors relied on their belief in the efficacy of agbiotechnology, economic efficiency and private-interest governance. The emergence of the agbiotech industry was a result of a potent combination of the power of transnational corporations, the politics of governance, and the political economy of agriculture. I will touch on these issues in much greater detail in the chapters that follow.

⁵⁹ For an analysis of state-business nexus around biotechnology, see Newell (2003, 2006); Glover and Newell (2004); Glover (2007); and, Falkner (2007, 2009).

CHAPTER 3: A REGULATORY REGIME FOR *Bt* COTTON

The landmark policy decision to commercialize *Bt* cotton was symptomatic of the arrival of the bioempire in India. The neoliberal hollowing out of the state dissipated whatever effective regulatory power the state had to govern agbiotechnology, making the environment conducive for the emergence of the empire of agbiotechnology. The conflicts and contradictions within the governance process, and the resolution thereof, led to its emergence at the local level. Central to the regulatory drama was the dialectic between the local and global regulatory regimes, and the linkages forged between the global and local actors that favored a state-technology-capital nexus. This took place within a context of bureaucratic wrangling and technical negotiation, and framings and contestation of technocrats, entrepreneurs and activists.

This chapter explores various aspects of the regulation of *Bt* cotton in order to understand how the agbiotech regulatory framework facilitated the emergence of this form of empire. I begin by exploring a range of regulatory issues, and lay out a series of overlapping stories in the body of this chapter. **First**, using the legislative history of the regulatory framework for agbiotechnology as a benchmark to understand the centralized machinery of state control, I situate the emerging bioempire at the intersection of various modes of state governance. Tracing the movement in the state policy from environmentalism to neoliberalism, I focus on external influences and internal contradictions that shaped the local agbiotech regulatory regime. In the **second** section, I explore the politics of policymaking in a regulatory milieu that combined the elements of colonial, welfare-statist and neoliberal technocracies. I examine the struggle over regulatory authority within the regulatory community, and the manner in which the conflicts were reconciled in order to pave a way for the official approval of *Bt* cotton. In the **third** section,

I focus specifically on the role of transnational corporations in influencing the policy decision of the regulators. I highlight the shift of regulatory responsibility from experts to market, and the erosion of credibility of the regulatory process as a consequence. **Fourth**, using the field trials of *Bt* cotton as an empirical marker, I show how a subpolitics of techno-scientific-industrial dynamics subsumed regulatory practices to market exigency. The section explores the process of legitimization of field trials through narrow, technical, expert framings, which undermined the credibility of the *Bt* cotton approval process and neglected a range of risks and uncertainties related to the technology. In the **fifth** section, I examine the challenges posed to the regulation of *Bt* cotton by certain sections of civil society; and the manner in which the regulators circumvented those challenges that, in turn, benefited the agbiotech industry led by the transnational corporations. **Finally**, I explore the challenges posed by the global regulatory regimes to the local regulation of agbiotechnology. I highlight the manner in which the regulatory regimes overlapped, and yet conflicted; and, the way commitment to trade liberalization in the agricultural sector took precedence over the biosafety regulation.

3.1. Building the Local Regulatory Apparatus

The origin of the regulatory framework for *Bt* cotton can be traced back to the UN Conference on the Human Environment held at Stockholm in 1972. The decisions of the conference formed the basis for the rise of an Indian environmental state.⁶⁰ The statist environmentalism provided a benign and liberal dressing for the oppressive emergency regime⁶¹ of the then prime minister, Indira Gandhi. The emergent ideology of environmentalism was a

⁶⁰ This study acknowledges that a complex entity such as a state cannot be subject to a unified analysis, since there are distinct strands in thinking about the institution of state. Social scientists have characterized the Indian state in different ways. For an elaborate analysis of multiple manifestations of the Indian state, see, for example, (Herring,1999)

⁶¹ Prime Minister Indira Gandhi's declaration of the state of emergency unleashed oppressive policies like mass sterilizations and slum clearances that justified town planning and family planning welfare programs. Besides state-sponsored technological projects, such as big dams, that displaced millions of people.

strategic response of the Indian state to the new social movements⁶² that opposed the state models of development (Vishwanathan, 1987). In this scheme, the emerging environmentalism was an attempt of the ruling regime to depoliticize the implications of the ecologically inspired social movements⁶³ (Vishwanathan, 1987; Alvares, 1988; Shiva, 1989, 1991, 1993).

As a technocratic ideology, the statist environmentalism embodied specific assumptions about nature, technology and culture as a built-up environment. Under this mindset, the ruling regime began to view nature primarily as a resource or commodity, thereby justifying its preservation. However, the disjunction between such a mandate and the depredation of nature in the production system was not comprehended under the state version of environmentalism (Ravi Rajan, 2005). As a result, the twin goals of protecting the environment along with a need for science and technology driven development gave rise to schizophrenic policies that ended up being repressive instruments of state control. Against the background of such hegemonic policy goals, the ruling Congress party under the leadership of Rajiv Gandhi enacted the Indian Environment Protection Act (EPA) of 1986.⁶⁴ This Act called for the regulation of “environmental pollutants”, which were defined as “any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to the environment” (MOEF, 1986). Unlike several other measures that had been taken under the paradigm of environmental protection before and after the Stockholm Conference, the EPA 1986 concentrated sweeping regulatory power in the central government⁶⁵ (Leelakrishnan, 2005).

⁶² Like Naxalite and Chipko movements, which were the tribal and peasant uprisings against the state.

⁶³ Such as Chipko, Appiko and the KSSP (Kerala Sastra Sahitya Parishad).

⁶⁴ The EPA 1986 was enacted under the provisions of Article 253 of the Indian constitution.

⁶⁵ The Environment Protection Act 1986, s 3(1).

With the importation of *Bt* technology, the technocrats in the Department of Biotechnology (DBT)⁶⁶ optimistically constructed agbiotechnology as a technology of the future that would usher in a revolution in agriculture.⁶⁷ At the same time, they conceptualized risks related to transgenic crops as an uncertain and unknown terrain that called for governmental intervention. The recognition of the need to govern the import and use of genetically engineered organisms (GEOs), including transgenic seeds, set the tone for the incorporation of agriculture into a regime of legibility (Scott, 1998) through setting up a standardized regulatory grid in order to centrally monitor and control it. Within this framework, the procedure to approve the commercial production and release of transgenic seeds was determined by a standard regulatory format. The broad definition of “environmental pollutant” under the EP Act was used by the Ministry of Environment and Forests to issue rules to govern the use of genetically engineered organisms. The 1989 “Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms, Genetically engineered Organisms or Cells” constituted the legally binding regulatory framework for genetically engineered organisms (Ghosh and Ramanaiah, 2000). Under these rules, the lumping of GEOs in the same category as hazardous microorganisms was justified by their alleged potential to be hazardous substances that could pollute the environment. At the same time, these rules expressed a sense of uncertainty related to the nature of these hazards, and reduced definition of risks related to transgenic seeds to technological aspects.⁶⁸ By leaving out social, ethical and economic risks of transgenic seeds outside the scope of regulatory decision-making, the policy narratives remained linked to the larger political imaginary of the overlapping policy goals of ‘modernization’, ‘development’ and ‘neoliberalism.’

⁶⁶ Department of Biotechnology is under the Ministry of Science and Technology.

⁶⁷ See, for instance, “Biotechnology: A Vision (Ten Year Perspective)” at <http://dbfindia.nic.in/vision1.html> (accessed on November 22, 2008)

⁶⁸ For important work on risk and uncertainty, see Douglas and Wildavsky (1984), (Beck (1992), Hiskes (1998) and Wynne (2005)

The creation of regulatory policies within this hegemonic discourse offered an uncontested definition of 'risks', which were to be scientifically fixed by objective experts. Since the 1989 Rules necessitated the development of guidelines to give them effect, technocrats in the Department of Biotechnology (DBT) issued biosafety guidelines in 1990. These guidelines have been revised and expanded since then. The revised guidelines made an important change to the 1989 Rules in the treatment of deliberate release of GEOs. While the 1989 Rules banned such releases, the 1990 guidelines permitted them with an emphasis on assessing and managing environmental and health risks that might result. The revocation of the prohibition on deliberate release paved the way for the commercial release of *Bt* cotton of MMB (Monsanto-Mahyco Biotech India Ltd) in 2002. Through this shift in the framing of guidelines, the DBT reformulated the boundaries of risk against the backdrop of an emerging political economy of neoliberalism.

These guidelines were constructed against a particular definition of 'risks', conceptualized as threats to the safety of the environment and health, and necessitated governmental intervention to assess and control them. A number of models from around the world were looked at to draft the guidelines. The 1990, 1994 and 1998 risk assessment guidelines drew upon models used by the United States Department of Agricultural Plant and Animal Health Inspection Service (APHIS) as well as from biosafety guidelines elaborated by other OECD⁶⁹ countries (interviews). In this sense, external influences and models played a major role in the development and interpretation of regulation, appropriated largely to save time and effort in a pressured timetable for the bureaucrats (Scoones, 2005). Since the risk assessment guidelines were largely borrowed from the developed countries, the constitution of the

⁶⁹ OECD stands for Organization of Economic Co-operation and Development, which has 30 European countries as its members.

boundaries of risks and the creation of expert enclosures (Gottweis, 1998) in the regime of governability were closely tied to the risk philosophy prevalent in those contexts.⁷⁰

Within this regulatory framework, the guidelines upheld a rather narrow view of risk assessment⁷¹ as a rational, technical, science-based process dominated by exclusion and curtailment of public participation in policy making. With the guidelines focusing on detailed guidance on containment and safe laboratory practices, the risk assessment strategies were inseparable from molecular biology and genetics discourse (Gottweis, 1998). The molecular biologists and geneticists who dominated the bureaucracy of the department cultivated science-based policy narratives, thereby normalizing and bounding risk. Through this disciplinary hegemony, science gained authority in regulation; and, biological sciences were able to translate, simplify and inscribe risks within a narrow disciplinary space in the regulatory field (Wright, 1994).

In order to implement the standardized format of regulatory guidelines, the government established an institutional apparatus to oversee the regulatory process. As per the 1989 biosafety rules, the authority to regulate agricultural biotechnology was divided between the Ministry of Science and Technology (MoST) and the Ministry of Environment and Forests (MoEF). While the former would promote basic research activities and review small scale field tests, the latter had to oversee large-scale field trials and commercial release of transgenic seeds. This division of responsibility was a recognition that the goals of achieving biotechnology led development

⁷⁰ The risk philosophy varies in different contexts. See, for example, Jasanoff (1995)

⁷¹ The technical information required in a biosafety assessment includes details of the host organism, source of the transgene, characteristics of expression vectors, insertion genes and promoters, transformation methods, genetic analysis of stability and biochemistry of the expressed product. For laboratory use and greenhouse trials, it requires information about backcrossing methods, germination rates, phenotypic characteristics, and toxicity and allergenicity potential in handling the GEOs. For field trials, information about germination rates, gene flows, invasiveness potential, possibility of weed formation, possibility of transfer of transgenes to near relatives, and toxicity and allergenicity potential. Also, data on the long-term survivability of the novel organism, including susceptibility to diseases and pests, and comparison between the engineered and non-engineered organism in pest susceptibility is needed (DBT, 1998; Ghosh and Ramanaiah, 2000)

and the protection of the environment from genetically engineered pollutants were conflicting articulations of state projects. A technology that was not well understood in terms of its interaction with the environment had given rise to contradictory objectives of both advancing and containing it. Thus, the regulatory community, akin to Haas's notion of 'epistemic communities' (Haas, 1992), lodged in different ministries set for itself the objective to tackle risks related to agbiotechnology; while, at the same time, advancing the research and development related to transgenic technology.

In the case of *Bt* cotton, this tension was most apparent in the Department of Biotechnology (DBT), which is situated within the Ministry of Science and Technology. Populated by scientists and headed by a specialist technocrat instead of a generalist bureaucrat, the DBT carried out much of the regulatory oversight of *Bt* cotton. It defined risks of *Bt* cotton and oversaw the regulatory process. In order to gain credibility and legitimacy, the department relied on a network of experts in an enormous array of committees, advisory groups and working parties.⁷² The then Secretary⁷³ of DBT, Dr. Manju Sharma, depended on a number of science advisers who had been allocated different tasks within the department. The key adviser had been Dr. P.K. Ghosh, who also acted as the member secretary to the RCGM committee that oversaw the field trials of *Bt* cotton. He had been a key figure in arguing the case for the regulatory framework in numerous articles, workshops, newspaper articles, media interviews and in submissions to the Supreme Court. Despite its regulatory role, the DBT turned out to be a benefactor of the scientific community and the biotech industry pursuing *Bt* technology research and development. Over a period of time, the department became a strong proponent of

⁷² The department has three scientific advisory committees, a research promotion committee, and a total of 17 task forces on different themes (DBT Annual Report, 2000-2001). See www.dbtinida.nic.in (accessed on September 20, 2009)

⁷³ The Secretary in a government department is the most senior civil servant (bureaucrat). The Secretary is next in line of authority to the Minister, the politician, who heads the ministry.

biotechnology as a key driver of the new economy; and a supporter of a large and influential group of molecular biologists across the country, many with strong industry connections. In this sense, the regulation of *Bt* cotton provided a new site for the state-scientist-capital nexus, which was accompanied by a tension between the roles of government to promote and regulate the technology at the same time.

3.2. The Regulatory Community

Lodged in different ministries, the regulatory community for GEOs in India follows a culture that can be traced back to the centralized decision making processes set by the British colonial administration. An alliance between the political leadership and the scientific elite constitutes the core of both the ministries, the MOEF and MOST, and the experts regulating the agbiotech network range across diverse disciplines and disparate skill bases. While these ministries remain dominated by the cadres of the Indian Administrative Service (IAS), which is a tradition of elite generalists dating back to Indian Colonial Service established by the British (Potter, 1996), experts get handpicked by politicians and the bureaucrats. As members of the advisory committees or task forces, the experts are known to the public for pushing their own professional, commercial and political interests.

Against the contemporary neoliberal context, the politics of policymaking in these ministries is characterized by an alliance of business-science elite that forms the core of technocracy. A new breed of scientist-entrepreneurs populates the commissions, task forces and advisory groups created by the politicians who head these ministries. The neoliberal technocracy is committed to the economic reform agenda, and willingly strikes up alliances with the private sector. However, the old frame of welfare-statist technocracy that led the state-based, welfare

planning process has not been replaced completely. The legacy of the license-permit raj,⁷⁴ which evolved in the era of centralized state planning, and often resulting in networks of patronage, continues with most bureaucrats who are less interested in regulation and oversight of biotechnology than in facilitating it. Other colonial administrative practices and procedures persist in these ministries. Within an intensely hierarchical structure, the bureaucrats engage in trade-offs, concessions and deals that influence negotiations between various departments and committees across these ministries (Scoones, 2002). The extensive rational-choice literature would cast such bureaucrats as rent-seekers, similar to corporations, who act to maximize the resources under their control (Tullock, 1965; Niskanen, 1971). However, this kind of normalized bureaucratic corruption is not the only problem with the state-led agricultural modernization and development.

Some scholars claim that a high staff turnover is a major impediment to an effective administration of development in India (Wade, 1985; Potter, 1996, Das, 2001). The members of the regulatory community, especially the generalist civil servants, get deployed to any department within the ministries, and often for only short periods. The policy of moving the knowledge elite across various departments was formulated within the welfare state to break apart the power bases or fiefdoms of bureaucrats. This process of debalkanization of bureaucracy constructs a diffused network of knowledge/power (Foucault, 1972, 1980) that causes technocratic ideas, concepts and categorizations to flow throughout the regulatory network. While the diffusion of power/knowledge is productive for the regulatory community, it creates conflicts and clashes as the technocrats carry along their divergent interests and agendas as they move within this network.

⁷⁴ The term connotes the opportunities for rent accumulation as a result of deals made in the granting of licenses and permits controlled by bureaucrats.

In this political milieu that combines elements of the colonial, welfare-statist and neoliberal technocracies, the division of responsibility for regulating GEOs between the two ministries, the MOEF and MOST, gave way to a convergence of the two state projects. The rapid movement of personnel between the ministries led to a collapse of distinctions between bureaucratic functions. In order to allow space to the dual, yet convergent, regimes of governability, two committees⁷⁵ were set up to regulate research in agbiotechnology and to oversee deliberate release and commercialization of transgenic products. The Review Committee on Genetic Manipulation (RCGM)⁷⁶ was constituted under the DBT in the Ministry of Science and Technology to regulate ongoing research in biotech. It was also authorized to carry out multi-locational field trials in small plots to generate data on human and animal health concerns. An inter-ministerial Genetic Engineering Approval Committee (GEAC) was set up under the Ministry of Environment and Forests for overseeing the deliberate release and commercialization of transgenic products. Its function includes granting approval for large scale uses and industrial production of GEOs, and their release into the environment.

Both of these committees consist of scientists from public sector institutions as well as government bureaucrats. But, unlike the RCGM, the GEAC has representatives from a wide range of ministries and departments,⁷⁷ and the generalist bureaucrats largely dominate it. In theory, the GEAC was constituted with a view to accommodate the concerns and mandates of various ministries, to make sure that all government players committed themselves to the policy

⁷⁵ In addition to these national level committees, every institution engaged in genetic engineering research in India is required to establish an Institutional Biosafety Committee (IBSC). Today, there are several hundred approved IBSCs in India.

⁷⁶ The RCGM includes members from Department of Biotechnology (DBT), Indian Council of Agricultural Research (ICAR), Indian Council of Medical Research (ICMR), Council of Scientific and Industrial Research (CSIR) and other experts in their individual capacity.

⁷⁷ GEAC includes members from Ministry of Environment and Forests, DBT, Department of Science and Technology, ICAR, ICMR, CSIR, Ministry of Health, Ministry of Industrial Development, Central Pollution Control Board, State Biotechnology Coordination Committees. District Level Committees and state and local bodies are yet to be created wherever necessary.

decisions. The thrust was on the formal bureaucratic function of ensuring acceptability of biotech policies across a range of ministries that were related in some way to the technology in some way. The RCGM was constituted to provide the necessary technical and scientific advice to the GEAC, and the latter had to follow the key decisions and advice emerging from the expert-led, science-based RCGM. In this scheme, the regulatory process was conceived as a linear, rational and science-based process, whereby guidelines developed by experts and enshrined in law had to be implemented by bureaucrats with the assent of politicians.

Challenging the positivist conceptualization of the relationship between science and policy in which science speaks truth to power (Price, 1965, Wildavsky, 1979), the case of *Bt* cotton reveals a much more complex scenario. The supposedly rational policy decisions were not conceived and implemented in a clearly defined way. Like any other regulatory politics, once any decision entered the melee of departmental rivalry and bureaucratic politics, scientific criteria ultimately gave way to political struggle and negotiation between different arms of bureaucracy, scientists and politicians. For instance, the representatives of the Indian Council of Agricultural Research (ICAR) and the ministries of Agriculture and Health on GEAC challenged the authority of the Ministry of Science and Technology and the DBT in monitoring the field trials of *Bt* cotton. Viewing the DBT as a strong proponent of *Bt* technology, having a close connection with the community of molecular biologists and the agbiotech industry, the GEAC representatives expressed skepticism over the reliability of scientific data that was submitted by RCGM to GEAC.

Taking the bureaucratic politics further, the ICAR representative on GEAC argued that the private sector led regulatory approach was unwise, and that the ICAR would not “abide by

the dictates of GEAC.”⁷⁸ Further, the representative claimed that the ICAR was a “responsible public sector research institution having an international reputation”. Other members of GEAC added to the struggle for authority to oversee the field trials and commercial approval of *Bt* cotton. The representatives of the Ministry of Agriculture wanted the approval of a technology related to agriculture to be under their ministry, rather than with the Ministry of Environment and Forests (Gupta, 2000). And, other members of GEAC from the Ministry of Health⁷⁹ questioned the lack of concrete scientific data on health effects of transgenic cotton. Such conflicts between positions of different ministries on the regulatory process proved problematic for conceiving and implementing the standardized “science-based” regulatory framework.

Although the formal procedure of field trials, laboratory tests and data compilation dominated the *Bt* cotton policy rhetoric, the approval process of *Bt* cotton involved reconciliation of internal wrangles between different arms of bureaucracy on the regulatory committees. In order to resolve the conflict, the commercial approval of *Bt* cotton entailed a wide political consultation beyond GEAC with eminent independent experts on agricultural development, such as M.S. Swaminathan, and the politicians heading the concerned ministries. However, straddling the line between a narrow, technical, risk assessment approach and the wider politics within which the regulatory approval process was set, posed an important challenge to the DBT. Although its RCGM committee was less overtly political in terms of contestations over committee roles and influence, the framing of regulation of *Bt* cotton in a particular narrow way, with science based risk assessment at the centre and putting off the consideration of a wider socio-economic and ecological impact, politicized its policy decisions. With a marked absence of open discussion on the desirability of *Bt* technology and a reluctance to share the information

⁷⁸ See “ICAR calls for more trials on GM Mustard,” *Financial Express*, 17 November, 2002. (accessed on June 20, 2009)

⁷⁹ IPS Press Release, 6 September, 2002. See *AgBioIndia* archive, September 2002.

about the basis of its policy decisions, the thoroughness and probity of the regulatory procedure of the DBT was severely questioned by the increasingly vocal critics (Shiva et al. 1999; Qayum and Sakhari, 2005). Using technical arguments, the regulators in DBT tried to deflect such issues and absolve themselves of responsibility for the *Bt* cotton controversy. At the same time, the then DBT adviser P.K. Ghosh and other department officials fulfilled the departmental mandate of promoting agbiotechnology. They used print and electronic media to make a case for *Bt* cotton, pointing out its potential economic and environmental benefits (TERI, 2001).⁸⁰

Since promotion and regulation are both part of the formal mission of the DBT, the regulatory process of *Bt* technology underlined a contestation over which potential biases emerged from government funding of agbiotech research.⁸¹ The ambiguous role of the DBT led to the loss of public trust in the legitimacy and authority of the regulatory process of *Bt* cotton. The delineated functions of the regulatory committees raised a controversy about the fuzziness of the boundary between research and deliberate release, and the ambiguity over whether field trials are a contained research activity or a deliberate release of GEOs into the environment. Following the controversy generated by the field trials of *Bt* cotton, the DBT made a cursory attempt to clarify the boundary between containment and deliberate release. Field tests of up to one acre plots in twenty locations in one growing season were to be considered “small experimental trials for research”, and tests exceeding this as non-experimental deliberate release (DBT Addendum, 1999). However, it remains unclear whether even limited field trials can be designated

⁸⁰ Also, see “Biotechnology--A Vision: Ten Year Perspective” at <http://dbtindia.nic.in/vision1.html> (accessed on May 29, 2008)

⁸¹ For work on the politics of technology that underlines the importance of contests over which technoscientists are deemed authoritative to speak on an issue, which policy questions are seen as issues for scientific deliberation and which are firmly kept within the realm of politics, and which potential biases emerge from commercial and government funding of technoscientific research, see Ezrahi (1990), Jasanoff (1990) and Nelkin (1992)

“contained research”, since the requirement of a five meter isolation distance may not be feasible in the case of small landholdings.

In addition to such ambiguities, the much touted political promise of the decentralization of regulation did not materialize in practice. An elaborate framework of regulation at the level of states and districts, such as the State Biotechnology Coordination Committees (SBCCs) and the District Level Committees (DLCs), which were meant to decentralize regulatory authority, remained on paper. These committees were conceived in order to facilitate information exchange between the regulators at the center and the states. The recent addition to this bureaucratic network is a Monitoring and Evaluation Committee to oversee the field trial process and to monitor biosafety data generation (Ghosh, 1997; Ghosh and Ramanaiah, 2000; Gupta, 2002).

In a tightly technocratic approach to policy making and implementation, the democratic space for sharing of information and open debate on the details of regulatory deliberations was also missing. While the two central regulatory committees, the RCGM and the GEAC, consisted of scientists from public sector institutions with specialization in genetics and molecular biology, there were no social scientists or members of civil societies on these committees. As a relatively closed group, the regulatory community was shrouded in secrecy with few opportunities for wider deliberation. In the tale of *Bt* cotton, the DBT had limited interaction with the critics and the broader public, except through a limited number of public events and media briefings. Dismissing the public questioning of *Bt* technology as “irrational, unscientific, emotional and hypothetical risks” (interviews), the regulatory regime responded to the demands of democratic deliberation as a lack of public understanding of science and technology (Irwin and Wynne, 1996). The public was represented as being essentially “ignorant and uneducated about the complex scientific issues, and in need of education” (interviews). Such boundary work (Gieryn,

1999) entrenched the technocratic control of *Bt* technology, thereby disempowering the broader public to make a technological choice.

3.3. A Corporatist Turn in Regulation

Putting a spin on the issue of democratizing regulation, the anti-regulatory regulators extricated themselves from responsibility by stating that it was the market that would decide the fate of *Bt* technology, not the experts (Interview). In what can be considered a step towards corporatization of the regulatory process, the participation of representatives of the biotech industry as experts in individual capacities in specific sessions of the central committees is not restricted (DBT, 1994; 1998). But there are cases when petitions of NGOs to participate in particular sessions have been turned down (Gupta, 2000). Such an undemocratic culture of regulation favors promotion of biotechnology in yet another sense. The two central committees are composed of scientists who are themselves engaged in transgenic research. This results in a situation where scientists regulate themselves, rather than an autonomous agency regulating research in this area.

A close relationship between the applicant and regulators was manifested in the case of *Bt* cotton. In a clever move, Monsanto had linked up with Mahyco to take advantage of the political standing and personal connections of the director of the latter, Dr. B.R. Barwale. Over a period of nine years, Monsanto-Mahyco Biotech India Ltd. (MMB) had close interaction with the technocrats of the RCGM, and the DBT, who oversaw the regulatory process. In addition, the company used the strength of its technical teams in the Monsanto Research Centre in the city of Bangalore, and the extensive back up from the headquarters of Monsanto in the US, to jump all the regulatory hurdles to get the commercial approval on its technology. The maneuvers of the company smoothed the way for other agbiotech TNCs that followed in its trail. The TNCs

formed joint ventures with the local biotech firms to boost their credibility as legitimate players in local markets, and to tap the trust that the local seed companies have built up with farmers and their understanding of the regulatory environment. In order to seek approval of the regulatory authorities for its technology, MMB maintained a regulatory affairs office in Delhi to engage in routine interactions with government officials over policy developments (Newell, 2003).

In addition to these up front approaches, behind the scenes lobbying was also part of the approach adopted by the MMB. Monsanto informally funded a range of activities and events which were aimed at promoting biotech and *Bt* cotton in particular, as well as visits to India by articulate advocates of biotechnology. One vocal advocate was Dr. C.S. Prakash, a plant molecular geneticist from Tuskegee University in Alabama and a member of the US Department of Agriculture's Biotechnology Advisory Committee, who sat on the DBT's Scientific Advisory Committee (Overseas). His website, AgBioWorld, and newsletter, AgBioView, carried regular pro-GEO commentaries.⁸² He organized a global petition on declaration of support of agricultural biotechnology signed by thousands of scientists, including Norman Borlaugh, James Watson and Gurudev Khush (Visvanathan and Parmar, 2002). Both his website and trips to India to promote biotechnology were reportedly sponsored by agbiotech corporations (Scoones, 2005). Besides mobilizing support of influential scientists, Monsanto actively participated in sending members of the regulatory community on study visits sponsored by the US government, which were aimed at showcasing US biotechnology experience including benefits of its regulatory approach (interview). Through funding offered by the US embassy in Delhi, a number of scientists and DBT officials traveled on such study tours. As the corporation influenced the

⁸² See, for example, "Expert endorses *Bt* cotton decision," *Business Standard*, 12 April, 2002; "Huge potential of genetically improved plants outweighs hypothetical risks," *Financial Express*, 31 May, 1999; and, "Looking for answers," *Deccan Herald*, January 1, 2004. Also, see: <http://www.agbioworld.com> for more from Prakash.

regulatory decision process by such means, the credibility of the process was severely jeopardized.

3.4. Legitimizing Field-Trials

The commercialization of *Bt* cotton further revealed the tensions and discrepancies in the regulatory practices. Between 1996 and 1998, the joint venture of Monsanto-Mahyco Biotech India Ltd (MMB) developed three backcrossed cotton lines using the imported technology of *Bt* cotton to create transgenic cotton varieties.⁸³ Subsequently, the Review Committee of Genetic Manipulation (RCGM) approved the request of MMB to carry out 40 small field trials of *Bt* cotton in nine states in 1998. Field trials were approved formally by DBT on 27 July (25 Trials) and 5 August (a further 15), although in practice they were ongoing from mid June and early July (Shiva *et al.* 1999). Following the review of the 1998 data, the RCGM requested an additional ten trials in 1999. The results of these field trials were presented by MMB to the DBT in April 2000, resulting in RCGM clearance in May and a go-ahead from the GEAC in July for large scale field trials. The country was treated as a big laboratory by the MMB, as there were 400 trial locations in six states, including Maharashtra (180), Karnataka (89), Gujarat (23), Madhya Pradesh (23), Andhra Pradesh (49) and Tamil Nadu (11).

⁸³ These are Mech-12, Mech-162 and Mech-184.

Table 2: Timeline of Field Trials and Commercial Release of *Bt* Cotton

Date	Consent Seeking Agency	Consent Giving Authority	Type of Trials	Number of Trials Requested	Number of States to be Covered	Policy Decision
July, August 1998	Monsanto-Mahyco Biotech India Ltd (MMB)	Review Committee of Genetic Manipulation (RCGM) under Ministry of Science and Technology	Small-scale field trials	40	9	Permission granted
January, 1999						RCGM expresses satisfaction over trial results at 40 sites
June to November 1999	MMB	RCGM	Small-scale, field trials	10	9	Permission granted
May 2000						RCGM infers that <i>Bt</i> cotton is “safe” based on data from small-scale field trials
July 2000	MMB	Genetic Engineering Approval Committee (GEAC) under Ministry of Environment and Forests	Large-scale field trials	400	6	Permission granted
June 2001	MMB	GEAC	Commercial Release		6	Disapproved; GEAC requests ICAR to conduct independent field trials
June 2001	Indian Council of Agricultural Research (ICAR)	GEAC	Large-scale field trials	11	6	Permission granted
February 2002						ICAR submits a positive report on the field trials to GEAC
March 2002	MMB	GEAC	Commercial Release		6	Approved

Once approved by the RCGM, the field trials were supposed to test the transgenic seeds of *Bt* cotton in contained and controlled field conditions over a number of years. And, a range of studies were required to be undertaken at the field level, including basic agronomic monitoring, pest incidence, pollen flow and so on. In an attempt to fast-track governmental approval of *Bt* cotton commercialization, MMB evidently compromised on regulatory guidelines while conducting the field tests of the technology (Shiva et al. 1999; Qayum and Sakkhari, 2005). As clear from the table, the duration of field trials, size of trial plots and number of locations for making informed policy decisions regarding the effectiveness of *Bt* cotton in the field were inadequate. These field experiments, initially conceived as knowledge acquisition enterprise, were reduced to rhetorical devices to legitimize commercialization of *Bt* cotton. As hybrid spaces between the laboratory and the farms, the field trials highlighted the subpolitics of techno-scientific-industrial dynamics that subsumed experimental norms to market exigency.

Without releasing the details of the manner in which these field trials were conducted, due to the official policy of secrecy, the regulators maintained that the tests were focused on issues of agronomic performance, and the laboratory assessments focused on safety tests including allergenicity and toxicity of the transgenic cotton. The chosen approach neglected the concern about the full range of potential risks of *Bt* technology, and ignored areas of uncertainty, such as health, environmental and socioeconomic risks, by choosing particular temporal and spatial scales for field tests. The field trials were only able to assess the short-term impacts, and, those were concentrated in artificially constructed small spatial scales. In any case, the long term and broad scale impacts were not assessed. When the issue of experimental design and analysis was raised in a special issue of *Current Science* (Bharathan, 2000), such as the field trial size and the degree to which one acre plots were sufficient, the representatives of the DBT and MMB did

not respond to the questions. This despite the much wider debate about ecological risk assessment for transgenic crops, which widely questioned the conventional field trial approach adopted in India.

The inadequate field trials destabilized expert framings of the *Bt* cotton 'risks', and led to renegotiation of the boundary between the bureaucratic process and the scientific research. Skeptical scientists based in public institutions raised concerns about the potential bias in the field trial data, which was produced by the commercial applicant MMB, and the apparent sidelining of the agricultural universities and the Indian Council of Agricultural Research (ICAR) in the process. Following the review of the results of the trials in June 2001, the Genetic Engineering Approval Committee (GEAC) denied approval for commercialization on the basis of a number of conditions and requirements for on-going monitoring that had been neglected in these trials.⁸⁴ At this stage, the GEAC requested that the ICAR become involved to provide independent advice on *Bt* cotton. Although the government expected the open field trials to be completed by mid 2001, the GEAC decided to give an additional year for the trials under the supervision of the ICAR.⁸⁵ The ICAR, working with the agricultural universities, conducted field trials in 11 locations in six states.

In order to preempt growing public criticism, the involvement of the ICAR was a key move to give credibility to MMB's trials. The regulators claimed that the supervision of the ICAR meant a shift in the culture governing the field trials by transferring the responsibility from a technology promotion agency, the DBT, to the agricultural research institution that, they believed, represented the interests of the farmers. However, they overlooked the fact that the ICAR network, which includes the state agricultural universities, was also engaged in scientific

⁸⁴ *Frontline*, 18 July, 2001.

⁸⁵ *Hindu Business Line*, June, 2001.

research to produce transgenic crops. Thus, it would continue to function within the risk-promotion paradigm of the regulatory community. In addition, the involvement of the ICAR in field trials did not mean a change in the policy culture. The lack of data disclosure continued to undermine the public trust in the field trials,⁸⁶ and the process remained exclusive and secretive.

As the field trials were being carried out by the ICAR, the network of government actors operating in the scientific, economic and policy arenas controlled the normative and cognitive framing of the *Bt* cotton field tests. Terms like experimental data, scientific approach, and objectivity were used to define the field tests in relation to their contribution to the production of scientific data on “outcrossing, germination, weediness, food and feed safety, allergenicity, toxicity, and pollen escape” (Scoones, 2003; p 7). The regulators upheld the field trials of *Bt* cotton as based on a rational, objective and scientific approach in a bid to provide legitimacy and authority to the regulatory process. The questions about the kind of data generated, the rigor of the trials, and the number of tests needed before its commercial release were still left unanswered by the regulatory community. While the field trials were represented as a safe cognitive endeavor to be protected from the participation of the public, such an entrenchment was aimed to protect regulatory activities from democratic public discussion (Bonneuil, 2008). The domain of scientific discourse with its focus on facts, data and measurement issues surrounding the risk assessment procedure further entrenched the power of the experts in the regulatory procedure.

In line with the policy goal of the neoliberal technocracy to make *Bt* cotton an instrument to compete in the global cotton market, the ICAR concluded that *Bt* cotton was both economic and effective. The issue of the safety clandestinely gave way to the criterion of economic performance of the transgenic seeds of MMB (APCoAB Report, 2006; ISAAA, 2002). Even as the market-oriented thrust of the conclusion of ICAR became increasingly evident, the meaning

⁸⁶ See “Make field trial results of GM crops public,” *Financial Express*, 18 November, 2002.

of the bottom-line variables of the economic and effective nature of *Bt* cotton remained undefined. With the field trial data withheld from public scrutiny, the tests conducted by the ICAR could not garner much more credibility than the ones that had been carried out by the MMB.

Various activists strongly challenged the efficacy of these trials. While the then secretary of DBT, Dr. Manju Sharma, declared that the latest round of field trials was satisfactory, the director of the Research Foundation for Science, Technology and Ecology (RFSTE), Dr. Vandana Shiva, challenged the trials as illegal. Meanwhile, the convener of the Gene Campaign, Dr. Suman Sahai, filed a case in Delhi High Court charging the government with negligence in allowing large-scale field trials without appropriate “monitoring, regulation and safety” precautions. In another campaign, the director of The Ecological Foundation, Dr. Devinder Sharma, released an open letter to the then Prime Minister of India, Mr. Atal Bihari Vajpayee, at a press conference in New Delhi. He warned of the potentially devastating impact of *Bt* cotton on the farmers, and the “scientific fraud” involved in the way the research trials had been conducted and monitored. Calling the field trials “the biggest scientific scam to have ever hit India”,⁸⁷ Sharma claimed that the field trial data had been “hyped” as showing economic and effective results. Even as the activists mobilized opinion against the field trials, a ten member delegation comprising U.S. judges and scientists met the then Supreme Court Chief Justice, A.S. Anand, to “educate” him and other members of the judiciary on biotechnology.⁸⁸ These competing attempts to spin different narratives around field trials were intended to enroll actors into a line committed to or rejecting of *Bt* cotton.

⁸⁷“Devinder Sharma letter to Prime Minister of India on *Bt* Cotton, 12 Dec 01” available at <http://www.poptel.org.uk/panap/latest/dsletter.htm> (accessed on August 14, 2009)

⁸⁸ See, “*Bt* Cotton: Seeds of Discontent” available at <http://www.indiaresource.org/issues/agbiotech/2003/Btcottonseeds.html> (accessed on September 5, 2009)

Given the particularity of the Indian pest complex, and different spatial patterning of the agro-ecological landscape in Indian cotton growing areas, the concern about the impact of *Bt* cotton technology on pest resistance dynamics was largely ignored in these trials. Heavily influenced by industry concerns and the US approach to GEO product assessment, the experts developed consensus on adopting *Bt* technology based on narrow, technical, market-oriented variables. The advisory committees that oversaw the regulatory process framed ‘risks’ in such a way that broader issues were cut out or downplayed. As the scientific debate around *Bt* cotton was conducted in a highly fragmented way, the regulatory community black-boxed a range of uncertainties associated with *Bt* technology. As the debate continued, the insistence that the decisions were simply science-based became increasingly hollow. The divide between the technical and the political did not hold, since both were deeply intertwined in processes of mutual construction. Simultaneously, trust, legitimacy and authority related to the regulatory process were undermined by the secrecy and bureaucratic infighting that plagued the *Bt* cotton approval.

3.5. Tales of Deception and Desire

The effectiveness of the *Bt* cotton regulation received critical scrutiny from the public in the wake of public interest litigation filed by the Research Foundation for Science, Technology and Ecology (RFSTE) in the Supreme Court of India in 1999 against the DBT, the Ministry of Environment and Forests, the Ministry of Agriculture, and the MMB. The RFSTE alleged that MMB was given improper authorization to field test transgenic *Bt* cotton, and that the existing biosafety regulations were inadequate to protect against adverse ecological and human health effects posed by such transgenic crops (RFSTE, 1999 a, 1999 b). It further argued that since the field trials constituted a deliberate release into the environment, the consent should have come

from the ministry of environment rather than from the department of biotechnology. In response, the private sector developers of the crop and the governmental regulators represented the field tests as experimental research in contained conditions rather than as deliberate release. With the jurisdictional authority over field trials brought into question, the RFSTE also challenged the centralization of regulation. It highlighted that only central government approval was given for the field testing, without consultation with regional and state governments, and local communities. As the required state and district level committees were not yet in existence, the discrepancy between the laws on paper and their implementation became evident.

Besides challenging the authority of consent givers in the field trials, the information to be generated and procedures for field testing were also disputed in the RFSTE case. It alleged that a comparative study of pest incidence in transgenic and non-transgenic fields as mandated by the biosafety guidelines had not been generated (RFSTE, 1999 a). In addition, the mandatory containment measures as outlined in the guidelines were not followed. Although isolation distance of five meters around plantings of transgenic crops is required, such distance was not maintained in *Bt* cotton field trials (RFSTE, 1999 a). In fact, maintaining and monitoring a five meter isolation distances in very small farmer holdings may not be feasible, irrespective of whether it is a technically adequate containment parameter or not. Based on evidence gathered in the field by research teams from RFSTE, the Supreme Court filing also highlighted that *Bt* cotton was outperformed by non-transgenic local varieties at a number of trial sites across the country. The public interest litigations filed by RFSTE, the Gene Campaign and others generated public debate and brought the biosafety governance regime into question. For many the field trials were essentially symbolic, part of a ritual of regulatory process designed to favor the biotech industry (Shiva et al., 1999; RFSTE, 1999a, 1999b). The ritual of *Bt* cotton regulation, however, proved

to be a dangerous moment (Foucault, 1979) for the government when the lawsuits challenged its authority. As of 2003, when commercial release was approved, the court case was still ongoing. But, the legal challenge to the regulatory regime reactivated the power of the hitherto sidelined public.

The lawsuits helped to bring to light the centers of illegality that the rituals of regulation had ended up creating around the *Bt* cotton technology. As the GEAC deliberated on the final decision in 2001-2002, news broke out that illegal *Bt* cotton had been planted over several years in the state of Gujarat.⁸⁹ The seed had been supplied by a local company, Navbharat Seeds, and had gone out to distributors in a number of states. A section of the vast, largely unregulated network of seed bulking, supply and distribution outfits had made good use of the new product, and had sold it at a marked up price. While the regulators were deliberating in Delhi, the farmers in the far away states were reaping the harvest of *Bt* cotton. The widespread adoption of *Bt* cotton prior to formal regulatory approval pointed the needle of suspicion to the illegal sowing of *Bt* cotton by MMB since 1998, and some critics speculated linkages between MMB and Navbharat Seeds in this illegal activity (Ramani, 2008). However, there was no direct evidence to support the allegation against MMB.

The exposure of the illegal *Bt* cotton crops put the regulatory authorities in a tight spot. As a result, the Ministry of Environment and Forests ordered the destruction of illegal cotton crops based on lack of regulatory approval. The officials burnt the *Bt* crop in full view of the press, and arrested the director of Navbharat Seeds (for details, see chapter 5). Many in the *Bt* cotton lobby articulated that the farmers of Gujarat had proven the market demand for the

⁸⁹ In 2000, some 10,000 hectares were reported planted to *Bt* cotton in Gujarat alone, with other areas in the states of Maharashtra, Madhya Pradesh, Andhra Pradesh, and Karnataka also having unspecified areas under *Bt* cotton.

product, which pre-empted the 2002 decision by the GEAC.⁹⁰ On 26 March 2002, the GEAC formally approved the commercial release of Monsanto's *Bt* cotton for a three year period alongside a number of conditions. The conditions included the growing of a refuge area of five rows surrounding each *Bt* cotton plot, early removal of the cotton crop following harvest, and continuous scouting through the season. These conditions were supposed to act as barriers to pollen flow and to prevent insect resistance.

Such conditions set by GEAC were questioned by Monsanto and others. The research head of Monsanto-India, T.M. Manjunath, commented that Land holdings in some cotton growing pockets are so small that the mandatory refuge would make *Bt* cotton cultivation uneconomical.⁹¹ Farmers were equally skeptical. In a newspaper report, one farmer from Andhra Pradesh was quoted as saying, "Next year I may not plant the refuge area as it is a complete waste".⁹² But, the influential industry advocates of biotech, such as the Bangalore based Kiran Mazumdar Shaw and the non-resident Indian scientist C.S. Prakash, were satisfied by the GEAC decision. For them the approval of the commercialization of *Bt* cotton was a clear signal to the global venture capitalists to invest in the Indian agbiotech industry. Notwithstanding the apprehensions of Monsanto, the politics of regulation had an effect of advancing the emergent interests of the TNCs and their Indian collaborators. And, the framing of the debate around technical issues of environmental risks had relegated broader concerns such as technological desirability, farmers' livelihoods and societal future to the background.

⁹⁰ See numerous press reports, including: "Fate of illegal *Bt* cotton uncertain," *Financial Express*, 29 October, 2001, "Agri Ministry, biotech dept disagree on *Bt* cotton issue," *Economic Times*, 29 October, 2001, "Controversy over *Bt* cotton deepens," *Business Standard*, 22 October, 2001, "Gujarat Govt. in dark on *Bt* cotton issue," *Economic Times*, 13 October, 2001, "GEAC orders destruction of *Bt* cotton in Gujarat," *Economic Times*, 19 October, 2001.

⁹¹ *Financial Express*, 23 June 2002.

⁹² *Indian Express*, 12 November, 2002.

3.6. Empire of Standardization

As the case of *Bt* cotton shows, even within the concern for minimizing potential environmental risks, the regulatory community gradually changed its stand in the biosafety arena from precautionary to promotional policies (Paarlberg, 2000).⁹³ Tension between the DBT and the MOEF to strike a balance between promoting agbiotech and protecting the environment against its risks worked out in favor of promoting the technology. Ideally, within the risk-promotion paradigm of the regulatory regime, the two goals are not necessarily mutually exclusive (Jasanoff, 1995). But, due to interdepartmental conflict of interests and clash of mandates, a bias emerged in favor of a hasty process of commercialization of *Bt* cotton. The relationship between the Indian state and the agbiotech industry played a crucial role in this process. The state-capital nexus became intense as the interest of Capital coincided with the newly articulated government definition of national interest, envisioned as economic growth through hi-tech development in the biotech sector (Levy and Newell, 2005). Significantly, this happened around a time when the country signed and ratified the global biosafety protocol, which was one of the first transnational efforts to formulate legally binding rules for biosafety or the safety considerations associated with biotechnology.⁹⁴

While the regulators in Delhi were busy negotiating the commercialization of *Bt* cotton, the Indian government signed the Cartagena Protocol on Biosafety in January 2001 and ratified it in January 2003.⁹⁵ Though the general guidelines on research and handling of GEOs had been developed before the protocol's arrival, the latter ushered in a detailed regulatory framework for

⁹³ Policies that accelerate the spread of biotechnology within the borders are considered "promotional". Policies that are neutral toward biotechnology intended neither to speed nor to slow it, are considered "permissive". And, policies that slow down the spread of transgenic crops for various reasons are "precautionary" (Paarlberg, 2000).

⁹⁴ Cartagena Protocol on Biosafety to the Convention on Biological Diversity, Jan 29, 2000, 39 ILM 1027 (2000), available at <http://bch.cbd.int/protocol> (accessed on June 29, 2008)

⁹⁵ On January 29, 2000, over 130 countries signed the Cartagena Protocol on Biosafety to the Convention on Biological Diversity.

risk assessment and biosafety management. While the protocol allows national discretion about GEO policy decisions, it does not address the implications of private sector control over risk-related information. And, although the drama of regulating *Bt* technology began to unfold within a context of a case-by-case and precautionary emphasis of the domestic biosafety regulation, the newly emergent global regimes, such as the World Trade Organization (WTO) and the Cartagena Biosafety Protocol (CBP), necessitated the need to consolidate standardized and harmonized approaches to regulation. Both these global regimes favor scientifically sound risk assessment. In order to promote global trade in GEOs, under the dictates of the WTO, the CBP indirectly sought to encourage the developing countries like India to adopt a universalized model of regulation that would be minimally disruptive of trade (Newell, 2003). As a result, the universal, one-size-fits-all regulatory standards derived from science and modeled on a particular formula derived from Europe and the US, and promoted by the international agencies, encouraged further standardization of the regulatory approach.

The pressure for standardization emerging from attempts to develop a global trade regime under the WTO was increasingly mounted on the national government (interview). The free trade advocates and agbiotech corporations maintained that free trade in GEOs, including transgenic seeds, must not be hampered by the application of a domestic protectionist policy based on standards and procedures that were not universally agreed to. They argued that standardized regulatory procedures, with limited ambiguity and strict protocols, would encourage investment in biotechnology (Scoones, 2002). This was based on the assumption that transnational investors would not shy away from necessary up-front investments in agbiotech if there was no uncertainty surrounding the regulatory process, and thus no threat to the possibility of payback on investments. However, the case of *Bt* cotton suggests that the regulatory community did not

follow scientifically based, standardized guidelines and procedures exclusively, but adopted those in a discretionary manner at the level of negotiations between actors on the ground.

A policy space was created where the realms of science and politics overlapped. Within this hybrid space, however, the discretionary choices arising from ambiguity, secrecy and complexity of the regulatory process ended up serving the interests of the newly emerging global agbiotech industry. A hasty commercial approval of *Bt* cotton revealed that the standardized criteria of sound science⁹⁶ provided a veneer legitimating market-oriented practices of the neoliberal technocracy, while the secretive negotiations around the approval process of *Bt* cotton were aimed at furthering the commercial interest of the science-capital nexus. In both ways, Capital gained by using science as an ally.

The case of *Bt* cotton regulation highlights the fact that technical regulatory formulae along the lines advocated by the global regulatory regimes would not ensure effective regulation in practice. While development agencies engaged the agbiotech regulators in capacity building, which was to be exercised in accordance with the CBP guidelines, they could not help resolve the confusion that the regulators faced regarding the central conflict between the WTO agreements and the Biosafety protocol. The tension between domestic regulatory autonomy and global harmonization standards became a key feature in the ensuing debates. One of the most difficult and controversial issues faced by the Indian regulators was to reconcile the requirement of the precautionary principle of the Biosafety Protocol with the requirement of the sound-science approach of the WTO agreements (Safrin, 2002).

The sound science approach is directly opposed to the precautionary approach; the former requires evidence of harm before regulatory action could be taken, while the latter emphasizes

⁹⁶ For a discussion on “sound science” approach in regulation, see, for example, Levidow et. al.(1996) and Levidow (2001).

that genetically modified organisms be regulated or banned until proven safe (Halfon, 2007 b). For instance, the Sanitary and Phyto-Sanitary (SPS) and Technical Barriers to Trade (TBT) agreements of the WTO⁹⁷ called for the use of sound science criteria as the basis for evaluating risks related to agbiotechnology, which would legitimize trade restrictions. On the other hand, the use of the precautionary principle in the Biosafety Protocol employed a broader notion of risk, which did not rely exclusively on the option of sound-science and its support for expert-driven, technocratic modes of regulation. The contradictory requirements resulted in a tension between the government's autonomy to restrict the transgenic seeds into the domestic market on grounds of detrimental socio-economic and/or environmental implications and the standardized global regulatory rules that were being pushed by free trade advocates.

At first glance, the expectations of the CPB regarding the implementation of standardized regulatory rules, such as scientifically sound risk assessments, ran up against the perceived reality of capacity deficit, shortfall in resources and competition between state regulatory agencies such as the MoEF and the DBT. The translation of global policy commitments into workable local policies for biosafety management would become one more site for the contestation over technocratic authority and policy goals. Selective interpretation, conflict over priorities, and politicking at the highest levels of government had the potential to subvert areas tightly proscribed in the CPB (Newell, 2008). Even though the translation of policy commitments contained in the global regulatory agreements into workable national policies meant loss of policy autonomy in a global environment of high commercial interest and

⁹⁷ The WTO Agreement on the application of Sanitary and Phyto-Sanitary Measures (the SPS agreement) is the most relevant to the trade in genetically engineered organisms. The agreement regulates measures taken by member states to protect human and animal health (sanitary measures) and those taken to protect plant life or health (phytosanitary measures). The TBT Agreement applies to technical barriers to trade, such as packaging, marking and labeling requirements, that are not promulgated for sanitary and phytosanitary purposes.

aggressive political lobbying, the neoliberal technocracy shared the stance on regulatory practices that the global trade and biosafety regimes laid out.

Notwithstanding the complex context-specific, negotiated local regulatory framework, the capacity building efforts with significant donor support by such global agencies as USAID, UNEP/GEF, OECD and others⁹⁸ emphasized narrow biosafety issues, especially the health and environmental ‘risks’ of agbiotech, which were in line with the regulatory philosophy of the emerging neoliberal technocracy. Wider issues, such as the socio-economic and political consequences of adopting agbiotech were left out of the picture by these regulatory actors. For instance, the Global Environment Facility-World Bank (GEF-WB) funded capacity building project for implementing the CBP in India was designed to: assist the country in “developing national capacity for biosafety, enhance technical capacity for risk assessment, management and monitoring of risks, establish a biosafety database system, and support centers of excellence and a network for research, risk assessment and monitoring” (Talukdar and Kuzma, 2008), p 133). The intensive involvement of the US government aid agency in supporting the capacity building efforts appeared as an attempt to further impose a US view of regulation in developing countries like India (Mayet, 2003).⁹⁹

Although the risk assessment procedures were fraught with bureaucratic infighting over respective responsibilities, the CPB impetus for India’s contained use of transgenic seeds appeared to be a strategy to ensure that the RCGM, the agency functioning deeply within the risk-promotion paradigm, maintained control over field trials and biosafety evaluations of transgenic seeds. Given the nature of the Indian regulatory apparatus and epistemic community, the domestication of the global biosafety policy would set in a period of more bureaucratic

⁹⁸ See “Capacity Building Projects” available at www.bch.biodiv.org/capacitybuilding/projects.apx (accessed on March 12, 2008)

⁹⁹ “USAID project to promote GM crops” *Financial Express*, 29 August, 2005.

infighting over the interpretation and implementation of the CBP, over how to give weight to different elements of the protocol. This related, in turn, to competition over mandates between different ministries and departments within the regulatory apparatus, with a marked shift in the policy thrust of the environmental state towards fulfilling its neoliberal imagination.

As of 2003, there were more than a dozen agbiotech TNCs operating in India, and *Bt* technology was being used for creating a host of transgenic crops, such as tobacco, rice, potato, tomato, brinjal, cauliflower, cabbage, tomato, mustard (Ghosh and Ramanaiah, 2000). The globalizing state bureaucrats and localized global actors, such as TNCs and the scientific elite, were entering into a political web to regulate transgenic seeds. Within this network, the risk assessment procedures were amenable to bureaucratic maneuvers to further the interests of the commercial actors. Given the fragmentary and incoherent nature of the approval process, which is dispersed across too many departments whose precise roles in the process are poorly defined, and highly contested, the winners were invariably the agbiotech corporations who have channels of formal and informal engagement with the state. With strong linkages developed between the global and local biotech industries through strategic alliances, influential commercial actors such as the Confederation of Indian Industries (CII) and the All India Biotech Association (AIBA) started lobbying with the state for a consolidated one-step approval process to speed up the commercialization of transgenic seeds (Newell, 2003).

The superficiality and fragility of the distinction between the local and global actors in the *Bt* technology drama was becoming increasingly evident. So were the questions about practical enforcement of biosafety regulations. The case of illegal growing of *Bt* cotton in Gujarat by Navbharat Seeds made it clear that micro-managing the seed trade with high levels of government control was almost impossible in a large country where seed markets are heavily

deregulated, with unregulated sellers all over the country. The problem of the non-enforceability of biosafety regulation and the ungovernability of seed trade left unresolved questions about how commitments to trade liberalization in the agricultural sector could be squared with the use of biosafety regulations to restrict the trade in transgenic seeds and to regulate the agbiotech flows in the neoliberal empire.

3.7. Conclusion

This discussion has provided a window to look into the complex process of bioempire formation in India. An analysis of the microprocesses of governance of *Bt* cotton shows the coproduction of the regulatory regime of agbiotechnology and the emerging neoliberal order. As a series of overlapping sociotechnical practices, the governance of *Bt* cotton provides crucial insights into the shift from an expert driven regulation to market driven promotion of agbiotechnology. Apart from the external influences on the regulation of agbiotech, the internal conflicts in the regulatory apparatus brought about an ineffectiveness of regulating *Bt* cotton. The resolution of this contradiction was sought through a hasty policy decision of commercialization of *Bt* cotton, which provided an advantage to the transnational corporations that were making inroads into the seed sector.

The contradictions in the regulatory framework were caused by various factors. These included—borrowing a regulatory framework for an imported technology, overlaying neoliberal policy goals on a technocratic culture that had colonial and welfare-statist elements, the conflicting state projects of regulating and promoting agbiotechnology placed within the same regulatory agency, the lack of a clearly defined regulatory authority, a narrow definition of ‘risks’ that legitimized scientific risk assessment to the neglect of the broader politics surrounding the technoscience, the promoters of agbiotech regulating it, and the conflicting

requirements of the global regulatory regimes. These contradictions created tensions in the regulatory process, which led to an intense struggle that was resolved by a hasty policy decision that gave a clear advantage to the transnational corporation in alliance with the local seed industry. The 2002 official approval of *Bt* cotton set a precedence for the subsequent policies of privatization of agbiotech knowledge production and shifts in national agbiotech research goals. I will look in much greater detail at the beginnings of this phenomenon in my next chapter.

CHAPTER 4:
FROM NATIONAL AGRICULTURAL RESEARCH SYSTEM TO GLOBAL
AGBIOTECH INDUSTRY

The official approval of the commercial release of *Bt* cotton was accompanied by various initiatives to transform the national agricultural research system. This, in turn, paved a way for the emergence of an agbiotech industry led by the transnational corporations. Through a series of policy induced shifts in the knowledge production processes and practices, a new biopolitical institutional system was set into place that blurred the boundaries between the technoscientific, political and economic domains. The three spheres overlapped and invested one another in order to facilitate the capitalist pursuit of economic profits. The global neoliberal order provided terms and conditions to police agbiotech knowledge production in a way to ensure the capitalization of agbiotech knowledge at the local level. In this emerging bioimperial order, the control over agbiotech knowledge was situated in a network of global and local patent regimes. The incorporation of agbiotechnology into this imperial network, in turn, consolidated the neoliberal goal of opening up the agricultural sector to a global agbiotech industry.

This chapter explores these issues by tracing various aspects of the emerging bioempire as manifested in the transformation of the institutionalized agricultural research system, the privatization of agbiotech knowledge, and a convergence of institutional patterns via globally dispersed agbiotech knowledge production practices and intellectual property regimes. In the **first** section, I begin by exploring the historical antecedents of the political economy of agricultural technology. I trace the shifts that occurred in this form of power/knowledge leading up to the contemporary form of biopower embodied in agbiotechnology, which is situated at an interface of private and public alliance. In the **second** section, I focus on the case of the

Monsanto-IISc partnership as an empirical marker to show how the emerging nexus of agbiotechnology and neoliberal policies provided a fertile environment for Capital to penetrate the public domain of technoscientific research, and how this strategy offered a competitive edge to the transnational corporations over the public research institutions and the domestic seed industry. In the **third** section, I explore in detail the reasons behind the privatization of agbiotech knowledge and opening up of a new economic space for the strategic linkages between the public labs and transnational corporations. Using the case of the Monsanto Research Centre, I highlight the manner in which the neoliberal policies helped to create a hybrid subjectivity of local scientist-entrepreneurs. The section shows how this new breed of technoscientists provided a cheap labor force for the TNCs; and through this alliance, the local public research labs gained financial support for the agbiotech research, while they lost control over the research agenda, technoscientific practices and products. In the **fourth** section, using the example of the Monsanto-IISc alliance, I explore the manner in which the public-private alliance provided an impetus to the translation of the global intellectual property regime into the local patent policies. I examine the interface of global and local patent regimes by situating patents on agbiotechnology in a historical context. The section traces the origin of the patenting of life forms, the challenges that the global patent regime posed to the existing local patent laws, and the effects of the imposition of the global patent laws on the ownership and control of agbiotech knowledge at the local level. And, **finally**, I show how the alliance between the public and private institutions and the convergence of the global and local institutional patterns favored the emergence and stabilization of a globally linked agbiotech industry at the local level.

4.1. Historical Shifts in Power/Knowledge

The introduction of *Bt* cotton catalyzed the transformation of the existing relations of agricultural knowledge and state power in India. Historically, the alliance between biological sciences and the state was forged during the colonial period. The field of biological sciences emerged as an imperial innovation whereby the colonial state and disciplined forms of knowledge were co-produced (Foucault, 1970, 1976, 1979; Jasanoff, 2004). Drawing from the traditions of natural history and biological survey, the colonial state established departments of botany and zoology in the major universities to document the flora and fauna of the country. Employing the techniques, rationalities and institutions of these sciences, the colonial state thus established its rule over the alien Indian territory and its populations (Foucault, 1991; Cohan, 1996; Philip, 2004; Prakash, 1999). Deploying agricultural science, it transformed the production system of the peripheral colony in order to increase the profits of the industry at the European center (Wallerstein, 1974). This was mainly achieved by growing desired crops in the nonnative habitat and by exploiting the commercially useful native plants (MacKenzie, 1990, Ravi Rajan, 1996). While violence and force underlined the agricultural resource depletion, the colonial state resorted to standardized skills and techniques of agricultural science to control the economy from a distance.¹⁰⁰

After independence from British rule, the extractive and exploitative agricultural science gave way to a national agricultural research system (NARS), through which the state planners sought to control the agricultural sector. The nationalist impetus to agricultural sciences embodied an intense and highly charged relationship between technology and the state, which was geared towards achieving science-led agricultural development. Essentially a public sector

¹⁰⁰ Many analysts have recognized the central role of standardization as a mechanism for creating universal or translatable technoscientific phenomena. For a particularly broad discussion of standardization, see Porter (1995). Also, Latour (1983) and Fujimura (1992).

agricultural research and development effort, the relationship between agricultural science and the state reached a new zenith during the period of the Green Revolution in the 1960s and 70s. A massive infrastructure for agricultural research and extension service was created in its wake. The Indian Council of Agriculture Research (ICAR) with its huge network of institutes and research centers, and thirty associated state agricultural universities, were thus established (Randhawa, 1979; Mruthyunjaya and Ranjitha, 1998). Aimed at guiding location-specific and farmer-relevant research, the NARS prioritized funding agricultural research in the public institutions, rather than expanding research to private laboratories.

Although agricultural science was institutionalized in the NARS, the experimental and lab based biologists did not receive the same state patronage and support as the breeders and agronomists during this period (Sopory and Maheshwari, 2001). With the advent of recombinant DNA technology in the 1970s, the state interest in the lab-based molecular biology and genetic engineering took roots in the country. Two developments in molecular biology that occurred in the US in the 1970s gave birth to the state project of agbiotechnology in India. The use of restriction enzymes to cut and splice genes, and the use of cell fusion to develop hybrid cells with desired characteristics that would multiply themselves, opened up a potential field of state intervention into agriculture. Continuing the historical partnership of the biological sciences with the state, the new policy discourse of molecularizing agricultural science led the Department of Biotechnology (DBT) and the ICAR to create research infrastructure¹⁰¹ in biotechnology in the late 1980s (for roots of this new discourse, refer to chapter 2).

Besides funding an emerging community of agbiotechnologists, who began to work on particular traits and crops in agriculture, major efforts in training researchers and building life

¹⁰¹ See www.dbtindia.nic.in, and DBT Annual Reports 1987-88, 1993-94, 2000-01 (accessed on Aug 23, 2008)

sciences laboratories were initiated by the DBT.¹⁰² As a result, a network of publicly funded life sciences institutions and programs¹⁰³ emerged across the country that received the financial and training support of the DBT. In this policy milieu, the scientists were required to commit themselves to the advancement of agbiotech knowledge rather than to meet personal interest or profit-making. The pursuit of agbiotech was seen to be separate from politics or commerce, and independent of its applications (interviews). The goal of nation building included bringing agriculture within the purview of the state, and the aim of agbiotech research was to provide the policymakers with the knowledge inputs to control the agriculture within a centralized grid of planning.

Taking a departure from traditional agricultural science, the newly emerging agricultural biotechnology did not possess a specific disciplinary affiliation. Based on interactions between the proliferating specializations in life sciences, such as molecular biology, genetics, biochemistry, biophysics, cellular ecology and so on, agricultural biotechnology increasingly led to molecularization of agricultural knowledge. Unlike the sciences of plant breeding and agronomy,¹⁰⁴ which used to be carried out on fields, the locus of knowledge production now shifted to sophisticated and expensive public labs and greenhouses. The hybridization of knowledge also necessitated a new skill base to carry out the research in agbiotechnology. By breaking the disciplinary boundaries and by shifting the focus of analysis to the sub-cellular level, the mode of knowledge production was thus decentred and the control over inner mechanisms of plant cells was intensified. With the adoption of neoliberal policies and the entry

¹⁰² See www.dbtindia.nic.in, and Annual reports, 2001-02, 2002-03, 2003-04. (accessed on Aug 25, 2008)

¹⁰³ This includes program support for Indian Institute of Sciences, Bangalore; Centre for Cellular and Molecular Biology, Hyderabad; the International Centre for Genetic Engineering and Biotechnology, New Delhi; and support for autonomous institutes such as, National Institute of Immunology, New Delhi; the National Center for Cell Science, Pune; the National Centre for Plant Genome Research, New Delhi; the Institute of Bioresources and Sustainable Development, Imphal; the Institute of Life Sciences, Bhubaneswar (See Sharma et al, 2003)

¹⁰⁴ In agricultural science, the sub-discipline of plant breeding is used for backcrossing, and agronomy for field testing of the crop.

of TNCs into the Indian seed market, the field of life sciences became a resource to generate wealth for various actors, such as the Indian state and the seed entrepreneurs. Within this changing political economic milieu, the establishment of the Monsanto Research Center (MRC) in Bangalore signaled the institutional transformation of the agricultural sciences, which, in turn, heralded a change in the relationship between biological sciences and the state.

4.2. Capitalizing Agricultural Knowledge

Upon getting the patent on *Bt* cotton, Monsanto adopted a three pronged strategy to create legitimacy for its activities within India. Early on, it forged alliances with significant local actors, such as a long established and reputed local seed company in Maharashtra, the key regulatory agencies in Delhi, and a prestigious scientific institution in Karnataka. These linkages were created to form a network of allies to facilitate the commercialization of *Bt* cotton. The joint venture with Mahyco,¹⁰⁵ the local seed company, was crucial in understanding the dynamics of the domestic market, and to get an official approval on the importation of its technology. Through its regulatory affairs office in Delhi, Monsanto engaged in routine interactions with officials at the DBT and other government agencies over policy developments (refer to chapter three). And, the enrollment of the influential Indian Institute of Sciences (IISc)¹⁰⁶ into its expansionist agbiotech project provided a scientific window on the emergent agbiotechnologies. Capitalizing on a large technical workforce that could be hired at lower labor costs, Monsanto began to invest in research and development (R&D) in agbiotechnology in the

¹⁰⁵ MAHYCO stands for Maharashtra Hybrid Seeds Company.

¹⁰⁶ “Monsanto plans to set up \$25m R and D Centre” *Business Standard*, 20 August, 1997; and “Monsanto sets up R and D centre in Bangalore” *Business Line*, 31 January, 1998.

publicly funded research institutions.¹⁰⁷ Through such alliances, the corporation emerged as a metropolitan center of calculation (Latour, 1987) from which standardized agbiotech products began to flow out into the local market.

With Monsanto's progress in the European markets frozen throughout the 1990s, the neoliberalizing Indian economy and its huge agricultural market took on a great significance for the corporation. By 2000, the corporation consolidated its India operations and made a strategic move away from crop protection, mainly herbicides and herb control products, to transgenic crop production.¹⁰⁸ It also forged links with high-profile, well-established and trusted Indian institutions. When Robert Shapiro was appointed as the new Chief Executive Officer (CEO) of the corporation in 1995, he engaged in a program to reorient the commercial vision of the corporation to outsource its research and development (R&D) activities to India. In the linkages between the local and the global seed industry, the basic research in transgenics was initially done in the western laboratories. Gradually, the strategy to command the market was made more competitive through linkages with the public research institutions in India.

In 1998, Monsanto signed an agreement with the IISc during the tenure of the former director of the institute, Professor G. Padmanaban. Under this agreement, the Monsanto Research Center (MRC)¹⁰⁹ was set up on the premises of the IISc in Bangalore, Karnataka, after the

¹⁰⁷ "Monsanto, a contemporary East India Company, and Corporate Knowledge in India" available at <http://dissidentvoice.org/> (accessed on Oct 20, 2009)

¹⁰⁸ "Monsanto lines up big plan for India (the company wants to put the terminator gene controversy behind it)," *Economic Times*, 3 March, 1999; "Global consolidation, Indian impact," *Business Line*, 2 April, 2000; "Monsanto among Rs 508 crore FDI proposals cleared (to increase stake in Indian business to 72 percent with Rs 343 crore investment)," *Economic Times*, 12 April, 2000; "Agrochemicals: consolidating to grow," *Business Line*, 2 April, 2000; "Monsanto India: Seeds of success (restructuring by parent paying off)," *Business Line*, 17 September, 2000; "Monsanto integrates agribusiness (to acquire businesses from sister concern for Rs 342 crore)," *Deccan Herald*, 19 March, 2000.

¹⁰⁹ See: <http://monsantoindia.com/monsanto/layout/researchcentre/> (accessed on June 18, 2008)

corporation agreed to pay 300,000 US dollars per year to the IISc as annual rent.¹¹⁰ The linkage between Monsanto and IISc was partly triggered by a government policy that put pressure on public institutions conducting high-tech research to generate their own money to supplement public funding. Since the IISc faced a funding crunch due to the increasing research costs in biotechnology and decreasing funds from the neoliberalizing regime at the center, Monsanto used the opportunity to tie-up with the institution, amidst much public outcry.¹¹¹ The Society for Innovation and Development (SID), an outfit of the IISc, played a crucial role in linking the institute with the corporation and for giving permission to build the research facility on its campus. Following the agreement, the institution provided Monsanto with over 25,000 square feet to construct its laboratory, which was its only R&D center established outside the US, and a further 10,000 square feet of greenhouse space. Projected as a joint research center, the MRC hired the faculty and students of the institution to tap into its research potential. The scientific workforce of the MRC was drawn from different departments of the IISc, who were directed to do work in the areas of crop transformation, crop protection and bioinformatics.

Unlike the more traditional public sector research labs and institutions, IISc had recognized the significance of the newly emerging field of new biology decades before its alliance with Monsanto. Back in the 1970s, the then director of the institution, Dr. Satish Dhawan, introduced the trans-disciplinary field of life sciences into the institution (Current Science, 2002). Trained at Caltech in the US, Dhawan represented the new breed of scientists influenced by developments in the emergent field of new biology in the West. Under his directorship, many centers and departments in life sciences were created in the institution; which, subsequently, were linked to research groups working in life sciences in other labs in the

¹¹⁰ See “India’s finest, for hire,” at <http://www.nature.com/nature/journal/v407/n6806/full/407830a0.html> (accessed on September 9, 2008)

¹¹¹ See, “A protest in Karnataka” in *Frontline*, Oct. 10-23, 1998.

country. Because of the influence of the science-elite in policymaking at the center, the IISc, along with other prestigious science institutions, had been instrumental in the establishment of the Department of Biotechnology (DBT) in 1986. The setting up of the DBT, in turn, helped channel public funds to the institutions for basic research in life sciences, notably in the areas of molecular biology and genetic engineering. The availability of researchers in life sciences at the IISc helped Monsanto to further its market ambitions, starting off with backcrossing its *Bt* cotton into the local varieties (refer to chapter 2).

While the corporation subcontracted research work to the subsidiary laboratory at the IISc, the control of the research remained with the company headquarter in the US. The work at the MRC was supervised by group directors and the planning process was overseen by the head office at St. Louis. After setting the priorities, specifying the time-lines and allocating the budget, the head office expected the Indian lab to deliver (Scoones, 2005). The IISc scientists working for the corporation resented the control through such surveillance and the loss of research autonomy, but continued to do time-bound and product-oriented science for the commercial laboratory in order to bring in money to the institute, and to work on projects that otherwise might have been beyond their reach. Although the agreement between the institute and the corporation was supposed to encourage the joint use of research facilities and capacity between the IISc and the corporation, the symbiotic relationship that underlines a public-private partnership was missing in practice. The successful partnership met with several constraints, such as the lack of clarity in material transfer agreement and bilateral agreement for technology development, lack of a well defined modality for mutual human resource development, and lack of empowerment of the IISc managers to take the required administrative decisions (APCoAB, 2007). Rather, the relationship gradually turned into a viral mechanism whereby the corporation

took over the machinery of the institution and used the MRC as its research arm (Scoones, 2005). As a result of such acquisition, the market performance and the profits of the corporation showed a marked improvement, with sales doubling in 2000-01 to 2.68 billion Indian Rupees.¹¹²

The professed vision of a partnership between the IISc and Monsanto for mutual benefit gave way to the privatization of science based on the notions of value addition, profit, and efficiency of the emergent entrepreneurial science. This privatization of public knowledge was emblematic of a global process of commercialization affecting the universities (Derek, 2003, Krinsky, 1991, Etzkowitz et al., 1998, Gibbons et al., 1994), which signified the capitalist penetration into traditionally public institutions. The collaborative research between the IISc and Monsanto on agbiotech was tilted in favor of the corporation, with the IISc providing cheap intellectual labor to help the corporation reap the proceeds. The relationship symbolized a pattern of outsourcing and service support to the corporation, which was made possible by the added 'revolution' in information technologies that, increasingly, networked the diffused nature of the R&D operations of Monsanto. With the ability to transfer information over the internet, the headquarter in the US and the subsidiary MRC at Bangalore, separated by large distance in space and across territorial boundaries, could work together on the corporation's ambitious agbiotech project (Regis, 2003).

4.3. Changing the Paradigm of NARS

By consolidating the new phase of the privatization of public knowledge, in which the distinction between the spheres of technology, economy and politics were further blurred, the *Bt* technological network signaled a significant shift in the NARS. As the tale of commercialization of *Bt* cotton illustrates, it took Monsanto nine years and around 40 million dollars to get its

¹¹² See company reports on Monsanto India website: www.monsantoindia.org (accessed on September 11, 2008). Also, "Monsanto's gene-modified cotton sales in India rise," *Economic Times*, 10 September, 2004.

technology commercialized. The public research institutes under NARS and the local seed industry did not possess the political will or the economic strength to launch such an effort. Due to the complexity of gene sequencing, data processing and lab work, scientists in public labs found the production of transgenic crops to be a more expensive process than conventional crop research (interviews). Despite the investment of the government in plant biotechnology, meeting the cost of research and maintaining laboratories equipped to a reasonable standard became increasingly difficult for the cash-strapped public labs and universities.

The lack of precision of the genetic engineering of crops led to increased costs of experiments. The scientists increasingly recognized that genetic engineering is not a precise science as the analogy with ‘engineering’ suggests. As a scientist in the department of life sciences at Jawaharlal Nehru University (JNU) in Delhi commented, the science of genetic engineering is based more on an experimental tradition of trial-and-error than precise engineering. Getting a particular gene inserted at the right place is more a matter of chance than deliberate design (interview). Whether the transgenic transformation processes use particle bombardment or approaches using *Agrobacterium* vectors, the success of the insertion of any particular gene remains highly uncertain, thereby necessitating the repetition of costly experiments. The research costs of genetic transformation were further escalated by developments in the science of screening and processing of genetic and protein data. Not all genes showed one-to-one effect on protein function, and the complex interactive function of whole stretches of ‘junk DNA’ remained unclear. The complexity of relationships between genes, proteins and their phenotypic effects on transgenic plants necessitated the processing of vast amounts of data using enormous computing capacity (interview). As a result, the

exponential development of data processing techniques made the transgenic transformation of crops a bewildering and expensive process for the scientists.

While the higher rate of obsolescence of lab equipment and ever increasing stringency of lab safety standards constantly kept the research costs increasing, the expensive research was coupled with the limits on high level expertise in these labs. This explains why many years of research and major funding efforts later, no publicly funded transgenic seeds could be released prior to *Bt* cotton. Although much hype was created around some of the ongoing experiments, such as the transgenic potato developed by Prof. Asis Datta's laboratory at JNU in Delhi, such transgenic products were not seen as perfect (Scoones, 2005). This was partly the reason why the local seed companies remained rooted in traditional plant breeding techniques, the scientists with an interest in agbiotechnology research and development (R&D) stayed content with lower tech innovations (interview). However, the capital intensive nature of the agbiotech research opened up a new economic space for the emergence of strategic linkages between the public labs and the transnational corporations (TNCs). With the paradigm change induced by the policies of liberalization, the neoliberal regime encouraged the linkages of public research institutions with the agbiotech TNCs (Government of India, 1995, 1997). The latter were seen to possess the funds and the expertise required for successful commercialization of transgenic seeds.

With the setting up of the MRC, an important ideological shift in the orientation of the researchers at the IISc took place. Prior to the 1990s, as part of the larger scientific community in postcolonial India, the scientists at the IISc were largely influenced by the socialist philosophy of the welfare state. Following the Nehruvian vision of using science and technology for the modernization of agriculture, scientists integrated the socialist ideas of J.D. Bernal (Bernal, 1939) with the American model of science as an endless frontier (Bush, 1945). A vision that

combined some aspects of Soviet socialist planning with the strategic potential of Western industrial capitalism had led the scientists at the IISc to pursue knowledge for the sake of politically-determined policy goals, rather than the market good (Krishna, 2001). Although founded by a leading Indian industrialist, J.N. Tata, in 1909, the IISc had been established within a context of nation-building through science and technology, and scientists did not see doing science as part of building the private profit of industrialists.

With the advent of biotechnology, the scientists at IISc enthusiastically embraced the new technology. Notwithstanding the necessity of a continuous and iterative process of knowledge production in agbiotechnology, which breaks down the barrier between science and technology, the scientific community in IISc set out to pursue basic research in the newly emerging technology. Despite venturing into the field of agbiotechnology research, the scientists at IISc continued to view the scientific enterprise as an isolated process, with industry and market coming into reckoning only at the later stages. This cherished ideal of doing science for the sake of science, with no concern for its application and ownership, stood challenged following the collaboration with Monsanto. The initial shift from Mertonian science to corporate technology occurred with the signing of the memorandum between IISc and Monsanto to build the research center.¹¹³

Spurred by the neoliberal policies of value addition through technological change and increased role of knowledge in the creation of wealth and developmental process, public institutions like IISc underwent a transformation to incorporate an entrepreneurial mode of research. As envisioned in a CSIR document, the emerging culture of intellectual property rights (IPR) and creation of wealth from knowledge was supposed to give rise to the “entrepreneur in a

¹¹³ See: “Monsanto Research Centre” at <http://monsantoindia.com/monsanto/layout/researchcentre/> (accessed on October 20, 2008)

scientist”, who had to be “awakened, equipped and motivated to venture out in knowledge market space” (CSIR Report, 1996). Similarly, the pro-*Bt* technology lobby held that unless the state-run institutions interacted more actively with the industry, the R&D in agbiotechnology would lack dynamism (EPW, 2000). The manifestation of this trend was discernible from the IISc-Monsanto alliance, followed by other such linkages, which brought the university closer to the industrial needs and demands.

In this scenario, the R&D capacity emerged as a part of a global network of researchers whose location was increasingly less important because of their connectivity through the internet, which enabled rapid transfer of information between different labs around the world. In contrast to the earlier state funded agricultural science that was done within the ICAR institutions in the country, Monsanto’s researchers had regular interactions with the head office in the US. And, scientists regularly moved between labs of the corporation in Asia and the US. The global science activity was thus networked among different centers, as exemplified by the work on *Bt* cotton that was carried out through connections between company scientists in the US, India and China (interview). The networked, global research and development gave Monsanto an advantage in terms of allowing it to shift work between units as desired. For instance, when its research center at IISc became a target of continuous protest by the anti-biotech activists, Monsanto wound down its operations there in 2003, moving its research facility to a new, unmarked site on the outskirts of Bangalore.

With the easing of control over the foreign direct investment into the cash starved premier institutions, such creative collaborations between the public and private institutions were based on an assumption that the corporations would work in consonance with the public science institutions to expand their scope of work, in addition to creating financial resources for them.

However, the sudden closure of MRC at the IISc revealed several problems associated with this approach to expanding the country's agbiotech research base. Monsanto justified the closure by pointing out that with the redefinition of core areas at its US headquarters, the MRC did not justify the investment currently made. Clearly, the IISc had no say in the matter and lost a cutting edge research facility. The unceremonious closure of the MRC showed the tendency of global capital for a sudden flight in the face of uncertainty regarding its profits. The corporation evaluated its core research priorities constantly and shifted investment patterns accordingly. It did not consider it necessary to give any explanation to the IISc or its scientists for closing down its research facility abruptly (EPW, 2000). With the failure of this model of public-private partnership, it became clear that the IISc had not ensured that its interests be safeguarded in the original agreement. Therefore, it became a convenient location for the creation of a temporary subsidiary research facility for the TNC. The case of the MRC highlighted that public universities and institutions engaged in agbiotech research and development were beginning to walk a tight rope between shallow resources and relevant research agendas on the one hand and comfortable levels of investment of TNCs but markedly less control over research administration and priorities on the other.

4.4. Transforming the Local Patent Regime

The partnership between the IISc and Monsanto created an economic space for the capitalist accumulation in agriculture through the university-industry research endeavors and the establishment of a patent regime. The shift in the institution of science became most evident in the area of ownership of agbiotech knowledge. Traditionally, the science at IISc was geared towards the career reward structure of prestigious publications, medals and awards, and membership in academies and elite professional bodies. Unlike the public sector institution,

where publishing a paper was enough, research at Monsanto Research Centre was geared towards commercialization of transgenic products. As the state project of agbiotech research and development became increasingly hybridized through alliance with the private sector, the protection of intellectual property and commercial confidentiality became the byword of life sciences (Ghosh and Ramanaiah, 2001).

Although the public-private alliance in the area of agbiotech research was often advocated by the public sector scientists and policy makers to offset resource inadequacies (Mruthyunjaya and Ranjitha, 1998), the independence of scientists working at MRC was severely curtailed in order to maintain secrecy of research information from competitors. The publications by researchers at the Research Centre had to be approved at the head office at St. Louis; and everyday research activities and interactions were put under surveillance through strict commercial secrecy provisions (Scoones, 2005). The issue of secrecy raised a political debate related to the patenting¹¹⁴ of genetic resources and control of agbiotech knowledge.

Initially, life forms that include plants and micro-organisms were excluded from patentability under the Indian Patent Act of 1970 (Watal, 1998a, 1998b; Chaturvedi, 2001, 2002; Gupta, 1993).¹¹⁵ Under this restrictive law, the definition of an invention excluded methods of agriculture and microbiological processes.¹¹⁶ Through this Act, the welfare state ensured that agricultural processes and products were not monopolized by the private sector, mainly the

¹¹⁴ Patents give the patentee the right to prevent third parties from making, using or selling the patented product or process. This gives the patent holder a form of monopoly control for specified number of years, and creates a legal means of limiting market competition. Patentable products have to meet the criteria of patentability, such as novelty (that which is not known previously), non-obviousness (that which involves an inventive step), and usefulness (that which is industrially applicable). With some nuanced differences, the patent laws of all the countries follow these criteria (Watal, 1998). However, not all countries allow the patenting of plants, microorganisms or biotechnological products or processes.

¹¹⁵ Also, see Indian Patents Act, 1970, available at <http://www.patentoffice.nic.in/ipr/patent/patAct1970-3-99.html> (accessed on October 22, 2009)

¹¹⁶ See Section 3(h) of the Patents Act, 1970, <http://www.patentoffice.nic.in/ipr/patent/patAct1970-3-99.html> (accessed on October 25, 2009)

TNCs. While the capitalist countries conceived of patents as a way to ensure the fundamental right to private property, the Indian welfare state viewed intellectual property as a public good necessary to promote economic development (Stewart, 1993). Seeds were regarded a common property resource in the public domain, the state patent law ensured that farmers' rights to save, exchange and improve seed were not violated (Shiva, 2003). So, the existing patent regime could not protect *Bt* cotton in order to provide Monsanto the exclusive marketing rights (EMRs)¹¹⁷ over the technology.

4.4.1. Globalizing US Patent Law

Prior to the commercial release of *Bt* technology, the emerging regime of global property protection posed major challenges to the Indian patent law. With the formalization of the Trade Related Intellectual Property Rights (TRIPS) agreement¹¹⁸ of the World Trade Organization (WTO) in 1995, stringent standards for the protection and enforcement of intellectual property were laid down. Earlier, in 1980, the non-patentability of living forms changed in the US with the landmark Supreme Court case, *Diamond v. Chakrabarty* (Lumelsky, 2005).¹¹⁹ The court decided in a narrow 5-4 ruling that a strain of bacteria, which had been modified by the insertion of new genes,¹²⁰ was patentable because it did not occur naturally. The court articulated that the threshold question for patentability of an object was not whether it was inanimate, but whether it was the product of nature or human invention. The court went on to hold that a live, man-made

¹¹⁷ EMRs allow a transnational corporation to market its patented product in any WTO country. According to the WTO/TRIPs agreement, EMRs are to be provided in those countries where product patents are yet to be adopted as a practice for legal protection of intellectual property. In any case, all the member countries of WTO, including India, were required to adopt product patents by 2005 (Chaturvedi, 2002; Kumar, 1998)

¹¹⁸ The Trade Related Intellectual Rights (TRIPs) agreement of the General Agreement on Tariffs and Trade (GATT) provides a framework for the implementation of the global IPR laws.

¹¹⁹ The text of *Diamond v. Chakrabarty*, 447 U.S. 303 (1980) is available at, <http://caselaw.lp.findlaw.com/scripts/getcase.pl?court=us&vol=447&invol=303> (accessed on October 28, 2009)

¹²⁰ The foreign genes gave the bacteria an ability to break down hydrocarbons, and the “inventors” hoped that it might be useful for cleaning up oil spills.

bacterium was patentable under the US Plant Patent Act (PPA)¹²¹ by interpreting the statutory language broadly. The court's generous interpretation of the PPA established a new standard for invention that focused on the distinction between natural products and products of human effort. The judgment paved the way to commodify life forms as inventions, thereby setting in motion the trend towards the legal acceptance of the commodification of germplasm.

This case was followed by a series of biotech patenting cases in the US, during the 1980s and 1990s. Those not only expanded the legal boundaries of patentable living matter, but also narrowed the traditional seed saving exemption for farmers codified by the US Plant Variety Protection Act (PVPA) of 1970. The judicial decisions were rendered to spur biotechnology innovation and progress, and in doing so facilitated the creation and consolidation of an agbiotech industry dominated by large corporations, which in turn influenced the IP laws (Stein, 2005; Sell, 2002). With the emergence of the multi-billion dollar agbiotech industry in the US, the agribusinesses continued to advocate for the stringent patent policies beneficial for them. While the private industry lobby influenced the domestic intellectual property policy in the US, it also shaped a global IPR regime through the Office of the United States Trade Representatives (USTR). The USTR was instrumental in successfully linking intellectual property with the global trade regime at the Uruguay Round of multilateral trade negotiations¹²² in 1994. Combining the TRIPS and GATT agreements, the patent standards favorable to the US agribusinesses were incorporated in the global regulatory order (Drahos, 1995). The US aspiration to secure the TRIPS agreement as part of the GATT was thus a strategy to push an intellectual property regime favorable to the US onto the global trade stage.

¹²¹ The PPA of 1930 granted property rights for privately developed plant varieties for asexually reproducing plants for a period of seventeen years.

¹²² The Uruguay Round, the eighth and last round, of multilateral trade negotiations (MTNs) under the auspices of the GATT led to the creation of the World Trade Organization (WTO) to subsume the GATT in 1995. In the context of the WTO, the multilateral agreements are those to which all members of the WTO are parties.

Although the inclusion of intellectual property rights in the WTO lacked a convincing rationale,¹²³ it made them subject to the enforcement mechanism of the organization. This in turn made it possible for non-compliant WTO members to face trade sanctions in any area if they failed to live up to its rules. As a mechanism to globally police the US intellectual property rights, the TRIPS agreement obliged the member countries, such as India, to provide patent protection to life forms and biotechnological processes (Watal 1998a, 1998b). As the main protagonists in the strengthening of IPRs to regulate the technological flows, the US led advanced industrialized countries argued that inadequate standards of intellectual property protection encouraged the unauthorized use of technology by the developing countries, which in turn resulted in a proliferation of trade in counterfeit and pirated goods. By strengthening the rights of the owners of technology through enhanced monopoly power conferred by the TRIPS regime, technology flows could now be effectively controlled.

These arguments were, in fact, reflective of the views articulated by the increasingly dominant interests represented by the TNCs. The strongest support for this position came from the biotechnology industry which saw the inclusion of biotechnological inventions in the realm of intellectual property protection as the single most important instrument through which its commercial interests could be furthered (Chaturvedi, 2001). On the other hand, the developing countries maintained that as a result of the control exercised by industrialized countries over the market for technology, they did not have access to technologies on reasonable terms. These different positions led to the disputes in the GATT negotiations on the inclusion of IPRs in the WTO. The type of patent system that was in place in India was clearly against the global intellectual property regime promoted by the US.

¹²³ See: “Reintegrating India with the World Economy” available at http://www.iie.com/publications/chapters_preview/98/3ii2806.pdf. (accessed on November 3, 2009)

4.4.2. Challenging the Indian Law

The main objection of the US to the Indian patent law was that it allowed for process and not product patents, which could allow the Indian firms to find alternative processes to produce the pirated versions of a technology. According to the US, the Indian agricultural and pharmaceutical firms were copying technologies developed by the industrially advanced countries.¹²⁴ This was believed to have led to large-scale losses for the US economy. Under its Trade Act “Special 301”, the US thus threatened India with trade sanctions if the country failed to accept the intellectual property protection demanded by the former (Sahai, 1992; Patnaik, 1992).¹²⁵ Emphasizing the harmonization of patent laws, the US government considered the lack of patent protection for TNCs in India as unfair trading practice under the multilateral trading system enshrined in the GATT. This position sharply contrasted with the demands of the Indian civil society for the localization of intellectual property laws.

The US government used a sophisticated process of trade threat, accompanied by its surveillance apparatus, to coerce the Indian state into complying with its intellectual property objectives. The motivation for the development and use of this coercion came from the transnational corporations, such as Monsanto. The TNCs successfully persuaded the US government into arguing that trade coercion was the only way to stop the theft of the US technology and economic profits. For the US state, there was also a payoff. By helping its transnational industry to achieve *dominium* over the abstract objects of intellectual property, the US went a long way towards maintaining its global *imperium* (Drahos, 1995). The TRIPS agreement, at one level, was very much a story about the continuation of the US global hegemony. Political scientists have long argued that a hegemonic power must have control over

¹²⁴ See: www.iprsonline.org/ictsdocs/ResourcesTRIPSanita_ramanna.doc (accessed on November 5, 2009)

¹²⁵ Also see: www.assochem.org, History p. 9. (accessed on November 8, 2009)

the sources of capital and markets, and a competitive advantage in the production of highly valued goods and technologies (Keohane, 1984). One way to control the material objects is through the control of abstract knowledge. A patent right over a transgenic seed constitutes a property right over an abstract knowledge that gives the owner the power to determine the physical reproduction of that technological know-how. Through the emergent global property regime, the agbiotechnological knowledge came to be owned and controlled by the hegemonic neoliberal empire.

4.4.3. Translating the Global Patent Laws

As one instrument in a broader framework of economic liberalization, the TRIPS agreement created a global enforcement mechanism for IPR and obligated the member countries of the WTO to provide harmonized standards of IPR protection.¹²⁶ As transnational corporations placed increasing importance on uniform global IPR standards, the neoliberalizing Indian state considered a stronger IPR regime as a means of encouraging more Foreign Direct Investment (FDI) in new technologies, including agbiotech (Maskus, 1998). This belief, while unsubstantiated at the time the TRIPS agreement was being negotiated, was outweighed by the fear of being left out of a liberalized, global trade regime. The connection between strong IPR and economic growth was based in part on the theory that development in the neoliberal era would be dependent on trade in protected technological inventions (Eaton and Kortum, 1996). However, the civil society groups supported the maintenance of sovereignty over the scope of patent rights. For instance, in 1993, delegates from the National working Group on Patent Laws (India) and the Indian Drug Manufacturers Association, along with groups from other developing countries, declared that “governments must reject the proposals to impose a monopolistic patent

¹²⁶ See: Agreement on the Trade Related Aspects of Intellectual Property Rights (TRIPS), available at www.wto.org (accessed on November 11, 2009)

regime and the scope of subject matter that can be patented should remain a sovereign right of the state” (Garde, 2009, p 11).

Nevertheless, as a result of the commitment made while acceding to the TRIPS agreement and assuming membership of the WTO, the Indian Patent Act of 1970 was amended under the Acts of 1999 and 2002 in order to allow process patents in plant varieties (Ramakrishna, 2003). The first amendment was to introduce exclusive marketing rights and mail box arrangements for receiving agbiotechnological patent applications (Chaturvedi, 1999, Shiva, 2003).¹²⁷ These amendments translated Article 27.3 (b) of TRIPS into the Indian patent law. A somewhat ambiguous Article 27.3 (b) of TRIPS states that the “members may exclude from patentability plants and animals other than micro-organisms, and, essentially, biological processes for the production of plants or animals other than non-biological and microbiological processes.”¹²⁸ There was a lack of clarity on the reasoning used to decide what could and could not be excluded from patentability under Article 27.3 (b). The article did not clarify the following issues: one, why the option of exclusion of patentability of plants and animals did not extend to micro-organisms as there was no scientific basis for the distinction; second, why the option of exclusion of patentability of essentially biological processes did not extend to microbiological processes as the latter were also biological processes (Yamin, 2003).

Without a clear definition that the production of seeds by genetic engineering was essentially a biological process, the ambiguity of Article 27.3 (b) of TRIPS, as enshrined in Section 3(j) of the amended Indian Patent Act, led to different interpretations of the TRIPS provisions. While it opened the floodgate for patenting transgenic seeds, the legal ambiguity

¹²⁷ The Amendment provided for the establishment of a mail box system to file patents under article 70.8 of the TRIPS agreement and accorded exclusive marketing rights under article 70.9 of the TRIPS.

See: <http://www.nic.in/ipr/patent/patAct1970-3-99.html> (accessed on November 12, 2009)

¹²⁸ See: http://www.wto.org/english/docs_e/legal_e/27-trips.pdf (accessed on November 13, 2009)

provided space for resistance to the binding TRIPS regime. Contesting the provisions of TRIPS were interest groups of farmers, such as *Karnataka Rajya Ryota Sangh (KRRS)*, and civil society actors, such as Gene Campaign and the Research Foundation for Science, Technology and Ecology. The latter launched significant epistemic and political challenges to legislations in the area (Rangnekar, 2007). Arguing that the article 27.3 (b) affected farmers' rights and agricultural biodiversity, the critics found the patentability of plants and animals produced through non-biological and microbiological processes problematic. While the moving of genes across species barriers through genetic engineering techniques could be defined as non-biological in the sense that such mixing of genetic material would not happen in nature, the production of plants and animals with genes introduced from other species took place through an essentially biological process of reproduction (Shiva, 1996, Amankwah, 2007). Thus, a review of the provisions of the TRIPS was sought before changing the domestic patent regime.

Thus, alongside external pressure favoring change, the government of India faced enormous internal resistance to patent reform. Although the Indian government ended up conforming to the US trade pressure to amend the local IPR regime, there was no major domestic political constituency that favored policy change in the beginning. With the initiation of economic liberalization in the early 1990s, sections of the Congress Party began to favor the changes in patent laws. Similarly, the nationalist Bharatiya Janata Party (BJP), which came to power in 1998 replacing the Congress Party, abandoned its opposition to patent reform and adopted a pro-patent position. Although opposition to reform existed within both of these major political parties, the BJP and the Congress eventually ensured the dominance of groups within

their respective parties and affiliations that favored change on patents.¹²⁹ In line with the reform political parties, important industry bodies, such as the Confederation of Indian Industry (CII) and Associated Chambers of Commerce and Industry (ASSOCHAM), stressed before the Gujral Committee¹³⁰ that the country needed to change the patent laws in order to attract relevant technologies and an increasing flow of Foreign Direct Investment. These influential industry bodies began to support the amendment of patent laws in conformity with the provisions of the TRIPS.¹³¹ The Council of Scientific and Industrial Research (CSIR), with its chain of forty laboratories, also joined in to promote the changes to patent laws. The change in the stance of such domestic constituencies reflected a shift to a more global market oriented position that enabled policy changes to patents.

Under the revised law, the biotechnological processes that make plants resistant to pests, such as *Bt* cotton, were now patentable. However, the products of such processes were denied patent protection in the second amendment. The need for product patents to micro-manage the seed trade came to the fore around the scandal in Gujarat over the illegal growing and trading of *Bt* cotton (see chapters 2 and 5). Prior to the official clearance for the commercial planting of *Bt* cotton in 2002, the transgenic seed had been sowed illegally in many states of India. Upon discovery of the pirated seeds, the official investigation revealed that the illegal transgenic seed¹³² had been supplied by a Gujarat based company, Navbharat Seeds, since 1998. Subsequently, in 2002, the regulators in Delhi banned the pirated seeds, Nb151, on biosafety grounds. This decision was severely challenged by the oppositional network of activists, who

¹²⁹ See: "Parties undecided on Patents Bill," *Economic Times*, December 21, 1998; Also, "Congress Support to Ensure Passage of Patents Bill," *Economic Times*, December 23, 1998. And, "BJP Eases Stand on Swadeshi Plank, Backs Government Policy," *Deccan Herald*, January 5, 1999.

¹³⁰ Gujral Committee was established by the Indian Parliament to solicit views and prepare a report on the impact of WTO Agreements on India.

¹³¹ See, for instance, "CII's Wish List for the Government," at www.cii.org (accessed on June 10, 2008)

¹³² Although many versions of the genealogy of the pirated seeds got circulated, the origin of the seeds remains uncertain and contested.

argued at the time of the commercialization of *Bt* cotton, that if the illegally grown Nb151 was deemed to be unsafe, so was the legally approved *Bt* cotton. The issue though widely debated did not prevent the regulators from officially releasing *Bt* cotton in 2002.

4.4.4. *Expropriation of the Commons*

With the pressure of the US government and the requirements of the TRIPS agreement of the GATT, the sovereignty of the Indian state to choose patent laws was severely curtailed. The WTO gave the Indian state a five-year transition period to introduce plant genetic resources legislation, which would ensure the intellectual property protection for the agbiotech TNCs. In an address to the Indian Institute of Agricultural Research in 1996, Daniel Glickman, the then US Secretary of Agriculture, reiterated the US position on patents on life forms by stating that “the new legislation would provide responsible and reasonable protection to private seed companies” as there would be “very few inventions, particularly in agriculture, without patent protection”. In his view, “the fundamental fact of nature is that people will not go through the expense of development of new ideas just for the altruistic benefit of the human race”.¹³³ The value of greed underlying the neoliberal capitalist order was thus stretched to a context that preferred community interest over self-interest. The essentialist idea about human nature which suggested that knowledge could not be generated unless there was a motive of private profit clashed with the socialist philosophy of the welfare state that had guided the establishment of the agbiotech scientific infrastructure under the NARS. In making genes the object of value through the patent system, a shift took place in the approach to knowledge production along with the evolution of the concept of ownership of life forms. All centrally important components and production processes in a transgenic crop could now be patented and regarded as confidential

¹³³ See: “Protect Private Sector in Farm Research: Glickman,” *The Hindu*, January 30, 1996.

business information (Gupta, 2000). In any transgenic crop, the plant variety germplasm, the selectable marker gene, the novel trait of the gene, the promoting and coding sequence, and the transformation and gene expression technologies were patentable under the new intellectual property regime (Kapur, 1999).

The critics of the IPR regime, such as Vandana Shiva, argued that implicit in the term intellectual property rights was a commoditization and ownership of knowledge in private hands primarily for commercial purposes. For them, the integral element of the relationship of the community of scientists or farmers to their knowledge was its non-commoditized and communally owned nature. In this sense, the IPR regime on life forms devalued the community intellectual rights that used to be under community control, and instead privatized public knowledge for the sake of profits (Shiva, 1991b, 1996). The geographical spread of IPRs to India, facilitated chiefly by the neoliberal policies under the WTO through TRIPS, coupled with an extension in scope of IPRs to cover plants and life forms generated heated controversy. This was because the subject matter of IPRs had not been designed for rewarding the informal system of innovation, creativity and knowledge dissemination, such as those practiced by collective groups such as farmers and scientists in the public research institutions. The lack of a reward system for past conservation, on-going collective innovation and knowledge disclosure slowly emerged as one important concern in the linkage of IPRs with agbiotechnology research and development (WIPO, 2001).

The IPR regime as defined under multilateral agreements, such as the GATT and the TRIPS, deny the intellectual and material contribution of the farmers to global production and knowledge systems. This stands in contrast to the 1992 Convention on Biological Diversity (CBD), a treaty that acknowledges the rights of indigenous communities to their contribution to

biodiversity knowledge and conservation over generations, and supports the need to equitable benefit sharing with them. However, the implementation of CBD to establish the farmers rights, i.e., the rights arising from the contributions of farmers in conserving, improving and making available plant genetic resources, and the equitable sharing of benefits on commercialization of genetic resources, traditional knowledge and practices originating from India, faced challenges as the public debate created some degree of confusion in intermingling these issues (Watal, 1998). On the other hand, the TRIPS/WTO regime represented the visible face of the life sciences industry, which considered biodiversity as a raw material for the production of transgenic seeds. At the same time, it denied that farmers made a significant intellectual contribution to agricultural biodiversity, including seeds and plant genetic resources (Kloppenburg, 1988). Under the new global order, the farmers rights were reduced to rhetorical constructs, as the farmers and public scientists were subjected to a new round of appropriationist initiatives. As a result, there were potential conflicts, more of a political nature than legal, between the TRIPS patenting regime and the CBD.

As the neoliberal IPR regime no longer treated seeds as the common heritage of mankind freely accessible to all, the shift from common rights to private property rights through the IPR regime allowed the emergence of the global agbiotech industry that did not view seeds as a public commons. Until recently, the farmers had the right to save, replant and resell seeds to other farmers willing to buy seeds with desirable characteristics. Besides, the genetic composition of seeds, rather than the seed itself, was considered part of a common heritage which were bred and distributed freely by the public sector. Historically, the political economic order of capitalism set in motion a cycle of the expropriation of the commons (Hardt and Negri, 2000), thus systematically destroying the commons as a space of ownership. The neoliberal IPR

regime privatized public knowledge, as dictated by the necessities of the capitalist accumulation, thereby implying that commons was non-ownership, rather than commons as common ownership of agricultural resources.

4.5. Emergence of a Global AgBiotech Industry

Notwithstanding the contestation around the illegal *Bt* cotton, the introduction of the patented *Bt* technology into the Indian market transformed the meaning of research and development in agbiotechnology. The reductionism and fragmentation inherent in the patenting of genes, though convenient for the commercial concerns, violated the commonly held notions about the integrity of life forms and the common intellectual property rights of farmers and scientists. With the integration of the NARS into the global knowledge industry and the emergence of the neoliberal instrument of IPRs, a serious challenge was posed to the state reliance on the public sector R&D as the mainstay of developmental goals (Gupta, 1993). As the local firms and public research institutions started entering into alliances with the agbiotech TNCs, more often neglecting the crucial aspects of such joint venture agreements that gave advantage to the latter, the research priorities of the local firms and scientists underwent a gradual shift from pursuing what the state planners had defined as “public good” to accumulating private profit.

The interface between public and private favored the emergence of a global agbiotech industry in yet another way. With the corporatist turn in biosafety regulation (see chapter 2), the official approval of agbiotech products was linked to the confidentiality concerns related to intellectual property rights. As the case of *Bt* cotton shows, the confidentiality concern influenced the willingness of MMB to share the information about the field trial data during the biosafety assessment procedure with the regulators and the broader public. The link between the

intellectual property rights and biosafety concerns became the reason for the corporation to withhold information about *Bt* technology during the biosafety assessment procedure (Gupta, 2002). Since the regulatory authorities were public sector scientists often engaged in similar research, the corporations showed reluctance to share the information related with field testing and data generation with potential public sector competitors. With the emergence of the global biosafety and intellectual property regimes, the private sector increasingly became involved with the development of standards for biosafety assessment (Newell, 2003; Scoones, 2005). This furthered the interests of the agribusinesses over the interests and needs of the farmers and local populations.

The alliance of the TNCs with the local institutions reconfigured NARS and local seed firms into the network of the global agbiotech industry. Through the process of privatization of public knowledge, the public sphere of agricultural research and development was subsumed under the corporate domain. While the neoliberal technocrats defined agbiotech development and economic growth as intrinsically linked to each other, the increase in R&D spending was correlated to the potential emergence of agbiotech as a new high-tech industry. The new economic space for the agbiotech industry was further opened up by a plethora of small companies funded by venture capital. As the belief among investors that agbiotechnology constituted a technological revolution became stronger, the policy discourse of agricultural development through transgenic seeds led to the creation of a venture capital industry. With the increased role of an established private sector as well as startup companies investing in agbiotech, several financial agencies launched venture capital funding mechanisms.¹³⁴

¹³⁴ Six or seven venture capital firms, including ICICI (Industrial Credit and Investment Corporation of India) and Small Industries Development Bank of India (SIDBI) became active. Meanwhile, Biotechnology Consortium India Limited (BCIL) was established to act as an agency to forge linkages between research, financial and industrial institutions with the policy making framework at the government level. This was done in order to transfer research

The commercialization of *Bt* cotton led to enormous pressure on the local seed companies to engage in technological improvement of their seeds. The pressure emanated from the growing market penetration by the global seed corporations following Monsanto. For instance, Monsanto licensed the *CryIAC* gene to nine more Indian companies, besides Mahyco, in order to ensure the widespread use of *Bt* cotton (Krishna, 2004). To survive the competition in a liberalized economy, the local firms started exploring the possibility of embarking on agbiotech research and development. Some seed firms, such as JK AgriGenetics, set up a separate division for biotech research in those crops in which they owned a large share in the hybrid seed market. On the other hand, companies like Indo-American Hybrid Seeds started biotech research, but ended up struggling with identification of relevant gene sequences, high capital costs of R&D leading to resource crunch for research, and shortage of skilled manpower. Despite many institutes and universities that specialized in agbiotech research training, most of the local companies did not get relevant manpower for absorption in their R&D units (Chaturvedi, 2002).

As only a few local seed companies had capacity in agbiotech research, most of their research took place as part of an alliance with one of the global life sciences corporations. The local companies continued with this struggle to retain their market share. Most of the firms gradually started tying up with the TNCs for accessing their vast pool of gene sequencing for producing transgenic seeds. However, their problem was compounded by the growing number of genes or gene sequences coming under patent ownership of the TNCs. Upon entering into alliance with the TNCs, the role of the local companies was restricted to backcrossing the patented genes of the corporations with local varieties (interview). The case of Mahyco getting into alliance with Monsanto and backcrossing the *Bt* gene into a local variety is illustrative here.

leads from the publicly funded R&D projects in agbiotech to industries for scale up, validation and commercialization.

Following Monsanto, other agbiotech TNCs, including Syngenta, DuPont and Aventis, with science skills and technical know-how, began to forge alliances with local seed companies that possessed known brands and extensive market penetration. This was done to boost their credibility as legitimate players in the local market, and to tap the trust that the local companies had built with the farmers; in addition to their understanding of the regulatory environment.

With the commercialization of *Bt* cotton and penetration of TNCs into the domain of knowledge production, it became increasingly clear that transgenic seeds were produced within a few TNCs in tandem with fluid and hybrid networks of public/private, fundamental/applied research institutions. The highly specialized type of R&D within these global, hybrid networks implied that the production of transgenic seeds indeed took place in a concentrated-decentralized system of knowledge production (Ruivenkamp, 2005). With a wave of alliances, mergers and acquisitions among the TNCs, the public research institutions and private firms were swept within the corporate fold. The alliance between the public and the private spheres meant that the NARS gradually devoted itself to the commodification of the research process itself. As Monsanto led the way in this process, the commodification of the seed pushed along both technical and juridical paths (Kloppenburg, 1988). This in turn offered opportunities for increased profits for the TNCs in the enlarged agricultural market.

Meanwhile, the public-private alliance embodied in the MRC and commercialization of *Bt* cotton created widespread public discontent. In 2003, a group of angry farmers ransacked a building that formerly housed the research facility of Monsanto. The MRC had recently shifted from this site to an undisclosed location in the city. The farmers were probably unaware of this move of the corporation. Prior to this attack, the MRC had become a magnet of protests against agbiotechnology in general, and *Bt* technology in particular. The ammunition for this protest

came from a spate of farmers' suicides in the region following the introduction of *Bt* cotton. Staging noisy demonstrations against the corporation, the rampaging farmers shouted slogans demanding Monsanto to close down its operations in India.¹³⁵ Significantly, the attack on the research facility was timed to draw the attention of those attending the World Trade Organization meeting that was being held in Cancun, Mexico. The attack was justified by the oppositional network of actors on the grounds that the research facility symbolized the materiality of power/knowledge integral to the new phase of global capitalism and the associated neo-imperialism.¹³⁶ And, that the recent shift in the nexus of agricultural knowledge and state power had given rise to a new apparatus of transboundary control over Indian agriculture.

4.6. Conclusion

This discussion has revealed the mechanisms by which the neoliberal policies set in motion a cycle of private appropriation of the publicly funded agbiotech knowledge production. The disruption of the national agricultural research system was spurred by subsuming public research institutions into the corporate sphere. The introduction of *Bt* cotton symbolized the beginning of the penetration of transnational corporations into the domain of publicly funded and commonly owned knowledge. Through a process of private appropriation of this public property, the immanent relation between the public research system and the common knowledge was replaced by the transcendent power of knowledge as private property. Through a series of public-private alliances, the NARS was fundamentally reconfigured into a globalizing Indian agbiotech industry that had originated by dissolving and privatizing the public knowledge domain.

¹³⁵ See: "Agitated farmers damage IISc Building" *The Hindu Business Line*, 11 September, 2003; "Protestors attack Monsanto Greenhouse in Southern India," *Associated Press*, 11 September, 2003;

¹³⁶ See: "Indian farmers target Monsanto," *BBC News*, 11 September, 2003; "Indian farmers attack Monsanto after 70 suicides blamed on crop failure" available at http://www.non-gmfarmers.com/news_print.asp?ID=696 (accessed on November 14, 2009)

The analysis has also showed that a centrifugal agbiotech productive process was accompanied by a centripetal control over its production. While the deterritorialization of agbiotech knowledge production led to a dispersal of knowledge production processes and sites, it also provoked a corresponding centralization of control over agbiotech knowledge production from a distance. The bioempire emerged by governing the hybrid identities of a new breed of scientist-entrepreneurs through modulating networks of command and control of knowledge production. This was facilitated by an externally imposed, and internally contested, patent regime.

These aspects of the making of the bioempire show that it emerged through a process of institutional isomorphisms (DiMaggio and Powell, 1983; Meyer and Scott, 1994; Boli and Thomas, 1997 and 1999).¹³⁷ As the discussion reveals, the process of patent policy reform was complex and multifaceted, involving the interplay of internal and external factors and actors. Through a global enforcement and surveillance mechanism for IPR, the Indian patent regime was eventually brought in line with the harmonized global IPR standards that favored corporate interests. In this process, both coercive and expert isomorphisms helped in the emergence and the stabilization of the bioempire (DiMaggio and Powell, 1983). On the one hand, the coercion of the external actors brought about the conformism of the local actors to the demands of the global neoliberal policy of a harmonized global patent regime. On the other hand, the transformation of the publicly funded technoscientific institutions, because of their resource dependence on the transnational corporations, led the experts to dismantle the national agricultural research system in order to facilitate the appropriation of the public knowledge domain by the corporate actors. The isomorphisms were mostly led by the western-trained experts within the local government, technoscientific institutions and local seed firms to make a shift to subsume the public

¹³⁷ For a detailed discussion on this approach, see chapter 1.

knowledge production system under the corporate domain. The process of institutional isomorphism was challenged by anti-*Bt* cotton activists and NGOs. In the chapter that follows, I will look in much greater detail at the emergence of a counter-empire of resistance to agbiotechnology, which contested the bioempire on the same terrain.

CHAPTER 5: EMERGENCE OF A COUNTER-EMPIRE OF RESISTANCE

The introduction of *Bt* cotton into India created a new space for the biopolitical struggle against the emergent neoliberal regime and its technoscientific instrumentality. Triggered by the failure of the hybrid cotton crops in the state of Andhra Pradesh due to pest devastation, and subsequent suicides by farmers due to indebtedness, an intense debate ensued on the vulnerability of Indian agriculture in a globalizing world. The role of biotechnology in either causing or dealing with this agrarian crisis became central to the debate. Because of the role of transnational corporations and global regulatory regimes in the making of the bioempire, the struggle against *Bt* cotton was closely linked to the counter-globalization movement.¹³⁸ The resistance to *Bt* cotton was tied up with a network of actors engaged in a wider struggle against the dominance of transnational capital and the neoliberal institutions that led to a particular type of technological modernization. At stake in this anti-agbiotech struggle were issues related to capitalist imperialism, national sovereignty, and farmers' rights. The activists contested the meaning of *Bt* technology, challenged the form of its regulation, and articulated the needs of the farmers. And, in opposing the biotechnologization of Indian agriculture, they deployed rational science to legitimize their claims. Even as they evoked the romantic image of the traditional farming practices, the use of scientific rationality in their discourses kept the empire of resistance (Hardt and Negri, 2000; Jasanoff, 2006) rooted in the ideology of the European Enlightenment. The situated epistemologies of the disadvantaged farmers remained muted or selectively

¹³⁸ Here the term counter-globalization is used instead of “anti-globalization” to suggest that the resistance to the bioempire was linked up to global networks of activism.

represented in this counter-hegemonic force of resistance, which played out on the terrain of the emerging bioempire itself.

This chapter explores these issues by looking at the political struggles that characterized the emergent empire of resistance. The body of this chapter is laid out as a series of overlapping stories. **First**, using various tactics of mobilization deployed by the activists as empirical markers, I show how each campaign against *Bt* cotton ushered in a new framing of the power relationship embedded in agbiotechnology. The section follows the movement from an appropriation of symbols of nationalist struggle, to emphasis on a patriarchal and reductionist nature of agbiotechnology, and finally to highlighting the neocolonial dimensions of the bioempire. The **second** section explores how the construction of the terminator threat acted as a powerful rhetorical tool to mobilize opposition to *Bt* technology. The conflict and antagonism around the terminator gene made the power relations embedded in *Bt* technology visible to the public, thereby opening up a terrain of contestation around this technology. **Third**, I explore the construction of a network of counter-expertise constituted by the local activist researchers and their transboundary counterparts. The section focuses on the manner in which the counter-experts relied on scientific facts to dispute the official science behind regulation, and how the strategy opened up the regulatory domain to judicial scrutiny and public attention. In the **fourth** section, I focus on different camps of farmers' spokespersons using various rhetorical, discursive and technological strategies to construct a conflicting relationship of farmers with *Bt* cotton. The section explores the construction of farmers as victims or rational beings, and the manner in which such representations furthered the political and economic goals of the spokespersons more than the felt needs of farmers. Finally, in the **fifth** section, I show how a section of farmers put up a resistance to the hegemonic forces that represented their farming and technological needs.

Their desire to re-represent themselves led to a submerged form of resistance, which posed a serious challenge to the hegemonic elite forces acting as their spokespersons. This, in turn, led to a co-optation of the subversive politics of farmers into hegemonic representations of both the promotional and oppositional networks of agbiotechnology. The emergent bioempire was, thus, further stabilized as a result of the reorganizing and redirecting of the hegemonic policy and politics of the elite.

5.1. Symbolic Struggle against *Bt* Cotton

On August 9, 1998, in commemoration of the Quit India message given by M.K. Gandhi to the British, anti-biotech activists launched a citizen's movement against the supposed destruction of agricultural systems by global corporations in India. The protestors set out to mobilize farmers, consumers and scientists using "Monsanto Quit India" as the rallying slogan for this campaign.¹³⁹ By appropriating the symbols of Gandhian nationalist struggle, activists like Vandana Shiva invoked the public memory of the colonial occupation by the British that had oppressed and dispossessed the local populations. Some anti-biotech activists drew parallels between the East India Company (EIC), the seventeenth century Corporation that laid down the foundation of British rule in India, and the contemporary transnational corporations, such as Monsanto.¹⁴⁰ Citing the EIC as the first transnational corporation that consolidated the relationship of imperialism to capitalism (Spivak, 1999), activists saw the introduction of *Bt* technology as a new mechanism adopted by the emerging transnational capitalist class (Robinson, 2004; Sklair, 2002) to manipulate and control the production systems of the third

¹³⁹ See "Indians fight biotechnology giants: implement "operate cremate Monsanto," "Monsanto quit India" campaign, press release, RSFTE, New Delhi; see also: www.navdanya.org/campaigns/ (accessed on June 9, 2008); Also: "KRRS threatens to throw out Monsanto" *Times of India*, 23 November, 1999.

¹⁴⁰ "Monsanto, a Contemporary East India Company, and Corporate Knowledge in India" <http://dissidentvoice.org/2009/07/monsanto-a-contemporary-east-indi...> (accessed on Oct 5, 2009)

world. In this discourse of neocolonialism, *Bt* technology was inscribed into the expansionist program of a new phase of imperialism that gave rise to a new subaltern (Spivak, 1988) at the Indian periphery, which was silenced through the hegemonic representations of the transnational elite.

Taking the campaign to the next level, Shiva borrowed the tactics of the Gandhian nationalist movement and launched a *Bija Satyagraha* (seed protest) on 3 March, 1999.¹⁴¹ This coincided with the anniversary of Gandhi's famous Salt March that had challenged the legitimacy of the British Empire in a non-violent manner. Calling it a new freedom movement, Shiva proclaimed that "the Salt *Satyagraha* was India's refusal to cooperate with the unjust salt laws, and was India's quest for freedom with equity. The *Bija Satyagraha* is the refusal to accept the colonization of life through patents and perverse technologies, and a quest for freedom for all people and all species."¹⁴² The following year, Shiva announced a *Bija Yatra* (seed march) and a *Bija Panchayat* (seed tribunal), arguing for seed sovereignty and democracy.¹⁴³ For Shiva, seed sovereignty meant the independence of farmers to save, exchange or reuse seeds from harvest to harvest. She linked *Bt* cotton seeds with the terminator technology, which would "produce sterile seeds forcing farmers to buy new seeds every season",¹⁴⁴ which in turn would "enslave farmers and drive them to suicides".¹⁴⁵

Using the metaphor of the seed, Shiva linked the national and imperial imagined communities (Anderson, 1983) to a patriarchal, reductionist and violent technology embodied in *Bt* cotton. Drawing on her eco-feminist perspective, she argued that agbiotechnology perpetuated

¹⁴¹ See: www.navdanya.org, *Bija Satyagraha: A Call for a New Freedom Movement*. (accessed on June 10, 2008)

¹⁴² See: www.navdanya.org/archives/campaigns/bija_satyagriha (accessed on June 10, 2008)

¹⁴³ See: www.navdanya.org/campaigns/ (accessed on June 11, 2008)

Also see "Moratorium on farmer genetic engineering sought," *Times of India*, 27 September, 2000. "MNC seed interest vs farmers' plight," *Business Line*, 26 September, 2000.

¹⁴⁴ www.navdanya.org/archives/campaigns/bija_satyagriha (accessed on June 10, 2008)

¹⁴⁵ *Bija Swaraj—seed sovereignty* (2000), at www.navdanya.org (accessed on June 12, 2008)

a cosmological split that created a dichotomy between the human and non-human nature on which a patriarchal capitalist political economy was based (Shiva, 1999a). Further, agbiotechnology was seen as constituting seed as passive by locating the activity and creativity in the engineering mind. Having previously critiqued the green revolution as being inherently violent (Shiva, 1991), based as it was on a reductionist view of an inert earth in need of artificial fertilizers and a monocultural view of production (Shiva, 1993), Shiva saw genetic engineering as destructive of the seed itself. This technology robbed the seed of its regenerative capacity by bringing it under the control of masculine ideals and an oppressive legal system. Shiva's passionate critique of the power relations embedded in agbiotechnology engaged the interest of both activists and scholars. Among the latter, some viewed her ideas and activism favorably (Vishwanathan and Parmar, 2002), and others unfavorably (Herring, 2006, 2009; Pearson, 2006) or neutrally (Scoones, 2005).

Close on the heels of Shiva's campaign, the Karnataka State Farmers' Association (KRRS)¹⁴⁶ launched its "Cremate Monsanto" campaign in November, 1998. The movement's leader, M.D. Nanjundaswamy held the transnational corporations (TNCs) responsible for the spread of intensive farming in rural India. His Gandhian ideal of agriculture through rural self-management and the demand for decentralization of agricultural policies had catapulted him to the status of an influential farmers' leader a decade before his campaign against *Bt* cotton. In the early 1990s, Nanjundaswamy had organized mass rallies against the World Trade Organization (WTO) and the Indian government for being an instrument in the hands of the global neoliberal regime. In his view, the western countries were animated by the spirit of capitalism that preserved their hegemonic control over the non-West by various imperialist means, such as exporting their technologies, directing trade to their advantage through lopsided policies of the

¹⁴⁶ In local language, KRRS stands for Karnataka Rajya Ryota Sangha

WTO, and imposing the Euro-American system of production and consumption that promoted a lifestyle conforming to Western market values.¹⁴⁷

Ideologically, Shiva and Nanjudaswamy were similar to each other. However, the former was a global intellectual heading an NGO and the latter a political leader with a mass following (Madsen, 2001). The charisma of both the leaders energized the anti-*Bt* cotton campaigns that symbolized *Bt* technology as a threat posed by the global capital to the familiar mode of agricultural production and consumption in India (Nagaraj, 1996). Although driven by their nationalist vision of protecting Indian agriculture from technology-driven foreign intrusion, both Shiva and Nanjudaswamy entered into alliances with activist groups in other countries. By mobilizing allies across the borders into networks of resistance to *Bt* technology, they consolidated their persuasion and pressure tactics (Keck and Sikkink 1998). Thus, in the ideology and political activity of both the leaders, the geographies of domination and resistance were treated in a dynamic and networked way, where even long networks remained local at all points (Latour, 1993).¹⁴⁸

For instance, Nanjudaswamy was actively involved in the creation of the Inter Continental Caravan (ICC) on the occasion of a meeting of the Food and Agricultural organization (FAO) in Rome in 1996.¹⁴⁹ Following this, in June 1999, about 400 farmers from the Indian states of Karnataka and Uttar Pradesh joined hundreds of members of farmers'

¹⁴⁷ See: "Champion of farmers' cause" *Deccan Herald*, 4 February, 2004.

Also, "Indian Farmers Target Monsanto" at www.mindfully.org/GE/2003/Monsanto-Indian-Farmers11sep03.htm ... (accessed on June 29, 2008)

See, "Archive of Global Protests" at <http://www.agp.org/agp/en> (accessed on July 2, 2008)

¹⁴⁸ This type of solidarity across local movements is characteristic of the global justice (anti-globalization or counter-globalization) movement. For some seminal work on this approach, see, for example, Tarrow (1998, 2005), Keck and Sikkink (1998), Guadalupe and Rodrigues (2004), Edelman (1998), Guidry et al. (2000), and Smith (2004).

¹⁴⁹ The next year, Nanjudaswamy co-founded the World People's Action (WPA), an anti-globalization network which includes the Zapatista National Liberation Front of Mexico, the Sandinista Organization of Nicaragua, the Brazilian Movement of the Landless, the militant Maori peasants of New Zealand, and the ecological associations of the former Soviet Union. The WPA was also connected to Via Campesina, a federation of more than 200 farmers' organizations established in some sixty countries, founded in 1993.

organizations gathered below the Eiffel Tower in Paris.¹⁵⁰ The ICC had gathered to demonstrate against genetically engineered crops, terminator technology and the WTO.¹⁵¹ Moving from place to place across territorial boundaries, the Caravan was a visible, audible show (Madsen, 2001) through which the farmers and activists condemned the American imperialism, capital-intensive agriculture, and the global financial institutions. The protestors moved on to demonstrate at Cologne, in Germany, where the meeting of the eight rich and powerful countries of the world, the G8, was being held. The demonstrations continued to Geneva to protest against the World Trade Organization (WTO), and the offices of some TNCs and global financial institutions. Through its carnival-like movement, the Caravan made the power relations embedded in transgenic crops visible before they could be effectively contested (Featherstone, 2003). It articulated powerfully that resistance to agbiotechnology was real and effective, given that the geography of resistance was formed right at the point where relations of power were exercised (Foucault, 1980).

In its political activity, the Caravan followed the two key strands of resistance articulated by organizations like the KRRS: opposition to neo-liberal globalization and to transgenic crops, including the biotechnological innovations like the terminator gene.¹⁵² Closer to home, the KRRS combined the actions of targeting the local field trials of *Bt* cotton and the contestation of transnational power relations through its Cremate Monsanto campaign. Articulating his politics of dissent as a legitimate form of Gandhian violence, the meaning of this oxymoronic phrase remaining unclear, Nanjundaswamy declared that KRRS activists would burn all trial sites of

¹⁵⁰ See: "Indian farmers take the war to Europe," *IPS*, 25 May, 1999; Also, "Indian peasants at the European jaunt," *Business Line*, 10 March, 1999.

¹⁵¹ See: Inter Continental Caravan Press Release, at www.mail-archive.com/futurework@dijkstra.uwaterloo.ca/msg04238.html (accessed on January 10, 2010)

¹⁵² See: "Cremate Monsanto!" at <http://www.mail-archive.com/leftlink@vicnet.net.au/msg00063.html> (accessed on October 21, 2008)

genetically engineered cotton crops in Karnataka.¹⁵³ The event was widely publicized through the internet across the spatially constructed networks of resistance to agbiotechnology. The state responded by providing police protection to all US companies in Bangalore city,¹⁵⁴ and the High Court of Karnataka ordered security to the sites and property of the Monsanto-Mahyco Biotech (MMB) company.¹⁵⁵

Under the media gaze, the first burning of the *Bt* cotton crop took place on 28 November, 1998. Besides activists from a range of organizations,¹⁵⁶ the event was attended by a five member team from the Geneva based Global Peoples Action Group.¹⁵⁷ All through the campaign, the farmers who owned the trial fields let the protestors burn their crops after having accepted compensation from KRRS protesters. But, one farmer, Mr. Sankarikoppa of Haveri district, resisted the protestors and sought police protection.¹⁵⁸ The resistance of Sankarikoppa was put at the forefront of the pro-GE movement, as symbolic of the demand of *Bt* cotton among the farmers. The pro-*Bt* technology lobby criticized Shiva and Nanjundaswamy for their respective campaigns, which they saw as representing the well-off farmers organized and mobilized by privileged, urban-based, and transnationally-connected activist leaders. They argued that the farmers rallying behind these leaders had actually benefited from the green revolution (Madsen, 2001), so the protests and rallies had lost legitimacy in accusing the capital intensive farming of being a curse on the peasantry. In addition, the linking of *Bt* technology to

¹⁵³ See: "KRRS threatens to destroy Monsanto crops". *Deccan Herald*, 2 December, 1998. Also, "KRRS will destroy *Bt* cotton crops in Bellary today. Says it will file criminal cases against Monsanto, state and central govts," *Times of India*, 2 December, 1998.

¹⁵⁴ See: "Police protection to all American companies in Bangalore city," *Samyaka Karnataka*, 25 November, 1998.

¹⁵⁵ See: "HC orders security to seed firm," *Times of India*, 4 December, 1998.

¹⁵⁶ Activists from KRRS along with those of Progressive Front, Action Front for the Untouchables, Karnataka Liberation Front, and the Organization of the Landless.

¹⁵⁷ According to *Indian Express*, 30 November 1998

¹⁵⁸ See: "Anti-Monsanto campaign runs into dry ground," *Pioneer Press Service*, 5 December, 1998; Also, "Haveri farmers will resist KRRS destruction trail," *Times of India*, 5 December, 1998;

terminator technology and farmers' suicides¹⁵⁹ set up Shiva and other activists for a barrage of criticism from the pro-*Bt* technology network.

5.2. Mobilizing the Terminator Gene Against *Bt* technology

The controversy over the terminator gene¹⁶⁰ was sparked in 1998, by Monsanto's plan to purchase Delta and Pine Land Company, which held the patent for terminator technology in collaboration with the United States Department of Agriculture (Kluger, 1999).¹⁶¹ Although the terminator gene was not commercialized due to large scale protests worldwide, Monsanto's *Bt* technology was inextricably linked to the terminator gene in India. The confusion resulted because the timing of the field trials of *Bt* cotton coincided with the global protests against the terminator technology and its perceived relationship with Monsanto. As significant nodes in the network of oppositional epistemic brokers (Litfin, 1994), global activist groups such as the Canada-based RAFI¹⁶² and Spain-based GRAIN¹⁶³ issued press briefings to link Monsanto with the terminator technology. However, the allegation was vehemently denied by the Corporation.¹⁶⁴ Following a public uproar against the terminator technology, Monsanto was forced to issue a Statement in the Public Interest whereby it denied having used the technology in *Bt* seeds, and declared that it had no plans to use the terminator technology in India (Gupta,

¹⁵⁹ See: "Terminating freedom," *Hindu*, 26 December 1998; "Seeds of conspiracy," *Hindustan Times*, 3 December 1998;

¹⁶⁰ See: "Gene Terminator creates panic," *Times of India*, 28 November, 1998; "Patent for terminator filed in India, experts worried," *Indian Express*, 29 December, 1998; "Terminator seeds not permitted in India: Agri minister". *Economic Times*, 3 December, 1998; "Terminator seed tech will be banned: Som Pal," *Indian Express*, 2 December, 1998; "Terminator seeds not allowed," *Hindu*, 2 December, 1998; "India gears up to face the threat posed by the terminator gene," *Indian Express*, 10 September, 1998; "Stop entry of terminator into India, urge scientists," *Indian Express*, 28 July, 1998; "Infamous Invention," *Hindu*, 19 July, 1998.

¹⁶¹ See: "Terminator gene halt a "major U-turn"" available at, <http://news.bbc.co.uk/2/hi/science/nature/465222.stm> (accessed on May 19, 2010)

¹⁶² RAFI stands for Rural Advancement Foundation International

¹⁶³ GRAIN stands for Genetic Resources Action International

¹⁶⁴ See: "Terminator gene row a fabrication: Monsanto," *Times of India*, 26 November, 1998; "Monsanto releases educative ads," *Financial Express*, 8 December, 1998.

2000). And, in response to the protests against the terminator threat, the government of India tried to pacify the anxious public by issuing a ban on the technology.¹⁶⁵

Despite the denials by the officials of the corporation, assurances by the government, and much media commentary around the issue, the anti-GE activists continued linking *Bt* technology with the terminator gene. Although the construction of the terminator threat acted as a powerful rhetorical tool to mobilize opposition to *Bt* technology, it weakened the credibility of the claims of the activists considerably. The Monsanto/terminator/suicide seeds narrative came under scathing attack by the network of promotional epistemic brokers of *Bt* technology, who held the anti-GE activists responsible for inducing doubts in the minds of the public by constructing an untrue threat narrative (Herring, 2006, 2007, 2009). At the same time, the policymakers in the department of biotechnology (DBT) grabbed at this opportunity to dismiss the claims of the anti-GE activists as “factually wrong” since their terminator threat had created “panic without any scientific basis” (interviews). Questioning the technoscientific understanding of the activists, the neoliberal technocracy reinforced their cognitive authority by portraying the knowledge claims of the activists as erroneous. The carefully constructed boundary between legitimate official science and less legitimate activist non-science (Gieryn, 1983) was reinforced through the narratives of denial of the linkage between the terminator gene and *Bt* technology.

While both the promotional and oppositional epistemic brokers employed the terminator gene to mobilize allies into their networks, the productive aspects of the oppositional politics of the activists was ignored in the boundary work of the former. The narrative of Monsanto/terminator/suicide seeds succeeded in opening up a democratic space around *Bt* technology; which was a significant step beyond a mere symbolic struggle against the

¹⁶⁵ Assurances to this effect were given to the public in both the wings of the federal legislature, the *Lok Sabha* and the *Rajya Sabha*; and via Office Memorandum No. 82-1/98 PQD.

technology. The conflict and antagonism generated around the terminator gene made the power relations embedded in *Bt* technology visible to the public, bringing them to the terrain of contestation (Laclau and Mouffe, 1985). By linking *Bt* technology to the terminator gene, the activists succeeded in highlighting the possibilities inherent in the technology of hybridization that, if taken to the extreme, could dispossess the farmers of their means of production.

Since the process of hybridization makes the farmer dependent on the breeder for further stock, the activists held that the location of power shifts from the farmer to the seed industry. By emphasizing that genetic engineering decouples the means of production from the product, i.e. seed as seed and seed as grain (Kloppenburg, 1988), the activists articulated the penetration of capital into agriculture as an instrument of dispossessing the farmer. They argued that the relocation of the seed production from the farm to the corporate lab transferred the power and value of the agricultural production from farmers to the corporations, thereby dispossessing the farmers of their seed sovereignty. In this narrative of dispossession, the control of corporate scientists over the intellectual contribution made by the farmers through centuries of conservation, breeding, domestication and development of plant and genetic resources got represented as a form of institutionalized piracy embodied in the idea of patenting (Shiva, 1999; Sahai, 2005; Sharma, 2002b, 2003). In their critique of agbiotechnology, they denounced the juridical framework of the global intellectual property regimes, such as the GATT and the TRIPS,¹⁶⁶ which regard the saving and replanting of the patented transgenic seeds as a violation of law. In this sense, the terminator technology was a not yet realized technical embodiment of an already realized legal regime, which would delegate its disciplinary power to the technology (Latour, 1992).

¹⁶⁶ GATT stands for General Agreement on Tariffs and Trade, and TRIPS stands for the Trade Related Intellectual Property Rights. Both are the agreements of WTO.

The terminator gene narrative helped the activists to nail the argument against the construction of corporate monopolies through an unbridled quest for technoscientific progress. This, in turn, helped mobilize allies into an oppositional network of a resisting multitude (Hardt and Negri, 2000). However, the contestation around the terminator gene revealed that the discursive struggle around the technology mobilized science as a resource for political power (Ezrahi, 1990, Winner, 1986). The instrumental view of science enabled oppositional constructions such as corporate science and imperialist science, as opposed to promotional constructions such as pseudo-science and non-science. The truth claims of both the sides of the controversy, though claimed to be based on an objective and value neutral method of scientific inquiry, were increasingly linked to power in these constructions.

5.3. Constructing a Counter-Expertise

In order to lend legitimacy to their resistance, the activists mobilized objective science in support of their claims. The campaigns against *Bt* cotton were empirically tethered to scientific facts that were generated through grassroots research conducted by leading NGOs. In 1998, after MMB got permission from the RCGM to carry out small-scale field trials on forty locations in nine states, the Research Foundation of Science, Technology and Ecology (RFSTE) headed by Vandana Shiva carried out field surveys to probe into the details of the field trials. In their study, the RFSTE researchers claimed to have analyzed “the timing of plantation of trial crop, terms of trials of MMB with the farmers, criteria for selection of farmers and the fields, information dissemination of transgenic crops among the farmers by the corporation, comparison of the performance of *Bt* and non-*Bt* crop and ecological risks associated with the transgenic crops in the wake of the biosafety guidelines issued by the department of biotechnology” (Shiva et al., 1999, p 602). In order to investigate and interpret the details of field trials, the RFSTE

researchers did not depend on outside scientific expertise to make their case, for they believed that they were in control of their scientific inquiry.

The expertise of the RFSTE team derived from their socio-economic and agronomic knowledge. The team members included agricultural scientists, economists and sociologists, who possessed knowledge of sampling and interview techniques required for surveys. The research team relied on interviews with the farmers at various trial sites and on comparison of the parameters of field trial design, as specified by the biosafety guidelines, with the actual field trial practices of MMB. In an article in the prestigious social sciences journal *Economic and Political Weekly*, which carried their key findings (Shiva et al., 1999), the research team presented their evidence in technical terms in order to open up the blackboxes constructed by the regulators and MMB. Using the inscription devices of statistical tables, the RFSTE team provided a visual display of their findings to mobilize proof to support their claims (Latour, 1987). Along with the technical text of the report, the visual set of inscriptions included tables on comparison of actual dates of field trial plantings and the date of permission granted by the DBT, the yield reported by the farmers in the trial plots, the quantity of pesticides sprayed on *Bt* cotton trial plots, the details of field trial sites in terms of the location, names of farmers owning those plots, and the size of the plots.

In order to mobilize support for their claims, the research team drew on the knowledge claims of their transboundary allies. For instance, the myth of reduction in pesticide use was debunked by citing the dissident scientist Mae-Wan-Ho of the Open University of the UK, who attributed the failure of the pesticide reduction effect of *Bt* cotton to the unpredicted changes in the behavior of the *Bt*-gene. In addition, the analysis of the Pesticides Trust conducted on behalf of Greenpeace was mobilized to argue that the introduction of the herbicide resistant *Bt* seeds

would alter the pattern of herbicide use without changing the overall amounts used. The ecological damage posed by the transgenic seeds was also highlighted using the Greenpeace study (Shiva et al., 1999, p 608). Tying their analysis to the experiences of other countries, the RFSTE team mobilized specific evidence from Texas in the US where *Bt* cotton had failed. Arguing that MMB had not monitored the ecological impact of *Bt* cotton, the example of Texas was cited to support the claim that the pests attacking cotton developed resistance to the built-in biopesticide of transgenic seeds, and did not reduce the pesticide use. The team alleged that MMB was misinforming the public, since Monsanto faced a lawsuit by farmers of Texas over *Bt* cotton which suffered cotton bollworm damage and on which farmers had to use pesticides in spite of “corporate propaganda that genetic engineering meant an end to the pesticide era” (Shiva et, al. 1999, p 609). Thus, in constructing their scientific facts, the RFSTE team also relied on the transboundary network of counter-expertise for inputs to make their case against *Bt* technology.

Although the controversy around *Bt* cotton began soon after the technology was imported into the country, the opposition to the technology heated up when Vandana Shiva filed a public interest petition to the Supreme Court in 1999 to dispute the form and content of regulation on it (refer to chapter 3). The statistical data generated by primary surveys of the field trial sites was submitted to the court (RFSTE, 1999a, 1999b) to challenge the scientific claims of the regulators. Calling the field trials illegal, unscientific and fraudulent,¹⁶⁷ Shiva mobilized the legal-rational aspects of the case and provided the scientific evidence gathered by her team during the extensive hearings of the court.¹⁶⁸ While arguing that the surveys conducted by her researchers found contradictory evidence about the officially proclaimed efficacy of *Bt* cotton,

¹⁶⁷ See: “Monsanto trials illegal, says environmentalist” *Times of India*, 21 December, 1998.

¹⁶⁸ Because of my situatedness in the US and an inability to travel to India due to visa restrictions, I could not get access to the detailed proceedings of the court case.

the RFSTE claimed that the field trial data of MMB was essentially fabricated.¹⁶⁹ Within the context of the legal battle with the regulators and MMB, Shiva's ecological and victimization narratives got fused with the science of flawed field trials and failed crops.

More specifically, the RFSTE alleged that MMB was given improper authorization to field test transgenic *Bt* cotton, and that the existing biosafety regulations were inadequate to protect against adverse ecological and human health effects posed by such transgenic crops (RFSTE, 1999 a, 1999 b). It further alleged that a comparative study of pest incidence in transgenic and non-transgenic fields as mandated by the biosafety guidelines had not been conducted. In addition, the mandatory containment measures as outlined in the guidelines were suspected to be neglected in these trials. The RFSTE highlighted that the isolation distance of five meters around plantings of transgenic crops as required by the biosafety laws was not maintained in the *Bt* cotton field trials (RFSTE, 1999 a). The RFSTE researchers also claimed that the field trials were deliberately conducted at a time of the year when the infestation of pests would be low (Shiva et al, 1999). This, the activists argued, was done in order to give an impression of the improved efficacy of *Bt* cotton seeds over the controls used by the MMB. Speaking as the representative of the farmers, the RFSTE presented field-level interviews in court and to the media in order to show that the non-transgenic local cotton varieties outperformed *Bt* cotton.

Disputing the science behind regulation, the activists claimed that the commercial release of *Bt* cotton by the Genetic Engineering Approval Committee (GEAC) was a disaster in view of the total failure of the trial crops.¹⁷⁰ Responding to the crop failure narrative, the pro-*Bt* lobby argued that NGOs brushed aside the possibility of other factors, such as drought and attacks from

¹⁶⁹ See: *BBC Monitoring*, 20 July, 2000

¹⁷⁰ RFSTE Press Release, 26 September 2002, www.navdanya.org (accessed on August 21, 2008)

pests not affected by *Bt*, for causing the crop failures. While the petition sought the judicial intervention to check alleged violation of the regulations, at the time of the commercialization of *Bt* cotton, the RFSTE case was still pending with the Supreme Court. Because the MoEF allowed commercialization of *Bt* cotton at a time when the case was still under judicial review, the RFSTE had another reason to challenge the regulatory decisions of the RCGM and the GEAC. Even though there were no dramatic court rulings over-turning the regulatory decisions, with litigations in Supreme Court often long drawn out, the legal challenges to the science of regulation put the neoliberal technocrats on caution. By opening up the regulatory domain to judicial scrutiny and public attention, the case was an effective tactic to reinforce the external accountability of the ruling elite and to cause bureaucratic delays on further decisions on transgenic seeds.

Following the public interest litigation case of the RFSTE, other nongovernmental organizations (NGOs), such as the Greenpeace India, the Deccan Development Society (DDS) and the Gene Campaign, engaged in survey work and experimental science to support the case that *Bt* cotton field trials had indeed failed. Debunking the claims of Monsanto Mahyco India Ltd (MMB) and the regulators located in the Department of Biotechnology (DBT) and the Ministry of Environment and Forests (MoEF) about the scientific soundness of the field trials, the grassroots researchers asserted that the field trials lacked methodological rigor and were heavily biased in favor of MMB.

Among this plethora of alternative studies, however, one particular study gained relative credibility on account of its methodological uniqueness. In 2002, shortly after the start of commercial growing of *Bt* cotton in Andhra Pradesh, two agricultural scientists set out to study the experiences of farmers with *Bt* cotton in Warangal district in the state of Andhra Pradesh.

Associated with grassroots NGOs, such as the Deccan Development Society (DDS) and the AP Coalition in Defense of Diversity (APCDD), the scientists named Abdul Qayum and Kiran Sakkhari assessed the performance of *Bt* cotton in the state over a period of three years.¹⁷¹ The motivation to conduct the study was to unravel, in their words, the agro-socio-economic mystery of *Bt* cotton, and to find out the honest truth about *Bt* technology in a policy atmosphere that considered any opposition to *Bt* technology as an avoidable hurdle in the path of modernity. Challenging the boundary work of neoliberal technocrats, the dissident scientists spoke against an unspoken axiom that considered no science other than biotechnology as valid and anything that challenged it as anti-science (Qayum and Sakkhari, 2005).

Summarizing the research of Qayum and Sakkhari, the convener of the APCDD, P.V. Satheesh, wrote in the preface to their report that the scientists conducted the study in response to a perceived hype surrounding *Bt* cotton, which had bedazzled the politicians and policy makers. Their perception that a huge scientific lobby painted *Bt* cotton as a panacea for farmers and the environment coupled with an objection to corporate money that poured into creating a dazzling aura around *Bt* technology through a blitz of advertisements. While contextualizing their study within a broader political-economic milieu, Qayum and Sakkhari chose a scientific methodology to counter the hegemonic expertise of the regulators and their corporate partners. Claiming that they selected a transparent and open methodology, the two scientists questioned the methodologies adopted by other research groups who came once in a while after hearing of the cotton disaster, collected data at that point of time and went back”. In contrast, the scientists

¹⁷¹ The studies by Abdul Qayum and Kiran Sakkhari, “Did *Bt* cotton fail AP again in 2003-2004? A season long study of *Bt* cotton in Andhra Pradesh” and “False Hopes, festering failures: *Bt* cotton in Andhra Pradesh, 2005-2006” and “*Bt* cotton in Andhra Pradesh: A three year assessment” are available at: <http://www.grain.org/research/Btcotton.cfm?links> (accessed on January 13, 2010)

Also, “*Bt* Cotton in Andhra Pradesh—a three year assessment” at: www.grain.org/Btcotton/?id=302 (accessed on January 14, 2010)

And, “*Bt* cotton: the facts behind the hype” at www.grain.org/seedling/?id=457 (accessed on January 18, 2010)

claimed to have done a season-long study by staying close to the farmers to record their changing perceptions about *Bt* cotton, and by gathering information from them on a fortnightly basis. Their data collectors were village based grassroots researchers supposed to have a deep understanding of agriculture. Simultaneously, the experiences of the farmers about the performance of the crop were captured on video, and this video documentation continued till the end of the crop season. This visual data provided rhetorical force to their findings, and helped them mobilize more allies.

While MMB claimed that the cultivation of *Bt* cotton dramatically improved yields and reduced pesticide use (MMB, 2004), the activist researchers argued that their studies showed only nominal yield improvements and no pesticide use reduction (Qayum and Sakkhari, 2005). They also reported that the farmers incurred disastrous losses as compared to the non-*Bt* growing farmers who were shown to earn sixty percent more than *Bt* farmers. They further pointed out that the exorbitant price of *Bt* cotton seeds offset any increase in revenue from the improved yield. The science deployed by the dissident scientists was meant to show that the regulatory decisions relied on partial evidence and ambiguous results that black-boxed key uncertainties related to the technology. By using objective science to contest regulatory science and the performance of the technology as such, the counter-experts tried to reveal that the experimental designs of the MMB lacked the validity and objectivity required of scientific experiments. However, their epistemic brokerage relied on framing and interpreting the issues within the same paradigm of positivist science and under the same conditions of uncertainty that surround this technology. In their effort to delegitimize the regulatory science, the activists deployed an accountability science that was as political in nature as the former.

The credibility of the claims of the counter-experts was also established through numerous informal channels. Their styles of activism and particular frames of interpretations

were communicated across the borders through a burgeoning literature on their studies. The information flow on the internet was maintained by various groups, lists and networks to push an alternative scientific interpretation of transgenic crops as part of the larger cause. Acting as powerful nodes in these networks, agencies such as Greenpeace provided intellectual support to elite activists like Shiva and Najundaswamy. And, other INGOs, such as RAFI and GRAIN, channeled the scientific information, provided expert inputs and supported any material for legal submission. The elite and globally connected activists collected information produced locally and globally, and presented it in different forms in different contexts. In the context of legal submissions, it was presented as alternative experimental and survey data. These were projected as collections as per the standard norms of science, in which samples were established and statistics were applied. But, another kind of qualitative information, such as the case studies and individual testimonies, were found to be useful for projecting arguments in the media. And, one such context was the *bija panchayat* where the activists deployed the qualitative information for public consumption.

5.4. Framing the User-Technology Relationship

As the debate around *Bt* cotton intensified, a *bija panchayat* (seed council) was organized in Bangalore in September 2000. The broader aim of this tribunal was to “denounce the conspiracy to take over the seed markets in India, and other countries of the South, which destroy the inalienable rights of farmers over seeds.”¹⁷² Seeking to articulate the voice of farmers, the tribunal brought together some fifty farmers’ organizations,¹⁷³ including those from other

¹⁷² See: www.navdanya.org/archives/campaigns/ and www.navdanya.org/attachments/navdanya.pdf (accessed on August 22, 2008)

¹⁷³ Notably the KRRS, the Andhra Pradesh Ryota Sangha, the Bharata Kisan Union, and the All-Indian Kisan

countries,¹⁷⁴ as well as NGOs. At the opening of the seed council, Shiva represented the farmers as being implicated into an inappropriate technological frame of the gene revolution. Presenting herself as a spokesperson of the vulnerable farmers, she reiterated that their dependence on agro-chemicals had led them into a debt trap, which, in turn, had made some of them to sell their vital organs or to commit suicide. Through this tribunal, which was widely publicized, the political thread of the activists' narrative linking suicides, organ transplants and Monsanto was fused in the public imagination (Vishwanathan and Parmar, 2002), and was solidified by the testimonies of the victims of the technological frame of intensive agriculture.

Using a courtroom format, the tribunal opened up the *Bt* cotton debate to wider discussion. Through the jury that was designed to represent the marginalized or excluded farmers, the tribunal heard the testimonies of the victims of intensive agriculture about the disastrous effects of the expensive agricultural inputs on their lives. Defying the cognitive authority of neoliberal technocrats, the forum of expert-activists on the tribunal discussed the technical issues related to agbiotechnology, such as the control over seeds, the reduced autonomy of research in public agriculture, the costs and risks of genetic engineering, the implications of property rights and seed monopolies. Emphasizing that *Bt* technology would perpetuate the technological frame of the green revolution, which had already created an overdependence of farmers on a capital-intensive technological culture, these oppositional epistemic brokers concluded that *Bt* technology was inappropriate for the farmers as it intensified their technological vulnerability. In conclusion, the seed tribunal proposed a ten-year moratorium on the commercialization of genetically engineered agricultural products, and highlighted the need to develop the indigenous system of intellectual property in order to protect the seed sovereignty of the farmers.

¹⁷⁴ Such as the Rural Farmers' Confederation of Jose Bove, who was himself present at the event

Responding to such representations of the relationship between the farmers and *Bt* technology, some pro-GE farmer leaders supported the commercialization of *Bt* cotton. They argued that the construction of the victimization narrative had reduced the less privileged and poor farmers to the status of implicated actors (Oudshoorn and Pinch, 2003). They claimed that the Green Revolution had produced a class of well-off farmers who were now denying the less-privileged peasants the benefits of a new technology. The president of the Andhra Pradesh based Federation of Farmers Association, P. Chengal Reddy, claimed that farmers were being denied their rights to experiment with the new technology, as the bureaucracy and the advocacy groups prevented research in agbiotechnology to trickle down to them.¹⁷⁵ He added that farmers should be allowed to decide what was good for them, rather than having urbanized advocacy groups decide what was good for them. Similarly, the leader of the Kisan Coordination Committee, Sharad Joshi, made a strong case for not couching the agbiotech issues within the ideology of a free market economy.¹⁷⁶ For these spokespersons of farmers, the major concerns were the right of the farmers to get access to the latest technology and the supposed misrepresentation of farmers' needs by other actors in civil society.

As the two camps of farmers' spokespersons constructed a conflicting relationship of farmers with *Bt* technology, MMB adopted a range of advertising strategies to promote agbiotechnology among farmers. The discourse of cotton development through *Bt* technology was dispersed through a field of information campaign practices of the corporation.¹⁷⁷ Using various technologies of advertising, Monsanto sought to define the needs of the farmers that would be met through its *Bt* cotton. In order to enroll the farmers in its project, the corporation sent video trucks into the targeted regions to organize shows of documentary and fictional films

¹⁷⁵ See: *Business Line*, 21 July, 2001

¹⁷⁶ See; *Business Line*, 22 May, 2002; 19 June, 2002; 4 December, 2002.

¹⁷⁷ See "Monsanto releases educative ads," *Financial Express*, 8 December, 1998.

as a means of popularizing *Bt* cotton seeds. To convince the farmers that the new technology was an ally in their interest of increasing cotton yields, brochures and leaflets translated into diverse regional languages were read aloud at village gatherings. Newspaper adverts, open days and workshops were used to persuade a skeptical public. The corporation simultaneously trained hundreds of locally recruited field assistants to provide explanations, give demonstrations and advice, and extol the comparative advantages of the new seeds (Assayag, 2005). And, implied in this know-how was the command, control and communication of the do how of the technology (Luke, 2006). In this way, the technology itself was dispersed through the cognitive campaigns of the corporation.

Besides using the resources of knowledge, money and communicative skills to garner the acceptance of farmers for its new technology, MMB also began to tap into the cultural symbols of the targeted populations. It started sponsoring sports events and religious festivals in villages, as well as deployed the images of gods and saints for advertising its product. In some places, the figure of the goddess, regarded as a symbol of fertility and prosperity, was used to illustrate the packets of *Bt* cotton seeds. And, in other regions, the seed packets bore the image of venerated saints or displayed the name of various deities. Through such a regime of representation, a new technology that created both excitement and insecurity among the public was domesticated, in the sense of making it familiar and acceptable to them. By incorporating the cultural symbols of farmers in its capitalist project, the corporation sought to transform an unfamiliar technology into a familiar object, which could be identified in the everyday lives of farmers. Although the appropriation of cultural symbols highlighted the sign value of the technology rather than its utility value (Oudshoorn and Pinch, 2003), the packaging of the technology was intended to influence the users to integrate the technology into their farming practices. Through these

strategies, MMB partly succeeded in extending its biopolitical control over the cognitive and emotional aspects of farmers' lives, thereby shaping their technological choice to some extent.

While the concern of MMB was profit maximization, it represented farmers as bold and intelligent experimenters to the political elite. Its discursive strategy among the policymakers was to emphasize that farmers were rational beings, who would be able to maximize their benefits through utilizing *Bt* cotton. The latter would increase the economic gains of farmers through higher yields and lower use of pesticides, and by overcoming the vagaries of the natural environment. On the other hand, the anti-GE activists represented the farmers as having lost their traditional knowledge and agency. They were seen to be in need of re-education in order to reclaim their sustainable and indigenous ways of life (Pearson, 2006). Hidden in the discourse of indigenous knowledge was a goal of preserving it through the intervention of NGOs, which in effect negated an active agency to the farmers. By appealing to Gandhian philosophy, the activists attacked the project of modernization of agriculture through technoscientific means. But, at the same time, they resorted to the Enlightenment rationality to collect scientific evidence against the regulatory procedures and the performance of the new technology. Missing in their discourse was an acknowledgment of the hybridities that characterize the agricultural epistemologies and farming practices in the postcolonial world (Gupta, 1998)

5.5. Mobilizing Submerged Networks

While the urban, elite actors engaged in discursive struggle around *Bt* cotton, the farmers in some states constructed their relationship with *Bt* technology in a subversive manner. Defying the state laws and the attempted mobilization of both MMB and anti-GE activists, a set of actors adopted and diffused the technology through locally situated submerged networks (Melucci, 1989). In contrast to farmers who openly rallied behind the anti-GE activists to oppose the

technology, a section of farmers chose an underhanded mechanism to subvert the power of the elite. By growing *Bt* cotton seeds illegally, the hitherto silenced and victimized farmers showed resistance to the hegemonic forces that represented their farming needs and technological choice

The hidden network of subversive actors became visible when news broke out that *Bt* cotton had been planted illegally over several years in the state of Gujarat. The pirated transgenic seed, Nb 151, came under suspicion when cotton bollworm devastated crops across Gujarat in 2001, but spared fields that cultivated this variety. On testing the unaffected crops, the *CryIAc* gene patented by MMB was found in them. The official investigation that followed revealed that the pirated transgenic seed¹⁷⁸ had been supplied by an Ahmedabad¹⁷⁹ based company, Navbharat Seeds, since 1998. Acting as a crucial actor in this illegal seed network, Navbharat Seeds had somehow managed to acquire a handful of *Bt* cotton seeds. The company cross-bred them with the local varieties of cotton, and initially sold the transgenic seed as a new hybrid variety to the farmers. The pirated seed also went out to seed distributors in other states, such as Maharashtra, Madhya Pradesh, Andhra Pradesh and Karnataka.

Since the illegal planting had taken place before the official approval of *Bt* cotton of MMB, the discovery of the pirated *Bt* cotton embarrassed the central government. As a damage control mechanism, it issued a directive that the standing crops of the illegally grown *Bt* cotton be destroyed.¹⁸⁰ In response, the state government in Gujarat pointed out that the destruction of the plants should take place only after the farmers were duly compensated.¹⁸¹ Following the bureaucratic wrangling over the fate of illegal *Bt* crops, the state government in Gujarat did not implement the directive of the central government entirely, since the illegal crop was not

¹⁷⁸ Although many versions of the genealogy of the pirated seeds was circulated, the origin of the seeds remains uncertain and contested.

¹⁷⁹ Ahmedabad is the capital city of the state of Gujarat in Western India.

¹⁸⁰ See: *Economic Times*, October 12, 2001; *Times of India*, October 9, 2001.

¹⁸¹ *Business Standard*, October 24, 2001.

destroyed in some villages (Yamaguchi, 2004). As a result, the farmers continued growing not the variety sold by MMB, but the locally multiplied seeds sold by several local seed companies and farmers themselves.

The farmers adopted and diffused the pirated seeds for many reasons. Initially, the transgenic nature of Nb151 was unknown to them. But, once it became public, the demand for pirated seeds increased because those were seen to provide the agronomic advantage at a lower price than the officially approved MMB seeds. After the commercial release of the *Bt* cotton of MMB, the cheaper variants of Nb151 were preferred to the expensive seeds of Monsanto. Besides, the farmers believed that the cross pollination of local and global lines had produced stable and well-performing crops. In reaction to the government decision to ban Nb 151, the farmers adopted many strategies to get access to the illegal seeds. These included the storing of many generations of the original Nb 151 seeds, and the mobilization of available social networks that might open up access to Nb 151 (Yamaguchi, 2004; Shah, 2005). Farmers also articulated critiques of the government for banning Nb 151 in newspapers, and the farmers' leaders were deployed to New Delhi to persuade the central government to reverse or revise the decision against Nb 151.

After the exposure of the illegal *Bt* seeds, the underground market of pirated seeds got invigorated. Other local seed companies deployed the network as a laboratory to produce and sell other brands of transgenic seeds. Together with the farmers, the local seed industry used the Nb 151 germplasm in new combinations to produce hybrids with new names.¹⁸² The easy availability of skilled labor made the development of *Bt* cotton seeds possible in a short period of time. In some cases, the farmers themselves multiplied the seeds that were sold to other farmers from the same social or kinship groups. Alternatively, the seed companies gave contracts to

¹⁸² Such as *Agni*, *Luxmi*, *Rakshak*, *151* etc.

farmers to multiply the seeds, which when brought back were packaged and sold to other farmers. In order to facilitate this process, two types of foundational seeds were supplied to the farmers—*Bt* male and hybrid female, usually GujCot8 in Gujarat. The farmers believed that the *Bt* parental line was essential but not the key, and the female parental line determined the performance and stability of new seeds in the specific agro-ecological conditions in which the seeds were grown (Shah, 2005). Implicit in this radical reconceptualization of transgenic crops was the idea that *Bt* seeds sold by Monsanto were not good, but the little trait expressed by the *Bt* gene was. The latter was thus viewed as desirable and worth adopting in the local hybrid varieties.

The hybridization process allowed the subversion to emerge as a counter-hegemonic force that opposed the instrumentalizing attempts of various actors using technoscientific rationality to represent farmers and their needs. The adoption and diffusion of the pirated *Bt* seeds showed that agriculture in postcolonial India is not a closed field of meaning and action, but is profoundly shaped by the complex underground politics of class and caste differentiation. The diffusion of pirated *Bt* seeds partly succeeded due to a felt need of farmers to resist the hegemonic representation of their technological needs by the elite, and their desire to re-represent themselves. At the center of their defiance was an allegiance to the local seed companies that provided them a roster of seeds through seed vendors. Although MMB engaged the state regulators to penalize the owner of Navbharat Seeds, the technology went out of their control once it entered this network of seed production and distribution. The production, adoption and diffusion of the illegal variety of *Bt* cotton emerged as a weapon of the weak (Scott, 1985), by which the farmers combined their self-interest with the resistance to the hegemonic power of the elite.

After resorting to the cultivation of cotton in the liberalized economy, the farmers continued to view themselves as vulnerable, due to the related problems of pest-infestation and expensive agricultural inputs provided by the TNCs (Sahai and Rahman, 2004, Sharma, 2005; Krishnakumar, 2003). Thus, to counter the costly and well-advertised seeds of MMB, they mobilized the existing social networks to diffuse the locally grown and sold *Bt* seeds. The pirated *Bt* technology moved through channels of trust and solidarity, mainly the caste and kinship relationships (Yamaguchi, 2004; Shah, 2005). Farmers invoked these informal channels of known people to carry out the transactions of the locally multiplied brands of the generic Nb 151 seeds; at the same time they increasingly believed that the seeds of Monsanto had widely failed. While the *Bt* cotton seeds of Monsanto showed a dismal performance in a number of locations, the pirated seeds performed better owing to the inputs of local knowledge in their production. The social channels acted as conduits of knowledge in the production and diffusion of new seeds. In some places, the spread of pirated *Bt* cotton seeds was not because of the agronomic reasons, but because of channeling of information within social networks that influenced the farmers in adopting the pirated seeds (Stone, 2007).

Even though the pro-*Bt* cotton actors, such as Monsanto, saw the steadily increasing numbers of farmers planting the pirated *Bt* seeds as a testimony to the success of the technology and the benefits that farmers supposedly derived from it (Monsanto, 2006), a multiyear ethnographic study by Stone (2007) in Warangal concluded that the *Bt* cotton craze in that district fitted the pattern of localized seed fads. The farmers adopted *Bt* seeds in numbers that resembled a fad, much similar to seed fads preceding *Bt* cotton. Drawing on the characterization of social learning of farmers, the study concluded that a farmer emulated another on the basis of the social prestige of the latter, regardless of the actual success of the new technology. Along

with this prestige bias, the farmers also showed a conformist bias in adopting the technology, whereby a farmer adopted the new seeds just because it had been adopted by many others.¹⁸³

Asked about the influences on their cotton seed choice, the farmers in Warangal recalled other farmers who grew the seeds, and rarely recalled the agronomic details of the seeds. It was found that the demonstration plots of *Bt* cotton or its pirated version had an impact on the choice of these farmers. Since the demonstrations are often on the big farmer's plot, the interviews of farmers showed that they were swayed by who was growing the seeds more than the assessment of the crop. Though MMB was quick to attribute the adoption of the technology to the wisdom of farmers and faith in seeds (BBC, 2005), the ethnographic study showed that farmer experimentation and evaluation of the technology played a negligible role in seed choice. On the contrary, the adoption and diffusion of *Bt* seeds had, in fact, led to a process of deskilling, whereby the farmers did not build on the rationalization of their own experience with the technology, but through environmental and social learning.

The resistance posed by the adoption and diffusion of pirated seeds decolonized the representation of the hegemonic forces. With the farmers voting with their feet in favor of the pirated seeds, it became increasingly clear that it was not Monsanto's *Bt* seeds that had succeeded; but rather the *Bt* gene as hybridized by farmers through local practices had been successful. The success was limited to the illegal variety of transgenic seeds, not those sold by Monsanto legally. The *Bt* technology had not succeeded or failed as an artifact, but the technological network used by the farmers had succeeded over the network formed by the local and global elite. The hybridities of epistemology and practices of agriculture as depicted by the production, adoption and diffusion of pirated *Bt* seeds destabilized the neoliberal narratives of

¹⁸³ See; "Farmers turn to other farmers" *Deccan Chronicle*, July 4, 2005; and, "Farmers ape neighbors, pay price," *Deccan Chronicle*, July 6, 2003.

cotton development and the romanticized notions of indigenous farming of the anti-GE activists. However, the hybridity entailed in the pirated seeds led to a cultural recreation of technology that was partially re-inscribed in the hegemonic constellations (Escobar, 1995). The submerged form of resistance was incorporated into the hegemonic representations, whereby the promotional network of biotechnology asserted that the spread of the pirated seeds showed that farmers actually wanted the new technology. On the other hand, the anti-GE activists presented this as a proof that Monsanto and the regulators could not be trusted, and that the containment in regulation was a farce.

Despite the attempts to co-opt the subversive politics into the hegemonic discourses, the mobilization of submerged networks highlighted the resistance to the patent power of the TNCs through the spread of pirated *Bt* cotton seeds. The strong bio-property rights of MMB made the official transgenic seeds expensive, which in turn revitalized the underground piracy market. At the same time, the failure of the surveillance mechanism of the regulatory state allowed the submerged network to escape the panopticon of biosafety and bioproperty regimes. Paradoxically, the necessity of seeking bio-safety approval on transgenic seeds conferred monopolistic property rights on MMB, the holders of approved transgenic cultivars, while making smaller local firms unable to go through the time and money consuming regulatory procedure on their hybrid seeds. When Nb 151 of Navbharat Seeds was ruled illegal and was banned on the grounds of not obtaining the bio-safety approval from DBT regulators, the anti-GE activists accused the GEAC of market-rigging through costly and time-consuming regulation. In fact, the small firms lacked the resources to go through the regulatory process that Monsanto sustained for nine long years (see chapter 2).

By banning Nb 151 on bio-safety grounds, the regulators left the field open to MMB to license their technology to other firms at higher prices. This strengthened the monopoly of MMB in a country that lacked patent rights on genes or seeds. Although Monsanto is known to sue farmers for violating its patent rights in the US, it could not prove the violation of the property law in the case of the pirated seeds in the Indian states. This was because the Indian patent law did not recognize or grant product patents, as it protected only invented processes and excluded products *per se* from patentability. It did not prevent any firm from taking up a production locally of a product imported by another company holding patent on the same. The support for the exchange of germplasm was also based on the commonly held belief that all life-forms and all genetic diversity is a global common heritage (Gupta, 1993). The patent on life forms stipulated under Article 27.3 (b) of the TRIPS agreement, which was adopted in the US, had not been accepted in India yet. Irrespective of the lack of patentability of a biotechnological product in India, the IPR regime faced a dangerous moment with the discovery of pirated *Bt* cotton seeds. The failure of state surveillance proved that an escape from the legal policing of IPR and biosafety surveillance was possible. Undeterred by the global patent regime that held cultivation of *Bt* cotton seeds other than those marketed by MMB as violation of law, the local seed companies and farmers subverted the governance regimes of agbiotechnology by silently appropriating the new technology in their farming practices.

5.6. Conclusion

This discussion has provided a layered reading of the politics of resistance launched by the multitude. As an active subject, the resisting multitude constituted a significant node in the network of the bioempire and its multiple, yet overlapping, modes of governance. An analysis of the strategies and tactics adopted by various actors, such as the activists and farmers, showed

how this network of a resisting multitude constituted an alternative political organization of local flows and exchanges. The struggle of the multitude produced a counter-empire as an inversion of the image of the hegemonic bioempire itself, thereby revealing that the processes of empire making were not unified or univocal. The political task of the resisting multitude was to invent new democratic spaces and a new constitutive power that acted as a creative force, not only to resist the hegemonic policies and politics, but to reorganize them towards new ends. By countering the hegemonic forces of bioempire, the counter-empire contested and reconfigured the biosafety and patent regimes; at the same time it provided a space to reconfigure the user-technology relationship.

The struggle to contest and subvert the bioempire, as well as to construct an alternative to it, took place on the imperial terrain itself. The resistance was not marginal, but central, and opened up in multiple and overlapping networks. The activists linked to the transboundary, anti-agbiotech and anti-globalization coalition acted on both nationalist and moral imperatives. The intervention became a frontline force in the shaping of an intense public debate around the issues of corporate capitalism, regulatory regimes and technoscientific progress. At the same time, it remained immersed in the biopolitical context of the constitution of the bioempire, whereby the political subjectivities of the activists and farmers emerged as new hybridities of activist-experts and farmer-activists. The intervention of these hybrid subjectivities did not overthrow the forces that created the bioempire, but they consolidated the terrain of bioempire by getting subsumed within the global order.

CHAPTER 6:

CONCLUSION: MAKING A BIOEMPIRE

6.1. Summary of Findings

I started this work with a basic question: how are *Bt* technology and the political-economic configuration of neoliberalism related in India? Using an approach that combined the idiom of co-production, discourse analysis, and a socio-technical network perspective, I defined bioempire in the case of India as an extension of transboundary power, crystallized as a relationship between the project of *Bt* cotton and the global neoliberal order. This approach allowed me to explore the dynamics of the introduction of *Bt* technology into India from the time the Indian state embarked on a path of liberalizing its economy in the early 1990s through 2002, when the Indian government first gave approval to this transgenic crop. I focused on *Bt* technology as operating politically in several different registers—as a material technology, as a metaphysical device, as a discourse, and as an institution of governance—in order to show how this technology activated new forms of governance regimes and political struggles. By looking at *Bt* technology as an agent that linked the local and the global elements of the new biopolitical order characterizing the new empire, I traced four processes—the rationalization, standardization, privatization and mobilization—to explore the dynamic—the foundation, introduction, extension and reconfiguration—of the emergent bioempire.

The rationalization of *Bt* cotton took place mainly as a method of policy articulation and justification by a network of neoliberal technocrats located in the Department of Biotechnology (DBT), the Cotton Corporation of India (CCI), the Indian Council of Agricultural Research (ICAR), and the Ministry of Textiles (MOT). The experts inscribed cotton into the emerging order of global Capital, which had created a powerful rationale for subjecting cotton crops to

genetic control. Extending the genetic biopower to cotton crops, the policymakers and their corporate partners characterized cotton crops as sick and failing, thereby seeking to control the crop from its interior. The blackboxed aspects of genetic reductionism and market rationality were packaged and promoted as Monsanto's *Bt* cotton to facilitate its transnational expansionism. At the same time, the policies of structural adjustment adopted by the Indian state under the compulsions of the global neoliberal institutions, such as the IMF, the World Bank and the WTO, decreased the state capacity to regulate the transboundary flows of agbiotechnologies, including *Bt* cotton. The rationalization of *Bt* cotton was aimed at controlling the cotton crops both internally, through transgenic seeds, and externally, through neoliberal regulatory policies.

The need for *Bt* cotton was created through a range of discursive frames and institutional strategies adopted by the neoliberal technocrats and Monsanto-led corporations. The intertwined narratives of a cotton pest problem and the agrarian crisis became the dominant discursive resource that facilitated the construction of a pro-*Bt* policy narrative. The envisioned revolution in cotton productivity through *Bt* technology was aimed at revamping the old development apparatus that had guided the technologies of the green revolution in order to suit the neoliberal goals of making cotton competitive in the global market and maximizing profits for the emerging agbiotech industry. While the logic of the export-oriented economy led to a phenomenal expansion of cotton growing areas, the narratives of productivity, efficiency and competitiveness in cotton cultivation were responsive to World Trade Organization sanctioned restrictions on trade in agricultural products, such as cotton, that bear traces of pesticide residues. Harmonizing and standardizing cotton cultivation technologies would not only contribute to economic progress, but would enable the country to confront the challenges posed by the global trade regime. The logic of 'develop and modernize' cotton was thus guided by a combination of state-

led economic aspirations and the political obligations of the state to global neoliberal institutions. In this hospitable policy environment, Monsanto used the same discursive frames as the global trade regime to push its *Bt* cotton in India. The central frames used by Monsanto and the other global neoliberal institutions, such as the World Bank, the WTO and the IMF, of food security, environmental sustainability and pro-poor technology, resonated with the dominant policy narratives of the neoliberalizing Indian state. In this sense, the global and local rationalities around *Bt* technology converged and provided a foundation for the bioempire to emerge in India.

Upon this foundation was based the policy decision of 2002, whereby the neoliberal technocrats allowed the introduction of *Bt* technology into Indian cotton cultivation. The adoption of *Bt* technology was inextricably linked with the standardized regulatory grid that was established to centrally monitor and control transgenic cotton crops. External influences and regulatory models largely influenced the risk-assessment guidelines of the DBT, which reformulated the boundaries of risks associated with transgenic crops, in order to revoke the prohibition on the deliberate release of *Bt* technology. The regulatory community lodged in different ministries, such as the Ministry of Science and Technology (MoST) and the Ministry of Environment and Forests (MoEF), turned out to be a benefactor of the agbiotech industry led by Monsanto. The tension between the roles of government to both promote and regulate *Bt* technology was resolved in favor of the business-science alliance that characterized the emerging agbiotech industry. The regulation of *Bt* technology, thus, emerged as a site for the strengthening of the state-scientist-capital nexus.

In a political milieu that combined the elements of the colonial, welfare-statist and neoliberal technocracies, the supposedly rational policy decisions around the field trials of *Bt* cotton and its commercial release were not conceived and implemented in a clearly defined and

transparent way. Interdepartmental rivalry and bureaucratic wrangling gave way to a new form of political struggle and negotiation between different arms of bureaucracy and corporations. A close relationship between Monsanto, the applicant of *Bt* technology, and the regulators in the DBT lowered the credibility and legitimacy of the regulatory process, mainly the field trials of *Bt* cotton. The undemocratic and non-transparent regulatory culture in which the field trials of *Bt* cotton were conducted allowed for the corporatization of the regulatory process. The field experiments, which were meant to be a knowledge acquisition enterprise, became a site for the emergence of the subpolitics of techno-scientific-industrial dynamics that subsumed experimental norms to market necessity. As the politics of regulation advanced the emergent interests of the transnational corporations and their Indian collaborators, the standard framing of the risks associated with *Bt* technology relegated the broader concerns such as technological desirability, farmers' livelihoods and society's future to the background.

While the local biosafety regime changed its stance from a precautionary to a promotional policy, the newly emergent global regimes, such as the WTO and the Cartagena Biosafety Protocol (CBP), encouraged further standardization of the regulatory approach. The pressure for standardization, with an emphasis on universal regulatory standards modeled on a particular formula derived from Europe and the US, emerged from attempts to develop a global trade regime under the WTO. The local regulatory community did not follow science-based standardized guidelines and procedures exclusively, but engaged in political negotiations around *Bt* technology on the ground level. Thus, a policy space was created where the realms of science and politics overlapped. Within this hybrid space, the discretionary choices arising from ambiguity, secrecy and complexity of the regulatory process ended up serving the interests of the emerging global agbiotech industry. A hasty commercial approval of *Bt* cotton showed that the

standardized criteria of sound science in regulation of the technology provided a facade legitimating market-oriented practices of the neoliberal technocracy. And, the secretive negotiations around the approval process of *Bt* cotton furthered the commercial interests of the business-science elite.

The beginnings of a transformation of the public sector National Agricultural Research System (NARS) further led to an extension and consolidation of the emerging bioempire. By developing strategic alliances with the local, publicly funded technoscientific institutions, such as the Indian Institute of Sciences (IISc), and established local seed firms, such as Mahyco, the transnational corporations led by Monsanto ushered in a new phase in agbiotechnology knowledge production. As Capital made inroads into the public domain of agbiotech research and development, the publicly owned knowledge started getting privatized. The newly emerging global patent regime influenced the local patent laws to usher in the era of capitalization of agbiotech knowledge for private profits. In this changing environment of agbiotech knowledge production, the new patent regime provided a competitive edge to the transnational corporations over the public research institutions, life scientists in those institutions, and the domestic seed industry.

As a new breed of local scientist-entrepreneurs began to provide a cheap labor force for the TNCs, they increasingly lost control over their research agendas, technoscientific practices and knowledge products. Faced with a shortage in funding, due to the changing government policies and the capital intensive nature of agbiotech research, the public research labs and local seed firms started forging alliances with the resource-rich TNCs. As the case of the Monsanto-IISc alliance exemplified, the relationship was far from symbiotic, which was necessary for a successful partnership. Instead, it soon turned into a viral mechanism, whereby the corporation

headquarters in the US treated the local lab as its research arm while retaining control over research agendas and technical practices.

The transformation of the nature, locus and ownership of the new biological knowledge, embodied in agbiotechnology, helped the transnational industry, supported by the neoliberal regimes at the local and global levels, to maintain a hegemonic control over intellectual property. By privatizing the abstract agbiotech knowledge and material seeds that it produced, the neoliberal regime sought to control the agricultural sector from a distance. Just prior to the introduction of *Bt* technology, the emerging regime of global intellectual property protection posed major challenges to the existing Indian patent laws. With the formalization of the Trade Related Intellectual Property Rights (TRIPS) agreement of the World Trade Organization (WTO), stringent standards for the protection and enforcement of intellectual property were laid down. As the TNCs placed increasing emphasis on uniform global patent standards under the neoliberal empire, and under the TRIPS agreement, the Indian state was obligated to adopt harmonized, global standards of IPR protection. With the pressure of the US government and the requirements of TRIPS, the sovereignty of the Indian state to choose patent laws was severely curtailed. The neoliberal political economic order set in motion a cycle of expropriation of the commons, thus creating a space for privatization of public knowledge as dictated by the necessities of capitalist accumulation. The Monsanto-IISc alliance and the amendments to the local patent laws signified a process of privatization that subsumed the agbiotech knowledge sphere under the corporate domain.

The commercialization of *Bt* cotton and penetration of TNCs into the domain of transgenic seed production created a new space for the mobilization of the multitude within, and against, the emerging bioempire. The resistance to *Bt* technology was tied up to a wider struggle

against the dominance of transnational capital and the neoliberal institutions that pushed a particular type of technoscientific rationality. The activists contested the meaning of *Bt* technology, challenged its form of regulation and articulated the needs of farmers by linking these issues to the broader concerns of capitalist imperialism, national sovereignty and farmers' rights. While the local, transnationally connected anti-agbiotech activists, such as Vandana Shiva and Nanjudaswamy, acted as the spokespersons of farmers to represent their rights and technological needs, their rationality and methods of protest remained entrenched in nationalism and positivist science. In this sense, their voice emerged as yet another hegemonic force, which was countered by the resistance posed by the submerged network of illegal *Bt* cotton seeds. However, the elite, urban-based activists succeeded in creating a public debate around *Bt* cotton, thereby carving a democratic space for contesting the 2002 policy of commercial release of *Bt* cotton. As they debunked the regulatory framework and risk assessment practices, the activists emerged as counter-experts who energized and reconfigured the policy debate around biosafety and patent regimes; at the same time providing a space to reconfigure the user-technology relationship. However, the intervention and subversion launched by these activist-experts and farmer-activists remained immersed in the biopolitical context of the constitution of the bioempire. The struggle to contest and subvert the latter, as well as to create an alternative to it, took place on the imperial terrain itself.

These various processes of making a bioempire—the rationalization, standardization, privatization and mobilization—reflect back on the question of how *Bt* technology introduced, extended and consolidated a new form of empire into India. The new form of biopower that used *Bt* technology to control the plant population from its interior emerged from a state-scientist-corporation nexus, which operated within a context of the emergent neoliberal regime. The

political agency and economic power of the transnational corporations, backed by the global neoliberal regime, acted as a connective fabric of the emerging bioempire. The biopolitical system that emerged around *Bt* technology merged the political, economic and cultural aspects of this technology. This new biopolitics was based on a new technoscientific rationality that offered universalized genetic solutions to the local agricultural problems. While the modes of governance of *Bt* technology opened up a space for new forms of politics and political struggles, the genesis and the making of bioempire was largely guided by the logic of capital accumulation.

Within this political economic space, the emerging bioempire stabilized mainly through a process of institutional isomorphism led by the global neoliberal regime. The coercive and normative isomorphisms were partly facilitated by the western-trained experts situated within the local government, technoscientific institutions and local seed firms. The imperialist dimension of the emerging bioempire was mostly visible in the centralization of control over regulation of *Bt* technology and agbiotech knowledge production processes and practices. A control from a distance of the agbiotech flows was accompanied by a decreased capacity of the state regulation of this technology. Even as the activists and farmers devised their own mechanisms to subvert the power of the emerging bioempire, the imperialist aspects of this new form of governance subsumed their agency within the neoliberal, capitalist order.

6.2. Contributions

A major contribution of this dissertation is its analysis of socio-technical processes that led to the emergence and stabilization of a bioempire in India. I demonstrated that there was an internal connection between *Bt* cotton and a neoliberal order. Integrating theories of empires and imperialism with concepts and theories derived from STS, this project detailed the bioimperial dynamic in a postcolonial context. The dissertation demonstrated the analytic power of an

interdisciplinary approach to the study of a new generic technology, such as *Bt* technology, within a neoliberal context. The integration of the theories and concepts derived from the historical literature, political science and sociology with those of STS provided insights into the phenomenon of bioempire, which none of these fields would have allowed me in isolation.

6.3. Limitations and Future Work

In spite of the explanatory power of this study, more empirical work is needed to clarify the ways in which the users of *Bt* technology related to the emerging bioempire. A detailed ethnographic study of the farmer-*Bt* technology relationship in the changing policy context would help me address larger theoretical issues of how the user-technology relationship was forged at the ground level. Second, it would be useful to undertake a comparative study with other neoliberalizing countries to understand the variety of ways in which *Bt* technology extended cross-boundary political, economic and cultural power. Cross-national comparisons would enable me to gain a better understanding of how agbiotechnology and ‘neoliberalism’ get coproduced as this form of empire in different contexts.

Although I imply in this study that the global power relations extend into the technical practices of *Bt*—such as the reduction of organisms to genomes and to digital data, disciplining the plants, laboratory techniques, the methodology of field-trials—my account is concerned mainly with the political-economy of *Bt*, not *Bt* as political-economy. For instance, my discussion of field-trials does not take the practices of field trials as biopolitics. A detailed ethnographic study of these aspects of *Bt* technology would be worthwhile in the future.

Following the commercialization of *Bt* cotton in 2002, the American agbiotech TNCs intensified lobbying with Indian political parties to commercialize other *Bt* crops, such as *Bt*

brinjal.¹⁸⁴ Being the first food crop that would have the *Bt* gene inserted in it, the possibility of the commercialization of *Bt* brinjal, developed by Monsanto-Mahyco Biotech Ltd (MMB), raised a huge debate around food security and food safety issues. With a public outcry resisting the official approval of *Bt* brinjal, there has been a suggestion to rename the Genetic Engineering Approval Committee (GEAC) as the Genetic Engineering Appraisal Committee.¹⁸⁵ The idea here is that the TNCs get a clear signal that not every transgenic crop that they bring to the Indian state for approval can be passed. Given that there is no consensus among scientists on the bio-safety protocol, exhaustive food safety tests needed prior to the commercialization of edible *Bt* crops could pose a different set of regulatory problems. It may be worthwhile to study the debate around a transgenic food crop, such as *Bt* brinjal, to understand such contours of the bioempire.

In 2006, the then US president Mr. George Bush announced from the historic Purana Qila (Old Fort), in Delhi, that India and the US would enter into an Indo-US Knowledge Initiative on Agriculture (KIA). The US president made a point to emphasize that the initiative was to promote a “Second Green Revolution’ in India, which meant promoting transgenic crops and foods. In this rhetoric the agbiotechnology was cleverly packaged as the “Second Green Revolution” in order to favor the life sciences TNCs. Following this announcement, the Indian Prime Minister, Mr. Manmohan Singh, provided the US-based agbiotech TNCs a vehicle for lobbying with Indian policy-makers during his first term in 2006, when he approved the Indo-US Knowledge Initiative on Agriculture (KIA). It was announced with fanfare during his visit to the US and evoked a storm of protests at home, mainly from the Left parties and the farmer-activists.

¹⁸⁴ See, for instance, “Why the US is so keen to sell Bt brinjal to India” available at <http://www.gmwatch.org/latest-listing/1-news-items/11692-why-the-us-is-so-...> (accessed on August 30, 2010)

¹⁸⁵ See, “Moratorium on *Bt* brinjal: Jairam Ramesh” available at <http://www.cseindia.org/print/1051> (accessed on July 25, 2010)

The officially sponsored KIA is one of the latest steps towards the privatization of agricultural research in India. This agreement would further weaken public sector research and promote private sector interests through commercialization of transgenic crops. The board that has been set up for the implementation of the KIA includes TNCs, such as Monsanto and Walmart, as the official US representatives. It is reported that the latter has set up the agenda for the KIA, with development of transgenic strains of rice and wheat forming a major part of the initiative.¹⁸⁶ By studying the dynamics of this initiative in the future, I may be able to gain a clearer understanding of the complex situation that India faces in the adoption of agbiotechnologies. This dissertation can serve as a reference point as I undertake more research in the future to provide a better and deeper understanding of these contours of the bioempire in India, and its wider implications for Indian publics.

¹⁸⁶ See, “Why US keen to sell Bt brinjal to India” available at <http://www.gmwatch.org/latest-listing/1-news-items/11692-why-the-us-is-so-...> (accessed on August 30, 2010)

BIBLIOGRAPHY

- Abernethy, D.B. 2000. *The Dynamics of Global Dominance: European Overseas Empires, 1415-1980*. New Haven and London: Yale University Press.
- ActionAid. 2003. GM Crops—Going against the Grain. London: ActionAid. <http://www.actionaid.org.uk/content/documents/> (accessed on December 4, 2008).
- Adas, Michael. 1989. *Machines as the Measure of Men: Science, Technology and Ideologies of Western dominance*. Ithaca: Cornell University Press.
- Agbiotechnet, 2002. India asked to spend \$35 million on biotech. *agbiotechnet*, 4 March.
- APCoAB Report. 2006. *Bt Cotton in India: A Status Report*. Asia-Pacific Consortium on Agricultural Biotechnology. New Delhi, India.
- APCoAB Report. 2007. *Brainstorming Session on Models of Public-Private Partnership in Agricultural Biotechnology—Highlights and Recommendations*. Asia-Pacific Consortium on Agricultural Biotechnology. New Delhi, India.
- Assayag, Jackie. 2005. Seeds of Wrath: Agriculture, Biotechnology and Globalization In Jackie Assayag and C.J. Fuller (eds) *Globalizing India: Perspectives from Below*. London: Anthem Press. pp 65-88.
- Associated Press. 2003. Protestors attack Monsanto Greenhouse in Southern India. *Associated Press*, 11 September.
- Alvares, C.A. 1988. Science, colonialism and violence: A Luddite view in Ashis Nandy (ed). *Science, Hegemony and Violence*. Delhi: Oxford University Press. pp 68-112.
- Amankwah, H.A. 2007. Traditional Values and Modern Challenges in Property Law. *Journal of South Pacific Law*. 11 (1), pp18-38.
- Anderson, Benedict. 1983, *Imagined Communities: Reflections on the Origin and Spread of Nationalism*, New York: Verso Books.
- Babb, Sarah. 2001. *Managing Mexico: Economists from Nationalism to Neoliberalism*. Princeton: Princeton University Press.
- Bagchi, A.1994. Globalizing India: the fantasy and the reality. *Social Scientist*. 22. pp 18-27.
- Barwale, R.B, V.R. Gadwal, Usha Zehr and Brent Zeher. 2004. Prospects for *Bt* Cotton Technology in India. *AgBioForum*. 7(1&2). pp 23-26.

- BBC. The British Broadcasting Corporation. 1992. BBC Summary of World Broadcasts, October 14, 1992.
- BBC. The British Broadcasting Corporation. 1999. Terminator gene halt a 'major U-turn'. <http://news.bbc.co.uk/2/hi/science/nature/465222.stm> (accessed on May 19, 2010).
- BBC. The British Broadcasting Corporation . 2003. Indian farmers target Monsanto. http://news.bbc.co.uk/2/hi/south_asia/3099938.stm (accessed on November 14, 2009).
- BBC. The British Broadcasting Corporation. 2005. Monsanto's sales double in India. International News online. http://news.bbc.co.uk/2/hi/south_asia/4223284.stm (accessed on Jan 4, 2009).
- BBC. The British Broadcasting Corporation. 2009. Profile: Manmohan Singh. http://news.bbc.co.uk/2/hi/south_asia/3725357.stm (accessed on April 30, 2010).
- BCIL, Biotechnic Consortium India Ltd. 2004. *Biosafety Issues related to Transgenic Crops*. Manual for workshops sponsored by Ministry of Environment and Forests. New Delhi: Biotech Consortium India Ltd., January.
- Beck, Ulrich. 1992. *Risk Society: Towards a New Modernity*. London: Sage publications.
- Bernal, J.D. 1939. *The Social Function of Science*. London: G. Routledge & Sons.
- Bharathan, Geeta. 2000. *Bt-Cotton in India: Anatomy of a controversy in Current Science*, Vol. 79, No. 8, October 25, 2000, pp1067-75.
- Boli, J. and G.M. Thomas. 1997. World Culture in the World Polity: A Century of International Non-Governmental Organizations. *American Sociological Review*. 62 (2). Pp 171-190.
- Boli, J. and G.M. Thomas (eds). 1999. *Constructing World Culture: International Nongovernmental Organizations since 1875*. Stanford, California: Stanford University Press.
- Bonneuil, Christophe. 2008. Disentrenching Experiment: The Construction of GM-Crop Field Trials As a Social Problem. *Science, Technology & Human Values*. Vol. 33, No. 2. March 2008, pp. 201-229.
- Boyd, William, Scott Prudham, Rachel Schurman. 2001. Industrial Dynamics and Problem of Nature. *Society and Natural Resources*. 14. pp 555-570.
- Brass, T (ed). 1995. *New Farmers' Movements in India*. London: Frank Cass.
- Brooks, Sally. 2005. Biotechnology and the Politics of Truth: From the Green Revolution to an Evergreen Revolution. *Sociologia Ruralis*. Vol. 45, number 4, October, 2005.

- Buchanan, Ruth and Sundhya Pahuja. 2004. Legal Imperialism: Empire's Invisible Hand? In Paul. A. Passavant and Jodi Dean (eds) *Empire's New Clothes*. New York: Routledge. pp 73-93.
- Bush, Barbara. 2006. *Imperialism and Postcolonialism*. New York: Pearson Longman.
- Bush, Vannevar. 1945. *Science: The Endless Frontier*. Washington D.C: Office of Scientific Research and Development.
- Business Line. 1998. Monsanto sets up R and D centre in Bangalore *The Hindu Business Line*, 31 January.
- Business Line.1999. Indian peasants at the European jaunt. *Business Line*, 10 March.
- Business Line. 2000a. Global consolidation, Indian impact. *The Hindu Business Line*, 2 April.
- Business Line. 2000b. Agrochemicals: consolidating to grow. *The Hindu Business Line*, 2 April.
- Business Line. 2000c. Monsanto India: Seeds of success (restructuring by parent paying off). *The Hindu Business Line*, 17 September.
- Business Line. 2000d. MNC seed interest vs. farmers' plight', *Business Line*, 26 September.
- Business Line. 2003a. Area under cotton may rise 12 pc—*Bt* cotton coverage likely to treble *The Hindu Business Line*, 5 Sept.
- Business Line.2003b. Agitated farmers damage IISc Building *The Hindu Business Line*, 11 September.
- Business Standard. 1997. Monsanto plans to set up \$25m R and D Centre *Business Standard*, 20 August.
- Business Standard. 2001. Controversy over *Bt* cotton deepens. *Business Standard*, 22 October.
- Business Standard, 2002. IARI research to be market oriented. Crop breeding approach to be altered to suit foreign markets. This shift will leverage cost intensive biotechnology. *Business Standard*, 17 April.
- Callon, Michel. 1986. Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay In John Law (ed) *Power, Action and Belief: A New Sociology of Knowledge?* Sociological Review Monograph32; London: Routledge & Kegan Paul.
- Callon, M., J. Law, and A. Rip. 1986. *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World*. London; Macmillan.

- Callon, M. 1995. Four Models for the Dynamics of Science In Shiela Jasanoff, G.E Markle, J.C. Peterson and T. Pinch (eds). *Handbook of Science and Technology Studies*. Thousand Oaks: Sage.
- Callon, M. and B. Latour. 1981. Unscrewing the Big Leviathan: How Actors Macro-structure Reality and How Sociologists Help Them to Do So. In Karen Knorr-Cetina and A. Cicourel (eds). *Advances in Social Theory and Methodology*. London: Routledge & Kegan Paul.
- CBD. Cartagena Protocol on Biosafety to the Convention on Biological Diversity. 2000. 39 ILM 1027 (2000). <http://bch.cbd.int/protocol> (accessed on June 29, 2008).
- Castells, M. 1996. *The Information Age: Economy, Society and Culture. Volume 1. The Rise of Network Society*. Malden, Mass: Blackwell.
- CCI. Cotton Corporation of India. 2000. *Indian Cotton: A Profile*. Mumbai: The Cotton Corporation of India.
- Chaturvedi, Sachin. 1999. Amending Patents Act: Options before India. *Mainstream*. 6 March.
- Chaturvedi, Sachin. 2001. The public-private debate in agricultural biotechnology and new trends in the IPR regime: challenges before developing countries. *Research and Information Systems for the Non-Aligned and Other Developing Countries*. Working Paper 17. New Delhi; RIS.
- Chaturvedi, Sachin. 2002a. *Status and Development of Biotechnology in India: An Analytical Overview*. RIS Discussion Papers, RIS-DP # 28/2002, New Delhi: Research and Information System for the Non-Aligned and Other Developing Countries.
- Chaturvedi, Sachin. 2002b. WTO, Biosafety Regime and Trade in Genetically Modified Goods: Options before Developing Countries—An Indian Perspective. paper presented at a conference on *Biotechnology and Development: Challenges and opportunities for the Asian region*, organized by RIS at New Delhi, Feb 2002.
- Choudhary, B. 2001. Development of transgenic *Bt* cotton technology in India and China: a policy perspective. *Science and Public Policy*. Vol. 28, No. 3, June 2001. pp 219-229.
- Cohan, Bernard S. 1996. *Colonialism and Its Forms of Knowledge*. Princeton: Princeton University Press.
- Confederation of Indian Industry (CII). 2002. *Policy Paper on Proposals for Regulatory Reform in Biotechnology*. New Delhi.
- Cooper, Melinda. 2008. *Life as Surplus: Biotechnology and Capitalism in the Neoliberal Era*. Seattle and London: University of Washington Press.

- Corbridge, Stuart and John Harriss. 2000. *Reinventing India: Liberalization, Hindu Nationalism and Popular Democracy*. Cambridge: Polity.
- CSE. Centre for Science and Environment. 2010. Moratorium on *Bt* brinjal: Jairam Ramesh <http://www.cseindia.org/print/1051> (accessed on July 25, 2010).
- CSIR. Council for Scientific and Industrial Research. 1996. *CSIR 2001—Vision and Strategy*. New Delhi: CSIR.
- Current Science. 2002. Obituary Commentaries. Vol. 82 (2), 25 January 2002. pp 222-228.
- Das, S. K. 2001. *Public office, Private Interest: Bureaucracy and Corruption in India*. Delhi: Oxford University Press.
- DBT. Department of Biotechnology. 1990. Recombinant DNA Safety Guidelines. DBT. Ministry of Science and Technology, Government of India. New Delhi. <http://dbtbiosafety.nic.in?guideline/pdf/Annex-5.doc> (accessed on May 15, 2008).
- DBT. Department of Biotechnology. 1994. *Revised Guidelines for Safety in Biotechnology*. DBT. Ministry of Science and Technology, Government of India. New Delhi. http://dbtbiosafety.nic.in/guideline/pdf/guidelines_94.pdf.pdf (accessed on May 16, 2008).
- DBT. Department of Biotechnology. 1998. *Revised Guidelines for Research in Transgenic Plants and Guidelines for Toxicity and Allergenicity Evaluation of Transgenic Seeds, Plants and Plant Parts*. Ministry of Science and Technology, Government of India, New Delhi.
- DBT. Department of Biotechnology. 1999. *Counter Affidavit on Behalf of the Union of India- Respondent No. 1 to the Writ Petition*. Supreme Court of India, Extraordinary Original Jurisdiction, Civil Writ Petition No. 71/1999.
- DBT. Department of Biotechnology. 2001. *Annual Report. Department of Biotechnology*, New Delhi. www.dbtindia.nic.in. (accessed on May 7, 2008).
- DBT. Department of Biotechnology. 2001. *Biotechnology—A Vision (Ten Year Perspective)*. <http://dbtindia.nic.in/vision1.html> (accessed on Nov 22, 2008).
- DBT. Department of Biotechnology. 2005. *National Biotechnology Development Strategy*. www.dbtindia.nic.in (accessed on May 17, 2008).
- DBT. Department of Biotechnology. 2006. *Regulatory Mechanisms for GMO and Products Thereof*. DBT. Ministry of Science and Technology, Government of India. <http://dbtindia.nic.in/policy.reg.html>. (accessed on May 18, 2008).
- Deccan Chronicle. 2003. Farmers ape neighbors, pay price. *Deccan Chronicle*, 6 July.

- Deccan Chronicle. 2005. Farmers turn to other farmers. *Deccan Chronicle*, 4 July.
- Deccan Herald. 1998. KRRS threatens to destroy Monsanto crops. *Deccan Herald*, 2 December.
- Deccan Herald. 1999. BJP Eases Stand on Swadeshi Plank, Backs Government Policy. *Deccan Herald*, 5 January.
- Deccan Herald. 2000. Monsanto integrates agribusiness (to acquire businesses from sister concern for Rs 342 crore). *Deccan Herald*, 19 March.
- Deccan Herald, 2002. KRRS protest against Monsanto crops. *Deccan Herald*, 9 August.
- Deccan Herald. 2004a. Champion of farmers' cause *Deccan Herald*, 4 February.
- Deccan Herald. 2004b. India becoming a GM trash bin. *Deccan Herald*, 12 April.
- De Greiff, Pablo and Ciaran Cronin (eds). 2001. *Global Justice and Transnational Politics*. Cambridge, MA: MIT Press.
- Derek, Bob. 2003. *Universities in the Market-Place: The Commercialization of Higher Education*. Princeton: Princeton University Press.
- Dev, Mahendra and Chandrasekhara Rao. 2007. *Socio Economic Impact of Bt Cotton*. CESS Monograph No. 3, Centre for Economic and Social Studies, Hyderabad, Andhra Pradesh. November.
- Dhar, Biswajit. 2001. Regulations, negotiations and campaigns: Introducing biotechnology into India *Biotechnology and Development Monitor*, No. 47, p. 19-21.
- Dhawan, A.K. and , G.S. Simwat. 1996. Insecticide mixtures in multiple pest management in cotton. Paper presented at the Second International Congress of Entomological Sciences, Islamabad (Pakistan), 19-21 Mar 1996.
- Diamond v. Chakrabarty Case. 1980. The text of *Diamond v. Chakrabarty*, 447 U.S. 303 (1980) <http://caselaw.lp.findlaw.com/scripts/getcase.pl?court=us&vol=447&invol=303> (accessed on October 28, 2009).
- Diamond, Jared M. 1999. *Guns, Germs, and Steel: The Fates of Human Societies*. New York: W.W. Norton and Company Inc.
- Dicken, Peter. 2003. *Global Shift: Reshaping the Global Economic Map in the 21st Century*. New York: Guilford.

- DiMaggio, P. J. and W. W. Powell. 1983. The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review*: 48. pp 147-160.
- Douglas, Mary and Aaron Wildavsky. 1984. *Risk and Culture*. Berkeley: University of California.
- Doyle, M.W. 1986. *Empires*. Ithaca and London: Cornell University Press.
- Drahos, Peter. 1995. Global Property Rights in Information: The story of TRIPS at the GATT. *Prometheus*. Vol. 13, No. 1, pp. 7-19.
- Drayton, Richard. 1993. Imperial Science and a Scientific Empire: Kew Gardens and the Uses of Nature, 1772-1903. Ph.D. Dissertation. Yale University.
- Dreyfus, H.S. and P. Rabinow. 1983. *Michel Foucault: Beyond Structuralism and Hermeneutics*. 2nd Edition. Chicago: Chicago University Press.
- Drori, Gili S., John W. Meyer, Hokyo Hwang (eds). 2006. *Globalization and Organization: World Society and Organizational Change*. New York: Oxford University Press.
- Eaton, J. and S. Kortum. 1996. *A Rising Tide Raises All Ships: Trade and Diffusion as Conduits of Growth*. 82, Boston University: Institute for Economic Development.
- Economic Times. 1998a. Terminator seeds not permitted in India: Agri minister. *Economic Times*, 3 December.
- Economic Times. 1998b. Parties undecided on Patents Bill. *Economic Times*, 21 December.
- Economic Times. 1998c. Congress Support to Ensure Passage of Patents Bill. *Economic Times*, 23 December.
- Economic Times. 1999. Monsanto lines up big plan for India (the company wants to put the terminator gene controversy behind it). *Economic Times*, 3 March.
- Economic Times. 2000a. Monsanto among Rs 508 crore FDI proposals cleared (to increase stake in Indian business to 72 percent with Rs 343 crore investment), *Economic Times*, 12 April.
- Economic Times. 2000b. Fields of Genes: Government Gives Biosafety Approval to Monsanto's Cotton. *Economic Times*, 9 May.
- Economic Times . 2001a. Gujarat Govt. in dark on *Bt* cotton issue. *Economic Times*, 13 October.
- Economic Times. 2001b. GEAC orders destruction of *Bt* cotton in Gujarat. *Economic Times*, 19 October.

- Economic Times. 2001c. Agri Ministry, biotech dept disagree on *Bt* cotton issue. *Economic Times*, 29 October.
- Economic Times, 2002a, India has 500-600 plant molecular biologists *Economic Times*, 23 December.
- Economic Times. 2002b. India to contribute Rs 8 crore/year for biotech research. *Economic Times*, 19 August.
- Economic Times, 2003. Growth cohorts. *Economic Times*, 20 December.
- Economic Times, 2004a. Indian biotech on the billion dollar path *Economic Times*, 12 August.
- Economic Times. 2004b..Monsanto's gene-modified cotton sales in India rise. *Economic Times*, 10 September.
- Economic Times, 2004c. Splicing the grains of a risky venture. *Economic Times*, 21 November.
- Economic Times, 2005. Biocon on expansion spree. *Economic Times*, 21 July.
- Edelman, Marc. 1998. Transnational Peasant Politics in Central America. *Latin American Research Review*. 33 (3). pp 49-86.
- Elyachar, Julia. 2005. *Markets of Dispossession: NGOs, Economic Development, and the State in Cairo*. London: Duke University Press.
- EPW. 2000. Creative Collaboration. *Economic and Political Weekly*. June 17, 2000. pp 2083-2084.
- Escobar, Arturo. 1995. *Encountering Development: The Making and Unmaking of the Third World*. Princeton: Princeton University Press.
- Etzkowitz, Henry, Andrew Webster and Peter Healy. 1998. *Capitalizing Knowledge: New Intersections of Industry and Academia*. New York: SUNY Press.
- Ezrahi, Y. 1990 *The Descent of Icarus: Science and the Transformation of Contemporary Democracy*. Cambridge, MA: Harvard University Press.
- Falkner, Robert. 2000. Regulating Biotech Trade: The Cartagena Protocol on Biosafety. *International Affairs* 76 (2): 299-313.
- Falkner, Robert. 2007. *Business Power and Conflict in International Environmental Politics*. Basingstoke: Palgrave Macmillan.

- Falkner, Robert. 2009. The Troubled Birth of the Biotech Century: Global Corporate Power and Its Limits. In Jennifer Clapp and Doris Fuchs, eds., *Corporate Power in Global Agrifood Governance*. Cambridge, MA: The MIT Press. pp 225-252.
- Featherstone, David. 2003. Spatialities of transnational resistance to globalization: the maps of grievance of the Inter-Continental Caravan. *Transactions of the Institute of British Geographers*, 28, pp 404-421.
- Financial Express. 1998. Monsanto releases educative ads. *Financial Express*, 8 December.
- Financial Express. 2001. Fate of illegal *Bt* cotton uncertain. *Financial Express*, 29 October.
- Financial Express. 2002. IARI to shift attention to export markets—IARI to evolve designer crops to cater to requirements of importing countries now food self-sufficiency attained. *Financial Express*, 22 April.
- Financial Express. 2002a. ICAR calls for more trials on GM Mustard. *Financial Express*, 17 November.
- Financial Express. 2002b. Make field trial results of GM crops public. *Financial Express*, 18 November.
- Financial Express. 2005. USAID project to promote GM crops. *Financial Express*, 29 August.
- Fischer, F. 1990. *Technocracy and the Politics of Expertise*. CA: Sage Publications Inc.
- Fischer, Frank. 2000. *Citizens, Experts, and the Environment: The Politics of Local Knowledge*. London: Duke University Press.
- Forbes, Ian. 2006. States of uncertainty: governing the empire of biotechnology. *New Genetics and Society*. Vol. 25. No. 1. April. pp 69-88.
- Foucault, Michel. 1970. *On the Order of Things: An Archaeology of the Human Sciences*. New York: Vintage Books.
- Foucault, Michel. 1976. *The History of Sexuality*. Volume 1: An Introduction, New York: Vintage Books.
- Foucault, Michel. 1979. *Discipline and Punish: The Birth of the Prison*. New York: Vintage Books.
- Foucault, Michel. 1980. Truth and Power in Colin Gordon (ed) *Power/knowledge: Selected Interviews and Other writings 1972-1977*. New York: Pantheon Books.

- Foucault, Michel, Graham Burchell, Colin Gordon, and Peter Miller. 1991. *The Foucault Effect: studies in governmentality: with two lectures by and interview with Michel Foucault*. Chicago: University of Chicago Press.
- Frontline. 1998. A protest in Karnataka. *Frontline*, 10-23 October.
- Fujimura, Joan. 1992. Crafting Science: Standardized Packages, Boundary Objects and 'Translation'. In A. Pickering (ed). *Science as Practice and Culture*. Chicago: University of Chicago Press.
- Garde, Tanuja. V. 2009. *India's Intellectual Property Regime: A Counterbalance to Market Liberalization?* Centre for Democracy, Development and The Rule of Law. Stanford. CDDRL Working Paper Number, 99.
- Ghosh, Jayati. 2003. Corporate Agriculture: The implications for Indian farmers. http://www.macrosan.org/fet/dec03/pdf/Corp_Agri.pdf (accessed on May 23, 2008).
- Ghosh, P.K. 1997. Genetically modified crops in Indian agriculture. *Journal National Botanical Society* 51, India: 11-32.
- Ghosh, P.K. and T. Ramanaiah. 2000. Indian Rules, Regulations and Procedures for Handling Transgenic Plants. *Journal of Scientific and Industrial Research* 59, February, pp. 114-120.
- Gibbons, Michael, Camille Limoges, Helga Nowotny, Simon Schwartzman, Peter Scott and Martin Trow. 1994. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage Publications.
- Gieryn, Thomas. 1999. *Cultural Boundaries of Science: Credibility on the Line*. Chicago: University of Chicago Press.
- Gieryn, Thomas. 1983. Boundary-Work and the Demarcation of Science from Non-Science. *American Sociological Review* 48. pp 781-795.
- Glover, Dominic and Peter Newell. 2004. Business and Biotechnology: Regulation of GM Crops and the Politics of Influence. In Kees Jansen and Sietze Vellema, eds., *Agribusiness and Society: Corporate Responses to Environmentalism, Market Opportunities and Public Regulation*. London; Zed Books. P 200-231.
- Glover, Dominic. 2007. *Monsanto and Smallholder Farmers: A case study in CSR*. *Third World Quarterly*. 28 (4): 851-867.
- Glover, Dominic. 2009. *Undying Promise: Agriculture Biotechnology's Pro-Poor Narrative, ten Years On*. STEPS Working Paper 15. Brighton: STEPS Centre.

- GM Watch. 2009. Why the US is so keen to sell *Bt* brinjal to India. <http://www.gmwatch.org/latest-listing/1-news-items/11692-why-the-us-is-so->. (accessed on August 30, 2010).
- GOI, Government of India. 1966. *The Seed Act*. Act No. 54 of 29 December 1966. http://agri.mah.nic.in/agri/input/html/seedact_1966.htm. (accessed on May 29, 2008).
- GOI. Government of India. 1995. Report of the committee on partnership, resource generation, training, consultancy, contract research/contract service and incentive and reward systems. ICAR, New Delhi.
- GOI. Government of India. 1997. Training, consultancy, contract research/contract service in ICAR system rules and guidelines, ICAR, New Delhi.
- GOI. Government of India. 2000. *Large-Scale Field Trials for Transgenic Cotton Allowed*. Press Release, Government of India, 20 July. New Delhi: Press Information Bureau.
- GOI, Government of India. 2001. *The Protection of Plant Varieties and Farmers Rights Act, 2001*. Act No. 52 of 2001. New Delhi: Akalank Publications.
- GOI, Government of India. 2002. *National Seeds Policy*. <http://agricoop.nic.in/seeds/seedpolicy.htm> (accessed on August 20, 2008).
- GOI, Government of India. 2004. *The Seeds Bill, 2004*. Ministry of Agriculture. http://agricoop.nic.in/seeds/seeds_bill.htm (accessed on August 23, 2008).
- GOI, Government of India. 2005. *Agriculture and Food Safety. Mid-Term Review of the Tenth Five Year Plan*, Part II, Chapter 5, Planning Commission, New Delhi.
- Goodman, David, Bernardo Sorj and John Wilkinson. 1987. *From Farming to Biotechnology: A Theory of Agro-industrial Development*. Cambridge: Cambridge University Press.
- Goodman, David and M. Redclift. 1991. *Refashioning Nature: Food, Ecology and Culture*. London: Routledge.
- Goodman, David and Michael Watts (eds). 1997. *Globalizing Food: Agrarian Questions and Global Restructuring*. London: Routledge.
- Gottweis, Herbert. 1998. *Governing Molecules: The Discursive Politics of Genetic Engineering in Europe and the United States*. Cambridge: The MIT Press.
- GRAIN. 2001. *Bt cotton through the backdoor*. <http://webcache.googleusercontent.com/search?q=cache:NFhoWj8AJcoJ:www.indiaenvironmentportal.org.in/files/BT%2520COTTON.doc+technology+transfer+terms+Bt+cotton+monsanto+government+India+failed&cd=3&hl=en&ct=clnk&gl=us> (accessed on March 20, 2009).

- GRAIN. 2007. *Bt cotton: The facts behind the hype*. www.grain.org/seedling/?id=457 (accessed on January 18, 2009).
- Guadalupe, M. and M. Rodrigues. 2004. *Global Environmentalism and Local Politics: Transnational Advocacy Networks in Brazil, Ecuador and India*. New York: State University of New York Press.
- Guidry, John A, Michael D. Kennedy, and Mayer N. Zald (eds). 2000. *Globalization and Social Movements: culture, power and the transnational public sphere*. Michigan: University of Michigan Press.
- Gulati, Ashok and A.N Sharma. 1995. Subsidy Syndrome in Indian Agriculture *Economic and Political Weekly*, 30 September, 1995. pp A93-A102.
- Gulati, Ashok and Seema Bathla. 2001. Capital Formation in Indian Agriculture: Revisiting the Debate. *Economic and Political Weekly*. 19 May, 2001. pp 1697-1708.
- Gupta, Anil. K. 1993. Biotechnology and Intellectual Property Rights: Protecting the interests of Third World Farmers and Scientists. In U.K. Srivastava and S. Chandrasekhar (eds) *Commercialization of Biotechnologies For Agriculture and Aquaculture: Status and Constraints in India*. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd. Pp 31-56.
- Gupta, Aarti. 2000. *Governing Biosafety in India: The Relevance of the Cartagena Protocol*. Belfer Center for Science and International Affairs (BCSIA) Discussion Paper 2000-24, Environment and Natural Resources Program, Kennedy School of Government, Harvard University.
- Gupta, Aarti. 2002 a. Governing Trade in Genetically Modified Organisms: the Cartagena Protocol on Biosafety. *Environment*. Vol. 42. No. 4: 23-33.
- Gupta, Aarti. 2002b. Ensuring safe use of biotechnology: key challenges. *Economic and Political weekly*, 6 July, pp 2762-9.
- Gupta, Akhil. 1998. *Postcolonial Developments: Agriculture in the Making of Modern India*. London: Duke University Press.
- Haas, P. 1992. Introduction: Epistemic Communities and International Policy Coordination. *International Organization*, Vol. 46, No. 1: 1-35.
- Haggard, Stephen and Robert R. Kaufman, (eds). 1992. *The Politics of Economic Adjustment: International Conflicts and the State*. Princeton, N.J.: Princeton University Press.
- Halfon, Saul. 2007a. *The Cairo Consensus: Demographic Surveys, Women's Empowerment, and Regime Change in Population Policy*. UK: Lexington Books.

- Halfon, Saul. 2007b. Science and the Precautionary Principle. In George Ritzer (ed.), *The Blackwell Encyclopedia of Sociology*. Williston, VT: Blackwell. pp 4082-83.
- Hardt, Michael and Antonio Negri. 2000, *Empire* Mass.: Cambridge.
- Harvey, David. 2003. *The New Imperialism*. UK: Oxford.
- Harvey, David. 2005. *A Brief History of Neoliberalism*. UK: Oxford University Press.
- Headrick, Daniel R. 1988. *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940*. New York: Oxford University Press.
- Herring, Ronald, J. 1999. Embedded Particularism: India's Failed Developmental State. In Meredith Woo-Cumings (ed.). *The Developmental State*. Ithaca: Cornell University Press.
- Herring, Ronald. J. 2006. Why Did Operation Cremate Monsanto Fail? Science and Class in India's Great Terminator-Technology Hoax. *Critical Asian Studies*, 38:4(2006), pp467-493.
- Herring, Ronald. J. 2007. Stealth Seeds: Bioproperty. Biosafety, Biopolitics. *Journal of Development Studies*. January, Vol. 43, No 1, pp 130-157.
- Herring, Ronald. J. 2009. Illicit Seeds: Epistemic Brokers and Politics of Property in Genetic Engineering. *APSA 2009 Toronto Meeting Paper*, http://papers.ssrn.com/sol13/papers.cfm?abstract_id=1449228 (accessed on Dec 11, 2008).
- Hindustan Times. 1998. Seeds of conspiracy. *Hindustan Times*, 3 December.
- Hiskes, Richard P. 1998. *Democracy, Risk and Community: Technological Hazards and the Evolution of Liberalism*. New York: Oxford University Press.
- Hughes, Thomas. 1983, *Networks of Power: Electrification of Western Societies, 1880-1930*. Baltimore: The Johns Hopkins University Press.
- ICC. Inter Continental Caravan Press Release. www.mail-archive.com/futurework@dijkstra.uwaterloo.ca/msg04238.html (accessed on January 10, 2010).
- Indian Express. 1998a. Stop entry of terminator into India, urge scientists, *Indian Express*, 28 July.
- Indian Express. 1998b. Terminator seed tech will be banned: Som Pal, *Indian Express*, 2 December.

- Indian Express. 1998c. India gears up to face the threat posed by the terminator gene, *Indian Express*, 10 September.
- Indian Express. 1998d. Patent for terminator filed in India, experts worried, *Indian Express*, 29 December.
- Indian Patents Act. 1970. <http://www.patentoffice.nic.in/ipr/patent/patAct1970-3-99.html> (accessed on October 22, 2009).
- ISAAA, 2000. *Bt Cotton: Indian Case Study*. Global Knowledge Centre on Crop Biotechnology. International Service for the Acquisition of Agri-Biotech Applications. New York: Ithaca.
- Irwin, A. and B. Wynne. (eds), 1996. *Misunderstanding Science? The Public Reconstruction of Science and Technology*. Cambridge: Cambridge University Press.
- IPS. Inter Press Service. 1999. Indian farmers take the war to Europe. *IPS*, 25 May.
- ISCI. 1999. *Handbook of Cotton in India*. Mumbai: Indian Society for Cotton Improvement.
- Jansen, Kees and Esther Roquas. 2008. Biosafety Regulation and Global Governance: The Problem of Absentee Expertise in Latin America. In Gerardo Otero (ed). *Food for the Few: Neoliberal Globalism and Biotechnology in Latin America*. Austin: University of Texas Press.
- Jasanoff, Sheila. 1990. *The Fifth Branch: Science Advisers as Policymakers*. Cambridge, Mass: Harvard University Press.
- Jasanoff, Sheila. 1995. Product, Process or programme: three cultures and the regulation of biotechnology In M. Bauer ed. *Resistance to New Technologies*. 311-331 National Museum of Science and Industry: Cambridge University Press.
- Jasanoff, Sheila (ed). 2004. *States of Knowledge: The Co-Production of Science and Social Order*. London: Routledge.
- Jasanoff, Sheila. 2005. *Designs on Nature: Science and Democracy in Europe and the United States*. Princeton: Princeton University Press.
- Jasanoff, Sheila. 2006. Biotechnology and Empire: The Global Power of Seeds and Science in *OSIRIS* 2006, 21: 273-292.
- Jayaraman, K.S. 2000. India's finest, for hire. <http://www.nature.com/nature/journal/v407/n6806/full/407830a0.html> (accessed on September 9, 2008).
- Jayaraman, K.S. 2002. India Approves GM Cotton. *Nature Biotechnology*. Vol. 20. May 2002. p 415.

- Kahler, Miles. 1990. Orthodoxy and Its Alternatives: Explaining Approaches to Stabilization and Adjustment. In Joan M. Nelson (ed.). *Economic Crisis and Policy Choice: The Politics of Adjustment in the Third World*. Princeton, N.J.: Princeton University Press. pp 33-61.
- Kahler, Miles. 1992. External Influence, Conditionality, and the Politics of Adjustment. In Stephen Haggard and Robert R. Kaufman (eds.). *The Politics of Economic Adjustment: International Conflicts and the State*. Princeton, N.J.: Princeton University Press. pp 89-138.
- Kapur, Arvind. 1999. Opportunities in Agricultural Biotechnology. In Tata Energy Research Institute (ed). *Genetically Modified Plants: Benefits and Risks*. Proceedings of Workshop held on 24 June, 1999. New Delhi: TERI Publications. pp 80-92.
- Kautsky, Karl. 1899. *The Agrarian Question*. London: Zwan.
- Keck, Margaret E. and Kathryn Sikkink. 1998. *Activists beyond Borders: Advocacy Networks in International Politics*. Ithaca: Cornell University Press.
- Kelso, Dennis. 2003. The Migration of Salmon from Nature to Biotechnology In Rachel Schurman and Dennis Takahashi (eds.) *Engineering Trouble: Biotechnology and its Discontents*. Berkeley, CA: University of California Press.
- Kendall, Gavin. 2004. Global networks, international networks, actor networks. In Wendy Larner and William Walters (ed) *Global governmentality: Governing international spaces*. New York: Routledge. pp 59-75.
- Kennedy, P.M. 1988. *The Rise and Fall of Great Powers: Economic Change and Military Power from 1500-2000*. London: Fontana.
- Keohane, R.O. 1984. *After Hegemony*. Princeton: Princeton University Press.
- Kloppenburg, Jack Ralph. 1988. *First the Seed: The political economy of plant biotechnology 1492-2000*. Wisconsin: The University of Wisconsin Press.
- Kluger, Jeffrey. 1999. The Suicide Seeds: Terminator genes could mean big biotech bucks—but big trouble too, as a grass-roots protest breaks out on Net. *Time*, Feb 1, 1999, v 153 i4 p.44(1).
- Knorr-Cetina, Karen. 1981. *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science*. Oxford: Pergamon.
- Knorr-Cetina, Karen. 1995. Laboratory Studies: The Cultural Approach to the Study of Science In Shiela Jasanoff, G.E Markle, J.C. Peterson and T. Pinch (eds.). *Handbook of Science and Technology Studies*. Thousand Oaks: Sage.

- Kranthi, K.R. and S. Naidu. et.al. 2005. Temporal and Intra-plant Variability of Cry1Ac Expression in *Bt* cotton and its Influence on the Survival of Cotton Bollworm *Helicoverpa*, *Armigera*, *Current Science*, Vol. 89, No. 2, 25 July, 2005. pp. 291-298.
- Krige, John and Kai-Henrik Barth. (eds). 2006, *Global Power Knowledge: Science and Technology in International affairs*. OSIRIS/21, The History of Science Society.
- Krishna, V.V. 2001. Changing policy cultures, phases and trends in science and technology in India. *Science and Public Policy*, Vol. 28, No. 3, June 2001. pp: 179-194.
- Krishna, Janaki P. 2004. India Produces Indigenous GM Cotton. *ISB News Report*. August.
- Krishnakumar, Asha. 2003. Controversy: A lesson from the field. *Frontline* 20 (12). <http://www.flonnet.com/fl2011/stories/20030606005912300.htm> (accessed on June 11, 2008).
- Krimsky, Sheldon. 1991. *Biotechnics and Society: The Rise of Industrial Genetics*. New York: Praeger.
- Kumar, Nagesh. 1998. India, Paris Convention and TRIPS. *Economic and Political Weekly*. 5 September, 1998. pp 2334-2335.
- Laclau, Ernest and Chantal Mouffe. 1985. *Hegemony and Socialist Strategy: Towards a Radical Democratic Politics*. London: Verso Publication.
- Latour, Bruno. 1983. Give me a Laboratory and I Will Raise the World. In K. Knorr-Cetina and M. Mulkay (eds). *Science Observed: Perspectives on the Social Study of Science*. London: Sage.
- Latour, Bruno. 1987. *Science in Action: How to Follow Scientists and engineers Through Society*. Milton Keynes: Open University Press.
- Latour, Bruno and Steve Woolgar. 1979. *Laboratory Life: The Construction of Scientific Facts*. Princeton, NJ: Princeton University Press.
- Latour, Bruno. 1993. *We have never been modern*. London: Harvester Wheatsheaf.
- Law, John and Kevin Hetherington. 2000. Materialities, Spatialities, Globalities. in John R. Bryson et.al (ed) *Knowledge, Space, Economy*. New York: Routledge.
- Law, John. 1986. On the methods of long-distance control: vessels, navigation and the Portuguese route to India in John Law (ed) *Power, Action and Belief: A New Sociology of Knowledge?* Sociological Review Monograph 32; London: Routledge & Kegan Paul.
- Law, J. 1999. After ANT: Complexity, Naming and Topology. In J. Law and J. Hassard. (eds) *Actor Network and After*. Malden, MA: Blackwell/The Sociological Review.

- Leelakrishnan, P. 2005. *Environmental Law in India*. 2nd Edition. New Delhi: LexisNexis Butterworths.
- Lenin, Vladimir Ilich. 1916. *Imperialism: The Highest Stage of Capitalism*. London: Pluto.
- Levidow, Les, Susan Carr, R. Von Schomberg and David Wield. 1996. Regulating agricultural biotechnology in Europe: harmonization difficulties, opportunities, dilemmas. *Science and Public Policy*. Vol. 23. No. 3. June, pp 135-157.
- Levidow, Les, Susan Carr and David Wield. 2000. Genetically Modified Crops in the European Union: Regulatory Conflicts as Precautionary Opportunities. *Journal of Risk Research* 3 (3): 189-208.
- Levidow, L. 2001. Precautionary Uncertainty: Regulating GM Crops in Europe. *Social Studies of Science*. 31. pp 842-874.
- Levy, David and Peter Newell (eds). 2005. *The Business of Global Environmental Governance*. Cambridge, MA: MIT Press.
- Lewontin, Richard. 1998. The maturing of capitalist agriculture: farmer as proletarian. *Monthly Review* 50 (3). pp 72-85.
- Lindberg, S. 1997. Farmers' Movements and Agricultural Development in India. in S. Lindberg and A. Sverisson (eds.), *Social Movements in Development: The Challenge of Globalization and Democratisation*. New York: St. Martin's Press: 101-26.
- Lumelsky, Anna. 2005. *Diamond v. Chakrabarty*: Gauging Congress's Response to Dynamic Statutory Interpretation by the Supreme Court. *University of San Francisco Law Review* 39 (3): 641.
- Luke, Timothy W. 2006. Technocritique: The Politics of Technologies in Embodied, Imagined, and Engineered Communities. Paper presented at the International Social Theory Consortium, Hotel Roanoke, Roanoke, Virginia, USA. May 18-21, 2006.
- Lynch, Michael. 1985. *Art and Artifact in Laboratory Science: A Study of Shop Work and Shop Talk in a Research Laboratory*. London: Routledge & Kegan Paul.
- MacKenzie, J. (ed) 1990. *Imperialism and the Natural World*. Manchester: Manchester Press.
- Madsen, Stigtof. 2001. The View from Vevey. *Economic and Political Weekly*, Vol. XXXVI, No 39, September 29-October 5, pp 3733-42.
- Manjunath, T.M. 2004. *Bt cotton in India: The technology wins as the controversy wanes*. Paper presented at the 63rd Plenary Meeting of International Cotton Advisory Committee (ICAC) Meeting, Mumbai, 28 Nov-02 Dec, 2004.

- Mann, M. 1986. *The Sources of Social Power: A History of Power from the Beginning to 1740*. Cambridge: Cambridge University Press.
- Mann, M. 2003. *Incoherent Empire*. London and New York: Verso.
- Mann, Susan A. and James Dickinson. 1978. Obstacles to the Development of Capitalist Agriculture. *Journal of Peasant Studies*. Vol. 5, pp 466-481.
- Mann, Susan A. 1990. *Agrarian Capitalism in Theory and Practice*. Chapel Hill, NC: University of North Carolina Press.
- Marcuse, Herbert. 1964. New Forms of Control. In Herbert Marcuse, *One-Dimensional Man*. Boston: Beacon. pp 1-18.
- Marx, Karl. 1976. *Capital*. trans. B Fowkes. New York: Viking.
- Maskus, K. 1998. The Role of IPR in Encouraging Foreign Direct Investment and Technology Transfer. *9 Duke Journal of Comparative and International Law*. 109.
- Marglin, Frederique A. and Stephen A. Marglin. 1990. *Dominating Knowledge: Development, Culture, and Resistance*. Oxford: Clarendon Press.
- Mayet, M. 2003. Africa: The new frontier for the GE industry. www.pambazuka.org/index.php?id=19721.
- McHattie, B. 2000. *Threats posed by globalization and responses by rural social movements: case of Karnataka Rajya Raitha Sangha in South India*. MA thesis, The Faculty of Graduate Studies, the University of Guelph.
- Menon, M and N. Jayaraman. 2002. *Bt Cotton: Seeds of Discontent*. <http://www.indiaresource.org/issues/agbiotech/2003/Btcottonseeds.html> (accessed on September 5, 2009).
- Meyer, J. and R. Scott (eds). 1994. *Institutional Environments and Organizations: Structural Complexity and Individualism*. Thousand Oaks: Sage Publications.
- MoA. Ministry of Agriculture. 2004. *Report of the Task Force on Application of Biotechnology*. By M.S. Swaminathan, Chairman. Ministry of Agriculture, Government of India. <http://agricoop.nic.in/TaskForce/tf.htm> (accessed on July 10, 2008).
- MoEF, Ministry of Environment and Forests. 1986. *The Environment Protection Act*. <http://db/biosafety.nic.in/act/Annex-3.htm> (accessed on July 12, 2008).
- MoEF, Ministry of Environment and Forests. 1989. Rules for the Manufacture, Import, Export and Storage of Hazardous Microorganisms, Genetically Engineered Organisms or Cells,

- MoEF, Government of India. Gazette of India. Extraordinary Part II 3(i). <http://dBtbiosaftey.nic.in/> (accessed on July 22, 2008).
- MoEF, Ministry of Environment and Forests. 2005. *Recommendations of Sub-Committee on Bt Cotton and Related Issues*. MoEF under the chairmanship of Dr. S. Nagarajan, Director, IARI, New Delhi. http://www.envfor.nic.in/divisions/csurv/Btcotton/reco_Btcotton.htm (accessed on Aug 2, 2008).
- MoEF, Ministry of Environment and Forests. 2006a. Background Note on Bt Cotton in India. MoEF, Government of India. <http://www.envfor.nic.in/divisions/geac/bgnote.pdf> (accessed on Aug 3, 2008).
- MoEF, Ministry of Environment and Forests. 2006b. *Genetic Engineering Approval Committee* MoEF. Government of India. Multiple Reports on Monitoring <http://www.envfor.nic.in/divisions/csurv/geac/othinfo.html> (accessed on Aug 4, 2008).
- MMB. Monsanto-Mahyco Biotech. 2004. Nationwide survey by ACNielsen ORG-MARG underscores benefits of Bollgard[™] cotton. Monsanto-Mahyco Biotech, Press release. March 26. Mumbai, India.
- Monsanto. 2006. India: Conversations about plant biotechnology. <http://www.monsanto.com/biotech-gmo> (accessed May 17, 2008)
- Mruthyunjaya and P. Ranjitha.1998. The Indian Agricultural Research System: Structure, Current Policy Issues, and Future Orientation. *World Development*, Vol. 26, No. 6, pp. 1089-1101.
- Mukherjee, K. 2007. Indian farmer suicides spiral despite cash plans. *Reuters*, July, 6, 2007.
- Murgai, R., M. Ali, and D. Byerlee. 2001. Productivity Growth and Sustainability in Post-Green Revolution Agriculture: The Case for the Indian and Pakistan Punjab. *World Bank Research Observer*. 16. pp 199-218.
- Nagaraj, D.R. 1996. Anxious Hindu and Angry Farmer: Notes on the Culture and Politics of Two Resonances to Globalization in India in Luiz E. Soares (ed) *Cultural Pluralism, Identity and Globalization*. Rio de Janeiro: UNESCO, pp 271-93.
- Nagaraj, K. 2008. *Farmers' suicide in India: Magnitudes, trends and spatial patterns*. Preliminary Report. Madras, India: Madras Institute of Development Studies.
- Narayanamurthy, A. and S. S. Kalmkar. 2006. Is Bt cotton cultivation economically viable for Indian farmers? An Empirical Analysis. *Economic and Political Weekly*, 30 June, 2006. pp 2716-2724.
- Nature, 2001. Is the university-industry complex out of control? *Nature*, 11 January, Vol. 409.

- NCRB. National Crime Records Bureau. 2006. *Accidental Deaths and Suicides in India*. New Delhi, India: Ministry of Home Affairs.
- Nelkin, D. (ed). 1992. *Controversy: Politics of Technical Decisions*. Newbury Park, CA: Sage.
- Nelson, Joan M. (ed). 1990. *Economic Crisis and Policy Choice: The Politics of Adjustment in the Third World*. Princeton, NJ: Princeton University Press.
- Newell, Peter and Ruth Mackenzie. 2000. The Cartagena Protocol on Biosafety: Legal and Political Dimensions. *Global Environmental Change* 10: 313-317.
- Newell, Peter. 2002. Biotechnology and the Politics of Regulation. *IDS Working Paper* 146. Institute of Development Studies, Brighton, Sussex BN1 9RE, England. January 2002.
- Newell, Peter. 2003. *Biotech Firms, Biotech Politics: Negotiating GMOs in India*. IDS Working Paper 201, Sussex, UK: Institute of Development Studies.
- Newell, Peter, 2006. Corporate Power and Bounded Autonomy in the Global Politics of Biotechnology. In Robert Falkner, ed., *The International Politics of Genetically Modified Food*. pp 67-84. Basingstoke: Palgrave Macmillan.
- Newell, Peter. 2008. Lost in Translation? Domesticating Global Policy on Genetically Modified Organisms: Comparing India and China. *Global Society*. Vol. 22. No. 1. January, 2008. pp115-136.
- Niskanen, W. 1971. *Bureaucracy and Representative Government*. Chicago: Aldine-Atherton.
- Oudshoorn, Nelly and Trevor Pinch (ed.). 2003. *How Users Matter: The Co-Construction of Users and Technologies*. Cambridge: The MIT Press.
- Paalberg, R.L. 2000. Governing the GM Crop revolution: Policy choices for developing countries. *Food, Development and Environment Discussion Paper* 33. Washington, DC: International Food Policy Research Institute.
- Parayil, G. 2003. Mapping Technological Trajectories of the Green Revolution and the Gene Revolution from Modernization to Globalization. *Research Policy*. 32. pp 971-990.
- Passavant, Paul A. and Jodi Dean (eds). 2004. *Empire's New Clothes: Reading Hardt and Negri*. New York: Routledge.
- Patel, R. and A. Muller. 2004. Shining India? Economic liberalization and rural poverty in the 1990s. *First Food Policy* Brief 10, Oakland.
- Patnaik, Jagdish. K. 1992. India and TRIPS: some notes on the Uruguay Round Negotiations *India Quarterly*. Vol. XLVIII, no. 4, Oct-Dec. p 32.

- Patnaik, Prabhat and C.P. Chandrasekhar. 1998. India: *dirigisme*, structural adjustment, and the radical alternative In Baker, Dean, Epstein, Gerald, and Pollin, Robert (eds). *Globalization and Progressive Economic Policy*. Cambridge: Cambridge University Press. pp. 67-91.
- Patnaik, Utsa. 2002. Deflation and *déjà vu*: Indian agriculture and the world economy. in V.K. Ramachandran and Madhura Swaminathan, eds, *Agrarian Studies: Essays on Agrarian Relations in Less Developed Countries*. Delhi: Tulika Publications; pp111-143.
- Patnaik, Utsa. 2004. It is a crisis rooted in economic reforms. interview in *Frontline*. Volume 21, Issue 13, Jun. 19 - Jul. 02, 2004.
- Pearson, Mark. 2006. Science, representation and resistance: the *Bt* cotton debate in Andhra Pradesh, India. *The Geographical Journal*, Vol. 172, No. 4, December 2006, pp 306-317.
- Philip, Kavita. 2004. *Civilizing Natures: Race, Resources and Modernity in Colonial South India*. New Jersey: Rutgers University Press.
- Pieterse, Jan N. 2004. *Globalization or Empire?* New York: Routledge.
- Pinch, Trevor. 1986. *Confronting Nature: The Sociology of Solar Neutrino Detection*. Dordrecht: Riedel.
- Pinch, T.J. and W.E. Bijker. 1987. The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other. In W. Bijker et. al. (ed). *The Social Construction of Technological Systems*. MA: MIT Press.
- Pioneer Press Service. 1998. Anti-Monsanto campaign runs into dry ground. *Pioneer Press Service*, December 5.
- Porter, Theodore M. 1995. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton: Princeton University press.
- Potter, D. 1996. *India's Political Administrators*. 2nd Edition. Delhi: Oxford University Press.
- Prakash, Gyan. 1999. *Another Reason: Science and the Imagination of Modern India*. New Jersey: Princeton University Press.
- Price, D. 1965. *The Scientific Estate*. Cambridge, MA: Harvard University Press.
- Prime Minister A.B. Vajpayee's Speech at the Indian Science Congress in January 2001, www.isc2001.nic.in/vsisc3001 (accessed on April 20, 2008).
- Prudham, Scott. 2003. Taming Trees: Capital, Science and Nature in Pacific Slope Tree Improvement. *Annals of the Association of American Geographers*. 93(3). Pp 636-656.

- Qayum, Abdul and Kiran Sakkhari. 2005. *Bt Cotton in Andhra Pradesh: A three-year assessment*. Hyderabad: SRAS Publications.
- Ramakrishna, T. 2003. *The development of the IPR Regime in India with Reference to Agricultural Biotechnology*. Background Paper. Biotechnology and the Policy Process in Developing Countries project. Institute of Development Studies. Brighton: IDS. www.ids.as.uk/biotech (accessed on 31 June, 2008).
- Ramani, Shyama. V. 2008. After the Green Revolution: *Bt Cotton In India: Blessing or Regulatory Headache?* *Ecole Polytechnique, F-91128 Palaiseau Cedex, France, Working Paper*.
- Randhawa, M. 1979. *A History of the Indian Council of Agricultural Research, 1929-79*. New Delhi: ICAR Publication.
- Rangnekar, Dwijen. 2007. Context and Ambiguity in the Making of Law: A Comment on Amending India's Patent Act. *The Journal of World Intellectual Property*. Vol. 10, No. 5, pp 365-387.
- Ravi Rajan, S. (ed.). 1996. *Imperialism, Ecology, and Politics: Perspectives on the Ecological Legacy of Imperialism*. Delhi: Sage.
- Ravi Rajan, S. 2005. Science, State and Violence: An Indian Critique Reconsidered in *Science as Culture*, Vol. 14, No. 3, September 2005, pp 265-281.
- Reddy, Bheemeshwar. 2008. *The Status of Public Agricultural Extension Services: A Case Study in Rural Maharashtra*. MA Dissertation in Development Studies, Tata Institute of Social Sciences, Mumbai.
- Regis, Ed. 2003. *The Info Mesa: Science, Business and the New Age Alchemy on the Santa Fe Plateau*. New York: W.W. Norton & Co.
- RFSTE. Research Foundation for Science, Technology and Ecology. 1998. *Monsanto: Peddling Life Sciences or Death Sciences*. New Delhi: RFSTE publications.
- RFSTE. Research Foundation for Science, Technology and Ecology. 1999a. Writ Petition (civil) No. 71 of 1999. In the Matter of Research Foundation for Science, Technology and Ecology (Petitioner) versus Union of India and Others (Respondents). Supreme Court of India, Extraordinary Original Jurisdiction, Filed on 16 January, 1999.
- RFSTE. Research Foundation for Science, Technology and Ecology. 1999b. Common Rejoinder Affidavit to the Counter Affidavits Filed by the Union of India through Ministry of Science and Technology (Respondent No. 1) Maharashtra Hybrid Seeds Company Ltd. (Respondent No. 2) and Monsanto Biotech (India) Private Ltd. (Respondent No. 3). Writ Petition (Civil) No. 71/1999. Supreme Court of India. Extraordinary Original Jurisdiction.

- Robinson, William I. 2004. *A Theory of Global Capitalism: Production, Class and State in a Transnational World*. Baltimore: The Johns Hopkins University Press.
- Rudolph, L and S. Rudolph. 1987. *In Pursuit of Lakshmi: The Political Economy of Indian State*. Delhi: Orient Longman.
- Russell, Edmund. 2001. *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring*. UK: Cambridge University Press.
- Ruivenkamp, Guido. 2005. Tailor-made Biotechnologies: Between bio-power and sub-politics. *Tailoring Biotechnologies*. Vol. 1, Issue 1. pp 11-33.
- Safrin, Sabrina. 2002. Treaties in Collision? The Biosafety Protocol and the World Trade Organization Agreements. *The American Journal of International Law*. Vol. 96. No. 3. July, 2002. pp 606-628.
- Sahai, Suman. 1992. Patenting of Life Forms: What it Implies. *Economic and Political Weekly*. April 25, 1992. pp 878-879.
- Sahai, Suman. 1999. The Bogus Debate on Bioethics. *Biotechnology and Development Monitor*, No 30, March.
- Sahai, Suman and Shakeelur Rehman. 2004. *Bt-Cotton, 2003-2004: Fields Swamped with Illegal Variants*. *Economic and Political Weekly*. 26 June, 2004. pp 2673-2674.
- Sahai, Suman. 2005. A Disaster called *Bt Cotton Gene Campaign*. <http://www.genecampaign.org/Publication/Article/BT%20Cotton/A-disaster-called-Btcotton.htm> (accessed on Sept. 19, 2008).
- Sainath, P. 2007a. Farm suicides rising: Most intense in 4 states. *The Hindu*, November 12, 2007.
- Sainath, P. 2007b. One farmer's suicide every 30 minutes. *The Hindu*, November 15, 2007.
- Samytka Karnataka. 1998. Police protection to all American companies in Bangalore city. *Samytka Karnataka*, 25 November.
- SciDevNet 2006. GM in India: the battle over *Bt* cotton. <http://www.scidev.net/Features/index.cfm?fuseaction=readfeatures&itemid=570&language=1> (accessed on July 25, 2008).
- Scoones, Ian. 2002. Science, Policy and Regulation: Challenges for Agricultural Biotechnology in Developing Countries. *IDS Working Paper* 147.
- Scoones, Ian. 2005. *Science, Agriculture and the Politics of Policy: The Case of Biotechnology in India*. Hyderabad: Orient Longman.

- Scoones, Ian. 2007. The contested politics of technology: Biotech in Bangalore. *Science and Public Policy*. May 2007.
- Scott, James C. 1985. *Weapons of the Weak: Everyday Forms of Peasant Resistance*. London: Yale University Press.
- Scott, James C. 1998. *Seeing Like a State: How Certain Schemes to Improve Human Condition Have Failed*. New Haven and London: Yale University Press.
- Sell, Susan. K. 1999. Multinational Corporations as Agents of Change: The Globalisation of Intellectual Property Rights. In *Private Authority and International Affairs*, edited by A. Claire Cutler, Virginia Haufler and Tony Porter, 167-197. Albany: State University of New York Press.
- Sell, Susan. K. 2002. Industry Strategies for Intellectual Property and Trade: The Quest for TRIPS, and Post-TRIPS Strategies. 10 *Cardozo Journal of International and Comparative Law*. 79 (2002).
- Sengupta, S. 2006. On India's farms, a plague of suicides. *The New York Times*, 19 September.
- Serageldin, I. and Persley, G.J. (eds) 2003. *Biotechnology and Sustainable Development: Voices of the South and North*. UK: CABI Publishing.
- Seshia, S. 2002. Plant Variety protection and Farmers' Rights: Law-making and the Cultivation of Varietal Control. *Economic and Political Weekly*. 6 July 2002. pp 2741-2747.
- Seshia, S. and I. Scoones. 2003. Tracing policy connections: the politics of knowledge in the green revolution and biotechnology eras in India. *IDS Working Paper 188, Biotechnology Policy series 21*, Brighton: Institute of Development Studies.
- Shah, Esha, 2005. Local and Global Elites Join Hands: Development and Diffusion of *Bt* cotton Technology in Gujarat *Economic and Political Weekly*, October 22, 2005. pp 4629-4640.
- Sharma, Devinder. 2001. Devinder Sharma's letter to Prime Minister of India on *Bt* Cotton. <http://www.poptel.org.uk/panap/latest/dsletter.htm> (accessed on August 14, 2009).
- Sharma, Devinder. 2002a. The Killing Fields. <http://www.dsharma.org/agriculture/killing.htm> (accessed on Nov. 1, 2008).
- Sharma, Devinder. 2002b. Alarm Bells for Indian agriculture. <http://www.dsharma.org/agriculture/alarm.htm> (accessed on Nov. 2, 2008).
- Sharma, Devinder. 2003. A scientific fairytale on *Bt* Cotton. In *The AgBioTechIndia Bulletin*. India. Feb 14, 2003. <http://www.genne.ch/genet/2003/Feb/msg00075.html> (accessed on Nov. 3, 2008).

- Sharma, M., K. Charak, and T. Ramanaiah. 2003. Agricultural biotechnology research in India: status and policies. *Current Science*. 84: 297-302.
- Shiva, Vandana. 1989. *Staying Alive: Women, Ecology and Development*. London: Zed Books.
- Shiva, Vandana. 1991a. *The Violence of the Green Revolution: Third World Agriculture, Ecology, and Politics*. London: Atlantic Highlands; Penang, Malaysia: Third World Network.
- Shiva, Vandana. 1991b. Biotechnology Development and Conservation of Biodiversity. *Economic and Political weekly*. Nov. 30, 1991. pp 2740-2746.
- Shiva, Vandana. 1993. *Monocultures of the Mind: Perspectives on Biodiversity and Biotechnology*. London: Zed Books.
- Shiva, Vandana. 1996. Agricultural Biodiversity, Intellectual Property Rights and Farmers' Rights. *Economic and Political Weekly*. June 22. pp 1621-1631.
- Shiva, Vandana. 1999a. The Seed and the Earth: Biotechnology and Colonization of Regeneration in V. Shiva (ed.) *Minding Our Lives: Women from the South and the North Reconnect Ecology and Health*. Delhi: Kali for Women.
- Shiva, Vandana, A. Emani and A. Jafri. 1999b. Globalization and threat to Seed security: Case of transgenic cotton trials in India. *Economic and Political Weekly*. 34: 601-13.
- Shiva, Vandana et. al. 2000. *Seeds of Suicide: The Ecological and Human Costs of Globalization of Agriculture*. New Delhi: Research Foundation for Science, Technology and Ecology.
- Shiva, Vandana. 2001. *Stolen Harvest: The Hijacking of the Global Food Supply*. London: Zed Books.
- Shiva, Vandana. 2003. The Monsanto Amendment: The Real reasons for the Second Amendment of the Indian Patent Act. *Synthesis/Regeneration* 30. Winter 2003. <http://www.greens.org/s-r/30/30-19.html> (accessed on 15 December, 2008).
- Sklair, Leslie. 2002. *Globalization, Capitalism and Its Alternatives*. Oxford: Oxford University Press.
- Smith, Jackie. 2004. Transnational Processes and Social Movements in David. A. Snow et.al. (ed) *The Blackwell Companion to Social Movements*. London: Blackwell Publishers.
- Sopory, S. and S. Maheshwari. 2001. Plant Molecular Biology in India: the beginnings. *Current Science*. 80: 270-279.

- Spivak, Gayatri C. 1988. Can the subaltern speak? In Nelson, Carl and Grossberg, Laurence (eds) *Marxism and the Interpretation of Culture*. London: Macmillan. pp 271-313.
- Spivak, Gayatri C. 1999. *A Critique of Postcolonial Reason: Toward a History of a Vanishing Present*. London: Harvard University Press.
- Stallings, Barbara. 1992. International Influence on Economic Policy: DeBt, Stabilization and Economic Reforms. In Stephen Haggard and Robert R. Kaufman (eds.) *The Politics of Economic Adjustment: International Conflicts and the State*. Princeton, N.J.: Princeton University Press. pp 41-88.
- Stein, Haley. 2005. Intellectual Property and Genetically Modified Seeds: The United States and the Developing World. *Northwestern Journal of Technology and Intellectual Property*. Vol. 3. Issue 2, Spring 2005.
- Stewart, Terence. P. (ed.). 1993. *The GATT Uruguay Round: A Negotiating History, 1986-1992*. Vol. 2. Commentary, Netherlands, P 2255.
- Stone, Glenn Davis. 2007. Agricultural Deskillling and the Spread of Genetically Modified Cotton in Warangal. *Current Anthropology*. Volume 48, Number 1, February 2007.
- Strange, Susan. 1996. *The Retreat of the State: The Diffusion of Power in the World Economy*. Cambridge: Cambridge University Press.
- Subramaniam, C. 1979. *The New Strategy in Indian Agriculture: The First Decade and After*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Sunder Rajan, Kaushik. 2006. *Biocapital: The Constitution of Postgenomic Life*. Durham and London: Duke University Press.
- Swaminathan, M.S.1996. *Sustainable Agriculture: Towards an Evergreen Revolution*. Delhi: Konark Publishers.
- Talukdar, Kana and Jennifer Kuzma. 2008. Evaluating technology oversight through multiple frameworks: A case study of genetically engineered cotton in India. *Science and Public Policy*. March 2008. pp 121-138.
- Tarrow, Sidney. 1998. *Power in Movement: social movements and contentious politics*. New York: Cambridge University Press.
- Tarrow, S. 2005. *The New Transnational Activism*. New York: Cambridge University Press.
- TERI. Tata Energy Research Institute. 2000. *Stakeholders' Dialogue on Agricultural Biotechnology: Biosafety and economic Implications*. Proceedings of a Workshop held on 25 November 199 at Tamil Nadu Agricultural University. New Delhi: TERI Publications.

- The Hindu. 1996. Protect Private Sector in Farm Research: Glickman. *The Hindu*, 30 January.
- The Hindu. 1998a. 'Infamous Invention', *Hindu*, 19 July.
- The Hindu. 1998b. Terminator seeds not allowed, *The Hindu*, December 2.
- The Hindu. 1998c. Terminating freedom, *The Hindu*, December 26.
- The Hindu. 1999. Monsanto justifies trials in India in *The Hindu* February 24.
- The Hindu. 1999. Officials welcome field trials by Monsanto. In *The Hindu*. January 14.
Third World Network, Malaysia: Penang.
- The Hindu. 2005. Biotechnology is safe, says Monsanto official. *The Hindu*, 25 May 2005.
- The Indian Patents Act. 1970. <http://www..nic.in/ipr/patent/patAct1970-3-99.html> (accessed on November 12, 2009).
- The Statesman. 2007. Nearly 11, 500 farmer suicides. July 1.
- TOI. Times of India. 1998a. Terminator gene row a fabrication: Monsanto. *Times of India*, 26 November.
- TOI. Times of India. 1998b. Gene Terminator creates panic, *Times of India*, 28 November.
- TOI. Times of India. 1998c. KRRS will destroy *BT* cotton crops in Bellary today. Says it will file criminal cases against Monsanto, state and central govts. *Times of India*, 2 December.
- TOI. Times of India. 1998d. HC orders security to seed firm. *Times of India*, 4 December.
- TOI. Times of India. 1998e. Haveri farmers will resist KRRS destruction trail. *Times of India*, 5 December.
- TOI. Times of India. 1998f. Monsanto trials illegal, says environmentalist. *Times of India*, 21 December.
- TOI. Times of India. 1999a. Transgenic crop varieties spark controversy in *Times of India*, 2 July.
- TOI. Times of India. 1999b. KRRS threatens to throw out Monsanto *Times of India*, 23 November.
- TOI. Times of India, 2000. Farmer Suicides Lead to GM Moratorium Call. *Times of India*. September 26.

- The TRIPS Agreement. 1995. http://www.wto.org/english/docs_e/legal_e/27-trips.pdf (accessed on November 13, 2009).
- Tullock, G. 1965. *The Politics of Bureaucracy*. Washington D.C.: Public Affairs Press.
- Vaidyanathan, A. 2000. India's Agricultural Development Policy. *Economic and Political weekly*, 13 May, 2000, pp. 1735-1741.
- Vishwanathan, Shiv and Chandrika Parmar. 2002. A Biotechnology Story: Notes from India. *Economic and Political Weekly*. 6 July, 2002. Pp. 2714-2724.
- Vishwanathan, S. 1987. Ancestors and Epigones: Environmentalism in India. *Seminar* (330), February 1987. pp 14-24.
- Wade, R. 1985. The market for public office: Why the Indian state is not better at development. *World Development*. Vol. 13. pp 467-497.
- Wallerstein, Immanuel. 1974. *The Modern World System*. New York: Academic Press.
- Watal, Jayashree. 1998a. *Intellectual Property Rights in Indian Agriculture*. Indian Council for Research on International Economic Relations. Working paper No. 44.
- Watal, Jayashree. 1998b. The TRIPS Agreement and Developing Countries: Strong, weak or Balanced Protection? *Journal of World Intellectual Property*. Vol. 1, No.2, March. pp 281-304.
- Wildavsky, A. 1979. *Speaking Truth to Power. The Art and Craft of Policy Analysis*. Boston: Little Brown.
- Wilkinson, John. 2002. The Final Foods Industry and the Changing Face of the Global Agro-Food System. *Sociologia Ruralis*. 42 (4). pp 329-346.
- Williamson, John and Stephen Haggard. 1994. The Political Conditions for Economic Reforms. In John Williamson (ed). *The Political Economy of Policy Reforms*. Washington D.C.: Institute for International Economics. Pp 525-596.
- WIPO. World Intellectual Property Organization. 2001. *Intellectual Property Needs and Expectations of Traditional Knowledge Holders*. Report on Fact-Finding Mission on Intellectual Property and Traditional Knowledge, Geneva.
- Wright, Susan. 1994. *Molecular Politics: Developing American and British Regulatory Policy for Genetic Engineering*. Chicago: University of Chicago Press.
- Wynne, B. 2005. Risk as globalizing 'democratic' discourse? Farming subjects and citizens. In: M. Leach, I. Scoones and B. Wynne (eds). *Science and Citizens: Globalization and the Challenge of Engagement*. Zed Press: London.

Yamaguchi, Tomiko. 2004. *A Discourse Perspective On Agrifood Biotechnology Controversies: Bt Cotton In India*. Ph.D. Dissertation submitted to Michigan State University. Department of Sociology.

Yamin, Farhana. 2003. Intellectual property rights, biotechnology and food security. *IDS Working Paper 203*. England: Institute of Development Studies.