MAKING A BIOEMPIRE

MAKING A BIOEMPIRE

Nexus of *Bt* Technology and Neoliberalism in India

SUNITA RAINA

INDIAN INSTITUTE OF ADVANCED STUDY
Rashtrapati Nivas, Shimla

First published 2024

ISBN: 978-81-969454-1-1

Published by
The Secretary
Indian Institute of Advanced Study
Rashtrapati Nivas, Shimla-171005

Typeset at:
Sai Graphic Design, New Delhi

Printed at Excel Printing Universe, New Delhi

Contents

List of Abbreviations

Bt	Bacillus thuringiensis
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 (Karnataka Rajya Ryota Sangha)
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

Over the couple of decades following 1990, a large number of farmers committed suicide in the cotton growing regions of central and southern India. The suicide among farmers was not a new phenomenon in the country. Various personal and occupational reasons could have forced some farmers to end their lives in the past. Yet, there was something unusual about the recent spate of farmer suicides in the cotton growing regions. The rate of suicides went up dramatically since the country embarked on the path of economic liberalization in the early 1990s. The epidemic of suicides became visible through the enumerative practices of the Indian state, and the commentaries of journalists, activists and social scientists.[1] Although the reports showed an inconsistency in the number of suicides,[2] the phenomenal increase in the self-

1 For a discussion on farmer suicides, see Assadi 1998, Parthasarathy and Shameem 1998, Revathi 1998, Visvanathan 1998, Shiva et.al. 2000, Deshpande 2002, Patnaik 2004, Mohanty 2005, and Mishra 2006.

2 Between 2001 and 2007, contradictory figures of suicides were shown in different reports. For example, 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).Despite such contradictory

inflicted deaths indicated a serious crisis facing the farmers in the country.

Two explanations for the suicides of farmers dominated in popular and academic literature. On the one hand, it was recognized that the changed political economic conditions of agriculture provided the reason for the farmers to commit suicide. The new political-economic condition was believed to have affected the cotton cultivation adversely, thus pushing a large number of farmers to end their lives. On the other hand, the farmer suicides were linked to the commercialization of *Bt (Bacillus thuringiensis)* cotton seeds in the country. The new seed technology was held responsible for the construction of the agrarian crisis rather than resolving it. Although the new political-economic order and the new technology had global linkages, none of the two explanations reflected on the following questions. How were the domains of the social and the technical, the micro and the macro, the local and the global interlinked in the construction of the agrarian crisis? And, how were those linkages forged and stabilized within the country? These questions were important as the emergent sociotechnical order was a new articulation of a set of historical practices of domination and control solidified in, and through, biotechnology. The technology played an important role in the production and reinforcement of the hegemonic power relations that had a transboundary reach. The hegemonic order was an outcome of the consent of the Indian state to the coercive politics of the global actors (Gramsci 1971). And, this new regime of power was grounded in the materiality of technoscience.

HISTORICAL CONTEXT

Historically, the Western project of Enlightenment provided the ideals of scientific rationality and technological progress that

---

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*.

justified Europe's global hegemony. The Europeans had a perception of their scientific and technological superiority that guided their practices of dominance over the non-western populations (Adas 1989). A constant drive for raw materials, manpower and profits to reach and sustain the highest stage of capitalism necessitated the colonization of such distant territories (Lenin 1916). The process of dominance and subordination organized around a territorial centre and distant peripheral colonies illustrates the European imperialism of the 19th and 20th centuries (Wallerstein 1974). Such territorial imperialism was a distinctively political project on the part of actors whose power relied on the command of a distant territory and its population. The advances in scientific knowledge and technological innovation in Europe stimulated and maintained the territorial expansion of the imperial states (Headrick 1981, 1988). It depended on the capacity of these actors to mobilize human and natural resources of the colonies towards their political-economic ends (Harvey 2003).

In one such case, the British state deployed science and technology to rule over the Indian territory and its population from a distance (Cohan 1996; Philip 2004). The British hegemony regarded the Indians as culturally inferior due to their lack of science and technology, and colonized them for close to two centuries (Adas 1989; Diamond 1999). During this period, science and technology were linked to the early discourses of development. The peripheral Indian economy had to be developed in relationship to the core economy in Britain (Wallerstein 1974; Headrick 1988; Prakash 1999). The British rulers used development as a strategy to transform the production system in the Indian agriculture without developing the technological capacity of the country. This included introducing mono-crop plantations and commercially useful plants in India to boost the economic growth in Britain. The local farmers were forced to cultivate these crops in a non-natural habitat to increase the industrial profits in Europe. The British imperialism hinged on the extraction of resources and profits from the Indian agriculture, while neglecting the development of the agricultural sector as such.

After independence from the British rule, the technologies of Green Revolution embodied the necessity of self-reliance in grains for the newly formed Indian state. The transformation of the agricultural processes and practices was thought to be necessary for increasing the agricultural productivity to feed an ever-growing population. The state funded the research and development of the green revolution technologies and created legibility in agriculture through various administrative technologies. This involved a process of simplification that would take complex, illegible and local agricultural practices and create a standard grid by which agriculture could be centrally monitored. Thus, various government ministries and specialized state agencies monitored and controlled the agricultural sector. The statist imperialism of the high-modernist, planned social order was geared towards the control over crop populations in the local environments (Scott 1998, pp 2-6). The political-economic modernity of green revolution worked through a whole new range of technical processes and practices that embodied the power of various state actors. This included the power of state agencies with material and legal resources, and the power of experts with technoscientific knowledge. The state funded research in various agricultural universities and laboratories, and the experts in various ministries charted out the trajectory of agricultural development.

During the regime of the welfare-state that lasted for over four decades, the dominant ideology of statist developmentalism emphasized the interventionist role of the state in the economy. The state intervened through public ownership of strategic economic sectors, formulation of five-year plans for development, and regulation of the domestic market. Concurrently, the state protected the domestic market by the import substitution policy, industrial and agricultural subsidy, and restriction on the foreign direct investment into the country. But the Indian political-economy began to change in the early 1990s under the influence of some external non-state actors. Over some decades, the United States had played a decisive role in the making of the new world order. The United States government had been at the centre-stage in the constitution of global debt and the structural adjustment

program (Harvey 2005). It had also been at the centre of efforts to reorganize global trade rules and intellectual property laws along lines that would favour its own corporations. The political-economy in India could not remain isolated for long in the rapidly changing global order.

Throughout the 1980s, under the leadership of the successive Prime Ministers Rajiv Gandhi and V.P. Singh, the Government of India had financed its fiscal deficits by borrowing from the International Monetary Fund (IMF), the World Bank, and other commercial banks in the US. As India's external debts[3] 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 policies, pressured the Indian government to adopt the new policies of economic reforms.[4] As a configuration of political-economic ideology and practices, neoliberalism can be interpreted as a new thrust to liberalism or capitalist-democracy in some countries.

Although there are differences in the institutionalization of neoliberalism around the world (Harvey 2005), there are some common characteristics across different contexts. The neoliberalism prefers markets over governments as instruments of policy, trade liberalization over protectionism, and the power of large multinational corporations across the territorial boundaries. The IMF--US treasury--World Bank--World Trade Organization coalition constituted the advocates of neoliberal policies that brought in a globally diffused capitalist order. The imperialism of the capitalist sort was distinct from other conceptions of

3 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).

4 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.

transboundary power based on a territorial logic (Harvey 2003). The capitalist imperialism constituted a diffused political-economic order in space and time, where the accumulation of capital took primacy over the territorial expansion of power.

The debt crisis created a situation where the Indian state had to surrender its ideological and organizational initiatives to the global neoliberal regime. The IMF--US treasury--World Bank--World Trade Organization coalition promised to roll over the debt in return for the economic reforms or structural adjustment in India. The global neoliberal institutions wanted the Indian government to set up an institutional framework characterized by strong private property rights, free market and free trade (Harvey 2005). The hegemonic non-state actors capitalized on the debt crisis and intervened to shape the economic policies of the Indian government. Those included privatization of the public sector, deregulation of the market, and withdrawal of state intervention from many areas of social provisions including agriculture.

In the agricultural sector, the new political-economic configuration caused a major departure from the protectionist and inward-looking policies of the welfare-state. Initiated in 1991, the neoliberal reforms began to integrate the Indian economy into the global market. The economic restructuring opened up the seed market to external investment and allowed the Foreign Direct Investment (FDI) into the seed sector. The restrictions on the activities of the transnational corporations (TNCs) were loosened through abolishing licensing in the seed sector. A space was created for an automatic approval to foreign technology agreements and to Indian subsidiaries with up to fifty-one percent foreign equity. Simultaneously, the subsidies on agricultural inputs and low-cost institutional lending to farmers were gradually withdrawn.

A host of related policies such as downsizing of incentive pricing and shrinking public extension services amounted to a withdrawal of the state from the agricultural sector. This precipitated a deflation in farm incomes and the emergence of indebtedness among the peasantry (Patnaik 2002; Banerjee 2009). The neoliberal policies also aimed to increase exports from the agricultural sector in order to earn higher foreign exchange. The export-oriented economy

induced changes in crop cultivation, whereby millions of farmers made a sudden switch from food crops to cotton cultivation. 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 provided one explanation for the epidemic of suicides in the cotton growing regions.

INTRODUCING BT TECHNOLOGY

The new political-economy created a space for the commercialization of Bt cotton, which was the first transgenic crop[5] to be introduced in India. A transgenic crop is bred following the insertion of a foreign gene into seeds, which exhibit the characteristics conferred by that gene. Enabled by the 1953 discovery of the structure of DNA in living cells, transgenic seeds are produced through the genetic engineering technique of biotechnology. Scientists at Monsanto, the US-based transnational corporation, developed Bt cotton by inserting a toxin producing gene, *Cry1Ac*, from the soil bacterium *Bacillus thuringiensis* into cotton seeds. The proponents of the technology saw it simply as 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 not different than the old one, but merely much more precise as genes were individually isolated and transferred as desired.

The perspective suggested that genetic engineering might in fact be safer than the older practices. This view, however, did not find favour with those who maintained that the "old" biotechnology involved only an external manipulation of organisms, like altering temperature, acidity or nutrient. It did not intervene in the finer

5 The term 'transgenic' is synonymous with 'genetically engineered'. Genetic engineering is one of the techniques of biotechnology, which is a set of techniques of manipulation of life at the molecular level. Biotechnology includes other techniques, such as gene splicing, cell fusion, cell culturing etc., carried out at sub-cellular levels in plant and animal cells.

structure of internal controls of a living cell. In biotechnology, the external and internal controls of life forms were imposed simultaneously. While the conventional breeding methods shuffled different forms of the same gene (alleles), genetic engineering enabled completely new genes to be introduced in seeds. This had unpredictable effects on physiology and biochemistry of the resultant transgenic seeds. The risks[6] that this technology posed to human health, environment and the socio-economic condition of farmers remained unknown and uncertain. This made the technology highly controversial throughout the world.

Despite the discourse of risks associated with Bt technology, the Indian government approved the commercial release of Bt cotton in 2002. The government did so under the pretext that the technology would provide protection against cotton pests, which were believed to cause heavy losses to the farmers. The myths of the inevitability of Bt technology and its beneficial effects across the territorial boundaries were linked to the discourse of agricultural development. This kind of technoscientific imperialism took shape as a strategic apparatus of control that occupied and organized the key knowledge sites. The hegemonic actors invoked scientific knowledge to legitimize the introduction of Bt technology within a universalizing neoliberal order (Forbes 2006).

The new technology was inextricably linked to the neoliberal political-economic elements—such as ideology, regimes, actors, institutions, and practices. The technology represented both an effect of transboundary power and, concurrently, it formed an element of its articulation (Foucault 1976, 1980). In effect, Bt technology served as a vehicle through which the transboundary power reached the interiors of Indian agriculture. Power not only solidified in technical processes and practices around the technology, but also permeated discourses and institutions around it. Because the technology brought a paradigmatic form of power into existence, many regarded it as "revolutionary" in nature.

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

The transgenic cotton crop was at once a material technology with artificially induced gene and traits, and a social kind that brought about a particular political ordering. As material technology, Bt cotton was a new instrument for treating a perceived pest problem on the Indian farms. The technology was simultaneously a metaphysical device. It brought transgenic cotton plants into the world and through that process ordered a normative sense of both agriculture and economy. As a discourse, Bt cotton allowed diverse frames of representation. To some, it was a technology of economic growth and agricultural development, and to others, of unknown risks and dispossession of farmers. Bt technology was also an institution of governance. The technology shaped forms of political-economic order, and, at the same time got shaped by it (Jasanoff 2006, pp 283-284).

Since through Bt technology the control was exercised not only at the plant molecular level, but at the levels of discourse and governance as well, a new form of networked biopolitics came into existence. The biological life itself became a central political preoccupation with which the modern Indian state sought to control the crop populations. Central to the exercise of biopower, or power over life, was the characterization of cotton crops in ways that rationalized the state's policies (Foucault 1976 & 1980). A new form of control of plant life took shape through Bt technology (Brooks 2005; Jasanoff 2006). The cotton plant body became an object of disciplinary power, that is an object to be manipulated in order to make it productive (Dreyfus and Rabinow 1983). In the new era of global capitalism, then, the biopower was an essential element in the production and reproduction of capital.

The new biopolitical age gave rise to experts, technologies and technical practices for the management of plant life at the molecular level. In this book, the concept of techno biopower is used to suggest that the biopower or control over plant life was mediated through biotechnology. Thus, two things happened simultaneously in India. The neoliberal forms of power took charge of cotton plant populations at the genetic level through Bt technology. And, the technoscience was used as a political resource for constructing and maintaining the idea of economic

order (Ezrahi 1990). In this manner, the alliance of Bt technology and neoliberal order facilitated the production and reproduction of both transgenic plant life and transnational capital.

Whether Bt technology actually helped eliminate the attack of cotton pests on Indian farms or not remains contested to this day. Yet, it is clear that the technology did not offer a respite to the farmers from the capital intensive inputs for cotton farming. Within a highly contested field of agbiotechnology,[7] the policy decision of commercializing *Bt* cotton posed far-reaching challenges to cotton cultivation. Because of the withdrawal of the agricultural subsidies and small credit, the farmers were left at the mercy of private moneylenders to buy expensive Bt cotton seeds. As the input prices of cotton cultivation increased and the output prices crashed due to a sudden fall of cotton prices in the global market, an agrarian distress occurred that was increasingly linked to farmer suicides.

The Indian government approved the commercial release of Bt cotton amidst the transnational protests against Monsanto and its controversial technology. A vast body of literature suggests that the logic of capital shapes the relationship between technology and agriculture, often putting profits over people and ecological systems.[8] In recent times, agricultural biotechnology has emerged as a form of enterprise inextricable from contemporary capitalism.[9] Driven by the life sciences industry, then, biotechnology became a means to expand the control of global capital over the Indian agriculture.

7 Agbiotechnology refers to the application of biotechnology to agriculture.

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

9 Some scholars argue that life sciences represent a new phase of capitalism. See, for example, Kloppenburg 1988; Waldby 2000; Rose 2001: Sunder Rajan 2006: Cooper 2008.

BT TECHNOLOGY AND NEOLIBERALISM

As a distinct historical moment, the institutional push to neoliberalism constituted the guiding principle of the contemporary global order. A new globally diffused network of power began to extend its arms into India. Such regime of power emerged as a decentred and deterritorialized apparatus of rule that was constituted in tandem with global capitalism (Hardt and Negri 2000). The power was decentred and deterritorialized in the sense that there was no fixed territorial center of power in the new regime. The power was diffused throughout the modulating network of command that had significant nodes in the institutions such as International Monetary Fund, World Trade Organization, World Bank, US-treasury, and the transnational corporations. These sites of power functioned alongside the state apparatus.

The emergent global order subsumed the policy initiatives of the Indian State within its fold, which was made possible by the consent of the state actors. The hegemonic order that was thus constructed reduced the regulatory power of the Indian state, and its sovereignty declined substantially. Thus, the power of the state to regulate the transboundary flows of the forces of production, such as technology, decreased. The simultaneous push to neoliberal policies and *Bt* technology into India illustrated an important strategy of the hegemonic actors to exercise control over agriculture from a distance (Porter 1995). The statist control over agriculture intensified when the Indian state and its experts bought into the neoliberal project of which they increasingly constituted a part. Under the influence of the global institutions, the state reconfigured a set of regulatory and patent policies to create a conducive environment for the new technology. Within the new policy environment, Bt technology was deployed as an instrument of disciplinary control in the cotton sector to fulfill the economic ends.

Central to the formation of the new sociotechnical order were the powerful transnational seed corporations. The transnational corporations have played a commanding role in America's strategies of economic and imperialist self-invention (Cooper 2008). The

goal of these non-state actors was to expand their business into other countries and to increase profits in the global economy. To capitalize on the life forms, Bt technology was invented in the laboratory of one such transnational corporation, Monsanto. Over time, the technology became an essential element in the expansionist project of the corporation. This was achieved by the insertion of *Cry1Ac* gene into the machinery of cotton production, along with the inscription of the cotton plant populations into the processes of the global economy. Backed by the global neoliberal regime, then, these organizations occupied the key positions in the new biopolitical order.[10]

Thus, Bt technology embodied power that both shaped and was shaped by a set of relations. The power materialized through the relationship of the technology to the triad of US-led global neoliberal regime, the transnational corporations and the Indian state. A capitalist social form was thus constituted in which the transnational capitalist class and the Indian state entered into a hegemonic relationship (Robinson 2004; Laffey and Weldes 2004). This relationship was mediated by technology that forged linkages between state and transnational capital. As the Indian state linked up to the global institutions, the projects of biotechnology and the new political-economic order merged to constitute a new configuration of rule. As a result, a heterogeneous network emerged through which transnational power circulated freely.

The nexus of agricultural biotechnology and the neoliberal political-economy created a new form of rule that had imperial dimensions. This form of empire materialized through a relationship of agricultural biotechnology to the following elements of the political-economy. Firstly, the US-led neoliberal regime of governance that took roots in the Indian state. Secondly, the expansionist practices of the transnational seed corporations that enrolled the local seed companies and the state regulatory

10 For literature in social sciences that explores the role of transnational corporations in the processes of globalization, see Hardt and Negri 2000; Sklair 2002; Dicken 2003; Robinson 2004; and Bush 2006.

agencies. Third, the growth of a global knowledge economy that occupied and controlled the key knowledge sites in the country. And, finally, a resistance movement that challenged the nexus between biotechnology and the neoliberal political-economy across the territorial boundaries. The new regimes of governance, the new patterns of knowledge relations, and the new kind of relationship between the technoscience and social movement constituted the contours of the sociotechnical network. We call this emergent sociotechnical order the 'bioempire.' Constituted as a hegemonic network, the bioempire extended the transboundary power to manipulate the governed, both plants and publics, and dominate the local politics and policy regimes.

In the following chapters, we explore the making of the bioempire in India, including how it emerged, how it was contested and how it stabilized. Through four interconnected, mutually reinforcing processes—rationalizing, standardizing, privatizing and mobilizing—we understand the formation of the bioempire—its foundation, introduction, extension and reconfiguration. Various actors deployed the discursive, technical, and institutional strategies to rationalize the technology during the decade preceding the commercialization of Bt cotton. This laid down the *foundation* for the bioempire to emerge within India. The *introduction* of Bt technology and a standardized global regulatory regime allowed hegemonic power to make inroads into the Indian agriculture. The technical practices of the specialized government agencies constituted a significant instantiation of the new sociotechnical formation in the country.

The beginnings of the transformation of the publicly-funded National Agricultural Research System marked a shift in the locus and ownership of the biological knowledge. The drive towards the privatization of knowledge led to an *extension* and consolidation of the network. By allowing the penetration of transnational corporations into the domain of transgenic seed production and distribution, the hegemonic actors created a space for the mobilization of the multitude within, and against, the sociotechnical order. A struggle between the hegemonic power

and the civil society ensued at the crucial nodes of the emergent network. The mobilization paved a way for the *reconfiguration* of policies and the user-technology relationship.

AN STS APPROACH

In the past, scholars examined various dimensions of biotechnology in society. Some of them investigated the politics of biotechnology in general,[11] and others of Bt cotton in particular.[12] Their analyses focused mainly on the local actors and their politics, highlighting some aspects and ignoring others. Significantly, these studies downplayed or neglected the crucial global aspects---actors, regimes, politics and economics—that shaped the content and the context of Bt technology. Yet other studies focused on the international regulation of biotechnology,[13] and the regulatory framework of biotechnology in India.[14] Such studies analysed the general policy aspects of biosafety regulation, and did not problematize the power relations emerging around the technology. Missing from these accounts was a thorough analysis of the relationship between agricultural biotechnology and the neoliberal order in India. Moreover, these studies did not take the centrality of technology in power relations seriously. This book focuses on the processes by which hegemonic power materialized in, and through, biotechnology.

A series of overlapping technical processes and practices is explored that built the cohesion of the emerging sociotechnical network, while staving off its dispersion (Jasanoff 2006). This approach extends the field of Science and Technology Studies (STS) into an arena of technology-mediated constitution of empires. The concept of empire is used both as an analytical

11 See, for instance, Scoones 2007; Newel 2003, Vishwanathan and Parmar 2002.

12 See, Scoones 2005; Herring 2006, 2007, 2009; Yamaguchi 2004.

13 See, for instance, Falkner 2000; Newell and Mackensie 2000.

14 See, for example, Chaturvedi 2002a, 2002b; Dhar 2001; Gupta 2000.

category and a sociotechnical form. As an analytical lens, the concept helps to illuminate the contours of the new sociotechnical order that is not entirely state-centric. The older styles of analysis based on the nation-state and imperial grand narrative would not capture the nuances of the emergent sociotechnical network. To make it clear at the outset, the book does not engage with the sovereignty narrative, the juridical structure of the state, or the elaborate structure of the state apparatus exclusively. These themes are brought into discussion wherever necessary.

Given that Bt technology is a quasi-object—simultaneously material, social and discursive, the methodology draws largely on the interdisciplinary area of STS. In line with the dominant STS theory, the focus is on the construction of the sociotechnical network that linked technology, institutions, discourses, governance and epistemic mechanisms. The mutually reinforcing relations among these varied elements formed a heterogeneous network with hegemonic power effects. Because of its heterogeneity, the network could not be explored using a single method. A diversity of methods was deployed such as the sociotechnical network perspective, the idiom of coproduction, and the discourse analysis. The multiple perspectives allowed us to reveal the formation of the network that linked the local with the global, the micro with the macro, and the social with the technical.

Specifically, the study focused on the coproduction of technology and hegemonic order (Jasanoff 2004), the inclusion of both human and non-human actors in the hybrid network (Latour 1987; Callon 1986), and the collapse of micro-macro and global-local distinctions in the emergent network (Hughes 1983; Law 1986; Latour 1987; Callon 1986). The technology was coproduced along with a new political economy, new governance regime and new forms of political struggle. By linking up the idiom of co-production to the metaphor of network, simple explanations to the making of the bioempire are avoided. Rather than seeing the elements of the network as objective givens, a constructivist approach considers the complex networked production that allowed contestation on basic assumptions, strategies and goals (Halfon 2006). Since the constitution of the sociotechnical network

was embedded in a regime of representation, the discourse analysis provided important insights into its making.

Based on this methodology, the qualitative research techniques included the analysis of the discursive and textual sources, interviews, and archival exploration. Primarily, the statements and practices in central policy institutions, relevant academic spaces and activist settings were explored. During the fieldwork in Delhi, the research activities primarily involved interviewing policymakers, analyzing policy documents and annual reports of the state agencies. At the outset, the key actors were located and the main issues related to Bt technology were identified. Face-to-face interviews with a host of actors in the Bt cotton debate were conducted to gain insights into their interpretations of the technological order.

The actors were purposively selected to provide a range of views. The actors interviewed were senior technocrats at the central regulatory agencies, representatives of the major seed corporations, activists in the environmental NGOs, scientists at the public research institutions and the seed corporations, and cotton-growing farmers in Gujarat and Andhra Pradesh. An iterative approach was taken whereby the data from one interview could feed into another. Besides providing directed data for discourse analysis, this would clarify different positions upon an issue and investigated criticisms that one actor may have made of another.

At this level, it became clear how various processes and practices led to the emergence and stabilization of the sociotechnical network. The dynamics of the bioempire was studied 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-- right up to 2013, when the Biotechnology Regulatory Authority of India (BRAI) bill was proposed in the parliament. Close attention was given to histories, modes of justification, interactions between actors, the process of policy development and implementation, and the resistance at various sites. The framing, the assumptions, and the definitions used by different actors, institutions and regimes provided a map to the contours and complexity of the network. A diversity

of documentary sources was drawn upon to provide a historical, political and policy context for the analysis.

OVERVIEW OF THE BOOK

In the following chapters, the story of the emergence and stabilization of the bioempire in India will unfold. In Table 1, the relationship of each of the chapters to an overall exploration of the sociotechnical network of bioempire is outlined.

TABLE 1: DYNAMICS OF THE BIOEMPIRE

Chapter Number	*Focus of the Chapter*	*Dynamic of Power*	*Relationship 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

The second chapter examines the process of rationalization of Bt technology, whereby the foundation of the bioempire was laid

down. Close attention is paid to discursive struggle and technical contest around Bt technology to explain why one particular rationale became hegemonic at the local level. A network of technocrats and their corporate partners justified the need for Bt cotton through their representations, and emphasized the need for biotechnological intervention in cotton production. Using a range of discursive frames and institutional strategies, the hegemonic actors rationalized the technology, thereby creating a hospitable environment for its commercialization.

The third chapter explores the regulation of Bt cotton as one site where the new form of sociotechnical order began to take shape in the country. In order to understand the process, the landmark policy decision of the commercialization of Bt cotton is taken as an entry point to explore a range of regulatory issues. It becomes clear that the process of governance of Bt technology led to a specific articulation of the sociotechnical network. The development of regulatory standards advanced a risk-promotion paradigm that facilitated the corporatization of regulation. The governance was complexified in the new political-economic space as non-state actors began to influence policies to a greater extent, in clear contrast to the pre-reform era. The internal actors introduced the standardized culture of policy rationality that was simultaneously advanced by the hegemonic global institutions and regimes. The micropolitics of governance of Bt technology induced the convergence of scientism and neoliberalism, which strengthened the state-technoscience-capital nexus.

The fourth chapter discusses how a neoliberal push towards privatization set in motion a transformation of the publicly-funded knowledge production. The experts within the globally linked agbiotech industry, the local government and the technoscientific institutions guided the change in the nature and locus of knowledge production. The strategic linkages between the public and the private knowledge production sites stimulated the capitalization of agbiotech knowledge. Nonetheless, the convergence of institutional patterns of the public and the private research domains led to a partnership that was asymmetrical. The transformation of the patent laws signalled the emergence of the

new knowledge relations. And, the new policy regime provided a competitive edge to the transnational seed corporations over the local knowledge producers.

The fifth chapter analyses the mobilization against Bt technology that created a countervailing force to the hegemonic order. The resistance movement emerged as an alternative hegemonic political organization of transboundary knowledge flows and exchanges. There were multiple points of resistance in the emerging network of power. The process of mobilization against Bt technology had both productive and subversive dimensions. In particular, the political task of the local activists was not simply to resist *Bt* technology, but to reconfigure the policy decisions related to Bt technology. Their transboundary counterparts constituted significant allies in their political struggle against the nexus of Bt technology and neoliberal order. Concurrently, a group of farmers resisted Bt technology in a novel way. They subverted the hegemonic forces, including the authority of their elite spokespersons, through constructing a subterranean, illegal relationship with the technology.

The concluding chapter pulls together the preceding analysis to summarize the argument. It takes a combined look at the four processes of rationalizing, standardizing, privatizing and mobilizing that opened up new sites where imperial relations were forged. The chapter then revisits the theory of empire in order to highlight the broad theoretical implications of the analysis in the preceding chapters.

CHAPTER 2

Rationalizing *Bt* Technology

In 2002, the Government of India permitted the commercial release of Bt cotton. Over a decade before the commercialization of the technology, various actors deployed technical, institutional and discursive strategies to construct a "cotton pest problem" in the country. The actors characterized cotton plants as infested with pests, and systematically constructed a need to heal the sick and failing crops through Bt technology (Jasanoff 2006). The actors believed that the plants would be healed when the yields of cotton increased and the quality of the crops improved. Bt cotton was commercialized under the dominant rationale that the new technology would help in achieving both these goals.

Rationalization was a process of calculability and control in the cotton production process (Weber 1958). The calculation of achieving greater control over cotton production was geared towards maximizing profits in the global market. The pests that thrived on cotton plants were believed to cause heavy losses to the farmers, and the losses could be curtailed using genetically engineered seeds. Nonetheless, the decreasing yields of cotton crop due to the attack of cotton pests was not the only concern. Such dominant rationality intersected with other kinds of rationalities, such as making cotton competitive in the global market and increasing the profits for the seed corporations. The imported Bt cotton embodied a universalized solution to these issues and constituted an important element in the ensuing network of transboundary power.

The landmark policy decision of commercializing the first transgenic crop in the country signified a new form of biopower that was mediated through biotechnology. Various state and non-state actors characterized cotton crops as valuable economic resource that needed to be controlled from the interior using biotechnology. Central to this new politics of life was the interest of the hegemonic actors to govern cotton plants at the molecular level. Such molecular biopolitics reconfigured the historical alliance between biological sciences and the state to include the non-state actors. The rationalization of Bt technology also involved the formation and circulation of a discursive regime (Foucault 1972). Such regime constituted the narrative component of the new political economy within which Bt cotton was commercialized. A certain representation predominantly shaped the ways in which the reality was imagined and acted upon (Escobar 1995). The hegemonic discourse was material as well (Laclau and Mouffe 1985), in the sense that technology and institutions constituted parts of it.

CONSTRUCTING REGIME OF TECHNOBIOPOWER

Changing the Policy Context

The key global institutions associated with the political-economic doctrine of neoliberalism — the International Monetary Fund (IMF), the World Bank (WB), and the World Trade Organization (WTO) — had originated within the post-World War II, US-led hegemonic order. The loans of the supranational financial institutions, such as the WB and the IMF, and the trade agreements of WTO played a decisive role in the formulation of the new policy prescriptions, their legitimation and enforcement worldwide (Cherov and Babb 2009). Carrying forth the agenda of establishing the dominance of the transnational capital, these institutions expanded their jurisdiction into the economies of the developing countries such as India. Faced with the crisis of debt to these global financial institutions, the Indian state was left with no choice but to link its economy with the global economy.

The beginnings of the economic reforms are often dated to such iconic events as the presentation of the union budget speech of the then finance minister, Manmohan Singh,[1] to the Indian Parliament in 1991 (Corbridge and Harris 2000). The architect of the economic reforms, Singh represented a breed of economists trained by the elite educational institutions abroad in the philosophy of market liberalism that upheld free market economy. As part of a globally networked epistemic community, the minister defined the problems facing the Indian economy and offered solution in line with the prescription of the global neoliberal institutions (Haas 1992). He proposed a major departure from the protectionist and inward-looking policies of the then existing welfare State. As a way out of the debt crisis, the government followed the prescription and adopted the policy of structural adjustment to reshape the economy (Bagchi 1994; Patnaik and Chandrasekhar 1998).[2] The adoption of the policies of economic reforms constituted a hegemonic moment, in which the Indian economy was incorporated into a global system of market-liberalizing economic rules.

Under the rules of the global deregulation institutions, a series of policies related to agriculture were adopted. There was a dismantling of the State-controlled price-fixing in agriculture, a reduction 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 products. Economic liberalization also hastened the process of privatization of the seed sector.[3] The privatization of the seed sector and opening up of the market to external investment were accompanied by induced changes in crop cultivation. The new policies of the Indian state aimed at increasing

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

2 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).

3 Private sector seed investment in India more than tripled between 1993 and 1997.

exports from the agricultural sector, which would help the country to earn a higher foreign exchange to tide over its debt crisis.

The global prices of commercial crops such as cotton were rising due to trade liberalization under the WTO regime. The Indian government believed that the competitiveness of the country in the global market would increase by improving the quality of cotton. The economic growth was possible by harmonizing cotton cultivation with the requirements of the global trade regime. Since India was a signatory to WTO, the exports of cotton from the country were placed under the Open General License rules of the organization. And, a shift was made towards the technical devices of standardization in cotton exports. The government viewed the feasibility of export from the country as directly linked to producing surplus cotton with parity in prices and quality of international standards.

As unregulated export of raw cotton[4] was allowed, the logic of an export-oriented economy led to a phenomenal expansion in cotton cultivation. This set in a period when millions of farmers made a sudden switch from food crops to cotton in order to make quick profits, since the global price of cotton was on the rise (Patnaik 2002, 2004). The specialized state agency, the Cotton Corporation of India (CCI),[5] played an important role in forging links between the cotton sector and the global trade.

4 Three years before 1990-1991, about 34,000 tonnes of raw cotton was being exported. The moment this sector was opened up, in a single year there was a jump of 374, 000 tonnes 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 tonnes a year.

5 CCI is a nodal agency of the government under the Ministry of Textiles (MOT). Registered under the Companies Act of 1956, CCI was initially conceptualized in welfare-statist terms 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.

Problematizing Cotton

The productivity of cotton was problematized within the context of the new political-economy that valorized free market and free trade over other liberal, democratic values. The seeds of doubt were sown regarding the quality of the Indian cotton as being far from satisfactory to compete globally. The threat of cotton-failure was constructed on the twin official rationale. It was believed that the Indian cotton would fail in the global market because it had low yields. In addition, the cotton fibres were regarded as contaminated with the pesticide residues. The policymakers in the Ministry of Agriculture and Ministry of Textiles were particularly concerned about the pesticide deposits in cotton. This was because of the regulation of the World Trade Organization (WTO) that restricted trade in agricultural products bearing traces of pesticide. Such rules were imposed through the instruments of non-tariff barriers[6] or sanitary and phytosanitary measures (SPS)[7] of the global trade regime.

The changing regime of governance rationalized biotechnology in terms of increasing the global trade in agricultural products. The apparatus of governance weaved a discourse of productivity and profits to rationalize the policies related to the technology. For example, Cotton Corporation of India (CCI) was concerned that even though India ranked third globally in cotton production, following China and the US, its cotton yields per hectare were one of the lowest in the world. Furthermore, the cotton crop was believed to consume approximately half of all the pesticides used for agricultural purposes in India, even though it occupied only around five per cent of the total cultivated area in the country (CCI 2000; ISCI 1999). By linking pesticide consumption with

6 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.

7 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).

the yields of cotton, CCI created a discursive space for the genetic engineering of the major varieties of cotton. Biotechnology was projected as an instrument to cut down the use of pesticides by half in cotton crops, thus save cotton worth billions of dollars.[8]

The important raw material for the narratives of improved quality of cotton and reduced use of pesticides came from the discourse of 'revolution' in cotton productivity. The idea of a revolution in cotton cultivation had come from policymakers higher up in the government, from the Prime Minister (PM's Speech 2001) down to the politicians heading the relevant central ministries.[9] Within a specific discourse of development, the potential of biotechnology to modernize agriculture had caught the imagination of the Indian policymakers in the late 1980s. In this discourse, a state-led institutional framework was set up to identify needs and priorities in biotechnology. An agency called the National Biotechnology Board (NBTB) was constituted under the Ministry of Science and Technology, which was later upgraded into a full-fledged Department of Biotechnology (DBT). Gradually, DBT came to play an important role in weaving pro-biotechnology narratives and legitimizing policies related to the technology.[10] In pursuit of the neoliberal variant of development in the early 1990s, the policymakers defined biotechnology and economic growth as intrinsically related to each other. In agriculture, this relationship hinged upon the control of crops at the molecular level.

The genetic control of cotton crops symbolized the 'revolutionary' nature of agricultural biotechnology. Some

8 Approximately 100 million to 200 million US dollars, annually (BBC 1992).

9 Such as, the Ministry of Agriculture and the Ministry of Science and Technology.

10 With time, six other major agencies were enrolled to finance and support research in biotechnology in public sector universities and laboratories. 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).

scientists and policymakers believed that the new technology would transform agriculture at a scale equivalent to an earlier revolution in agriculture. The gene revolution was represented as succeeding and improving upon the earlier green revolution. The former revolution was a natural and necessary outcome of the latter, hence a part of an "evergreen revolution."[11] The technological paradigm of the two revolutions was regarded the same (Shah 2005), as both relied on high-technology and capital-intensive agricultural inputs and practices. In this "green to gene revolution" discourse, the significant difference of the latter revolution from its predecessor was largely overlooked (Parayil 2003; Seshia and Scoones 2003). While the green revolution was a public sector project coordinated through an international network of agricultural research and policy initiatives,[12] the gene revolution was ushered in against a very different set of political-economic forces. It took place within the context of a changing balance of power between the states and markets in the neo-liberal era (Goodman and Redclift 1991; Strange 1996; Brooks 2005). As a global project, the gene revolution aimed at penetrating and disciplining agricultural markets in the developing countries. The developmental goals of self-sufficiency in food grains during the green revolution were replaced by the logic of global competitiveness based on comparative advantage in the market. Nonetheless, the common technological paradigm of the two revolutions leveled the contextual difference between them.

An alternative discourse of technological failure in green revolution did not deter the policymakers from celebrating the

11 This term is borrowed from M.S. Swaminathan, who is regarded the father of India's green revolution and a proponent of gene revolution (Swaminathan 1996).

12 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) 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).

impending gene revolution. Previously, various reports claimed that the gains of the green revolution had reached stagnation. The chemical intensive revolution had led to the degradation of soil and groundwater resources. This had reduced the productivity of crops (Murgai, Ali and Byerlee 2001). The green revolution was also held responsible for a significant loss of bio-diversity and an increased dependence of farmers on expensive agro-chemicals (Shiva 1989). In addition, the revolution was not seen as neutral in terms of its socio-economic impact. It had created an income cleavage between farmers with large landholdings and better access to inputs, such as agrochemicals and water, and farmers with small landholdings and a lack of capital for such expensive inputs. It was a belief in the inevitability of technoscientific progress that made the biotechnological enthusiasts ignore the failures of the green revolution. They upheld the same technological paradigm for the gene revolution, but a modified one that would intensify the control of the crops. Clearly, biotechnology emerged as a technology of choice for the policymakers over the technologies of the green revolution.

Subsequently, the researchers in publicly funded institutions came under increasing pressure from within the scientific community to deliver the 'indigenous' variety of the agricultural biotechnology.[13] This discourse of indigeneity was guided by a three-fold rationale. The indigenous transgenic seeds would reinforce the nationalist sentiment that was linked to technoscientific progress in the postcolonial period. The success in the indigenous research and development of transgenic seeds would also allow the scientific establishment to reclaim the prestige that they had enjoyed in the green revolution period, which was on a decline in the recent

13 Some of the public institutions where basic research on Bt cotton was initiated are: Central Institute for Cotton Research, Nagpur; National Botanical Research Institute, Lucknow; National Research Centre on Plant Biotechnology, New Delhi; University of Agricultural Sciences, Dharwad; International Centre for Genetic Engineering and Biotechnology, New Delhi; National Chemical Laboratory, Pune; Bhabha Atomic Research Centre, Mumbai [CICR Technical Bulletin No: 22, Available at http://www.cicr.org.in (accessed on July 29, 2013)].

times. Moreover, an indigenously developed biotechnology would meet the interests of Indian farmers more than that of the agbiotech industry. It was believed that the farmers would benefit by a cheaper variant of the expensive transgenic seeds that might be developed by the private industry. Despite their efforts, the Indian scientists were unable to develop and commercialize the indigenous variety of transgenic cotton seeds. This was because the research in agricultural biotechnology was a more expensive process than conventional crop research. The former involved complex gene sequencing, data processing and sophisticated lab work. Meeting the cost of the expensive agbiotech research was difficult for most of the cash-strapped public labs and universities.

Meanwhile, CCI played a central role in weaving the narratives of productivity, efficiency and competitiveness of cotton in the global economy. The agency constructed a discursive normativity that articulated a strong need for genetically engineered cotton (Gottweis 1998).[14] Along with constructing the technological need, the existing development apparatus was reconfigured to suit the neoliberal ambitions. Over the decade before the commercialization of Bt cotton, CCI expressed dissatisfaction with the development apparatus deployed in the cotton sector. The agricultural development and extension services were considered inadequate for meeting the goals of economic profitability and competitiveness in the global market. Following this, the agency launched an ambitious project of the Technology Mission on Cotton (TMC) that linked the Indian Council of Agriculture Research, the Department of Agriculture, and the Ministry of Textiles into an institutional network. The objective of this network was to bring about "tangible improvements in the productivity and quality of

14 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).

cotton in the country."[15] In the export-oriented economy of cotton, then, the state agencies were geared towards developing cotton through technical and institutional devices. The objective of the experts was to standardize cotton cultivation so that it could be more directly managed and controlled by the state and non-state actors (Scott 1998).

The incorporation of cotton into the emerging global neoliberal regime created a powerful rationale for subjecting nature in the form of cotton plants to technoscientific control. The technocrats in the Ministry of Agriculture, and the Ministry of Science and Technology, defined and applied more sophisticated technical criteria to create legibility in the cotton sector. Certain entities, such as the cotton pests, were targeted for systematic erasure (Scott 1998). Under the Mini Missions III and IV of TMC, the state agencies sought to deploy genetically engineered cotton as developmental intervention to meet the laid down targets. A growing will to link biotechnology to the goal of economic progress became hegemonic in the network of power represented by the experts in various ministries[16] and the global neoliberal institutions. The proposed gene revolution in agriculture was led by the experts, who networked across diverse skill bases and between disparate geographical sites.

Creating Pest Threat

Around the time when the Indian state embarked on the path of economic liberalization, the cotton bollworms became an overriding problem for the policymakers in the country. The technocrats in the Ministry of Agriculture, and the Ministry of

15 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).

16 Such as the Ministry of Agriculture, the Ministry of Science and Technology, and the Ministry of Textiles. For further details, see the CCI website, http://cotcorp.gov.in/developmental.asp (accessed on August 10, 2008).

Science and Technology, regarded cotton crops as substantially low in productivity due to the damage caused by bollworms. They invoked an image of bollworms, notably Helicoverpa armigera, posing a serious threat to cotton production in the country. On the contrary, the agricultural scientists in the publicly-funded research institutions and universities assigned the loss of yields to a cotton pest complex that included 160 species of insects (Manjunath 2004; Dhawan and Simwat 1996), and to a number of diseases that hit the tropical crops. Yet, the experts in the concerned ministries targeted cotton bollworms as the only cause for the annual losses of millions of US dollars in cotton production (APCoAB Report 2006). They reduced a complex phenomenon to one cause, thus making the tiny pest the sole reason behind the low yields of cotton.

A section of scientists from the seed industry lent support to the position of the technocrats in the government. They held that *Helicoverpa armigera* was the most dominant and difficult to control cotton-pest. This was chiefly due to its widespread insecticide resistance, prolific pattern of breeding, and high polyphagy. It was considered a highly destructive and wasteful feeder in the sense that a single larva could damage many squares and bolls (Manjunath 2004; Barwale et al. 2004). Although the experts represented the pest as a serious threat to cotton cultivation, the solution to the pest menace was not sought in the chemical pesticides. Rather, a case was made against pesticides that were extensively used until now on cotton crops. Significantly, the official disenchantment with chemical pesticides was not a result of the failure of the Green Revolution or the concern for the environment. The policymakers and agricultural scientists largely hailed the outcome of the green revolution, which relied heavily on chemical inputs like pesticides.

There was a growing public opinion that the agrochemical and water intensive production technologies of the green revolution culminated in intense pest infestation. A frequent spraying of pesticides on cotton crops had been certified by agricultural scientists, who believed that most of the pests that affected cotton crops were active throughout the plant life. Since the pests developed resistance to the pesticide cocktail, the farmers ended

up using as many as fifteen to twenty sprays[17] in a single growing season. Generally, farmers used pesticides as a precautionary measure or on noticing any pests on plants without regard to the threshold limits of the pests. Thus, the cost of the pesticide was greater than the benefits it provided (Dev and Rao 2007).

Some critics of green revolution believed that the need for excessive sprays of pesticides on cotton had been constructed by the agricultural experts to benefit the pesticide industry (Sharma 2002a & 2002b). While cotton pests had turned out to be a boon for the industry, the pesticides did not target the insidious pests alone. The abundance of benign insects available in the cotton fields were killed when the first pesticides were sprayed in a crop season. Bereft of their natural competitors, the menacing pests appeared stronger after each pesticide spray. As the pesticides disturbed the delicate equilibrium of nature, many of the little-known pests of cotton such as the white-fly or *Bemisia* also emerged as major threats to cotton crops. Nevertheless, through the dominant regime of representation, one tiny pest (Cotton bollworm or *Helicoverpa armigera*) became the sole cause of the lower yields in cotton. By constructing an image of the belligerent *Helicoverpa armigera* as the only cause behind the reduced cotton yields, the technocrats in the concerned ministries resorted to causal reductionism. They brought the tiny pest into public visibility, and a protracted contestation over its relationship to the use of pesticides followed.

Gradually, the experts represented the pesticides as inadequate to fight the tiny pest. Using a process of geneticization, then, the technocrats framed the issue in terms of genes and genetic resources (Gottweis 1998). The network of experts within the central ministries, and the specialized agencies such as CCI, justified the necessity of the cutting-edge biotechnology in agriculture. The new technology of Bt cotton was represented as a solution to the problem of the single pest. This became the

17 Reportedly, cotton crop alone consumed nearly 55 to 60 per cent of the total quantity of pesticides sprayed in the country (APCoAB Report 2006).

guiding rationale for the adoption of Bt technology that advanced a production and profits model in agriculture. Riding on this opportunity for market expansion, the largest seed corporation in the US offered its Bt cotton as a technological solution to the cotton-pest problem in India. Monsanto Corporation was a leading agrochemical transnational corporation then, and a global leader in agricultural biotechnology now. The resultant nexus of the Indian state, corporate capitalism[18] and Bt technology gave rise to a new form of control that was paradigmatic in nature.

Inventing Technology

The roots of the story of Bt technology can be traced back to the province of Thuringia in Germany. In 1911, 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 discovery led to the commercialization of an insecticide using this bacterium in France in 1938 and in the USA during the 1950s (Ramani 2008). Subsequent generation of the product was marketed in the form of a bacterial spray (Bharathan 2000). Around 1982, scientists at Monsanto succeeded in isolating a gene, Cry1Ac, from *Bacillus thuringiensis* (*Bt*). Enabled by the discovery of the structure of DNA in living cells, the technique of genetic engineering could move the discrete gene with the desired trait across species to create a new category of 'transgenic cotton plants.'[19] The transgenic cotton plant would express the characteristics conferred by the foreign gene, Cry1Ac, inserted into it. The gene was believed to be responsible for the production of a toxic crystal protein that killed a specific family of plant pests known as *lepidopteran* pests, notably the American bollworm. The insecticidal protein would block the mid-gut receptors of

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

19 The term "transgenic" is synonymous with "genetically engineered" as it is commonly used.

bollworms, leading to their loss of appetite and subsequent death.

The scientists at Monsanto introjected the new pest control mechanism into cotton plant cells (Marcuse 1964). As a result of the genetic intervention, the cells of cotton plants were converted into virtual pesticide factories. The intrinsic capability to kill *lepidopteran* pests would now be reproduced with every crop cycle. In this manner, a technology of genetic biopower was invented that had a self-reproducing potential. Subsequently, the selected gene became an important ally of the corporation in its ambition of transnational expansion. Initially, Monsanto commercialized Bt cotton in the US and later across the world. The new form of technological control aided the seed corporation to forge strategic alliances across the territorial boundaries.

Central to the political economy of Bt cotton was the capitalization of information coded in the *Cry1Ac* gene (Thacker 2005). The expression of the inserted gene in cotton seeds was believed to maximize profits from cotton production by controlling the crop pests and eliminating pesticide sprays.[20] A range of strategies were deployed to construct the 'effectiveness' of Bt gene. These included 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 for the transgenic seeds to capture the markets.

Two seemingly contradictory attributes of reductionism and complexity characterized the new technoscientific rationality (Wynne 2005 b). A genetic-deterministic belief, and a reductionist one, was entrenched in Bt cotton. The belief held that only one gene, and not more complex multiple interactions of the gene with the physical environment, shaped the phenotypic outcomes of the transgenic crop. Concurrently, the engineering of cotton plant at the molecular level involved a complex and fragmentary idea of 'Bt gene' (Rose 2001). The gene was conceptualized as having three parts. First, a front-end promoter that carried the regulatory information of the gene. Second, the middle of the gene

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

that contained the information for the protein expressed by the gene. And, third, the end of the gene that had information on the boundary of the gene that separated it from other genes. If the gene was so complex, then a whole bacterial gene introduced in cotton plants had a low chance of functioning. Although all genes use a basic vocabulary or genetic code to specify their gene products, different organisms regulate the function of a gene differently. There were chances that the cotton plants would not recognize the control signals present in the bacterial gene, as the former used different regulatory information in their promoters than the latter.

In order to justify the insertion of a bacterial gene into cotton plant cells, the scientists at Monsanto constructed a myth of precision in genetic engineering. A narrative of 'precise control' undergirded the new technoscientific rationality. The scientists held that both the regulatory signals and the expression of the bacterial gene in cotton plants were controlled precisely. This was done by chopping off the bacterial regulatory sequences and replacing them with the appropriate regulatory sequences from the plant gene. It was believed that the bacterial gene would now work in cotton seeds because the parts of the gene were swapped in a very precise manner.

Contrary to the belief of the researchers at Monsanto, there were scientists who claimed that the isolation of *Cry1Ac* gene from *Bacillus thuringiensis* and its introduction into cotton seeds was not a 'precise' process. Physically isolating a chunk of DNA from the soil bacterium into a test-tube and picking the one piece that contained the coded information necessary for the production of the pest-killing toxin was inherently a difficult and problematic step (Llewellyn et al.1992). Two delivery systems were available for inserting the bacterial gene into the plant cells. One, the Agrobacterium mediated gene transfer; and the other, the bombardment of cells with DNA-coated microprojectiles at a very high velocity. The precision with which the gene could be inserted at the desired location in the host cells by either of the two delivery systems remained a hit and trial method. In genetic engineering, then, the limits of precision were continually encountered. But those were also seamlessly bracketed and denied.

The belief that Bt cotton was invented with precision implied that the technology would have the intended effect on cotton pests. The control over cotton cultivation would be mediated through the new technology to suit the logic of capital. The universalizing of biotechnological solution for agricultural problems in diverse environments constituted an important aspect of this rationality. The possibility that the genotype of transgenic cotton would behave differently in different areas and seasons was also denied. The expression of *Cry1A*c gene was influenced by several factors inherent in the environments in which cotton was cultivated. The physical and chemical characteristics of the soil; the quantity, periodicity and distribution of rainfall and/or irrigation facilities; and the range of temperature--these were some factors that had a direct and indirect influence on the expression of the *Cry1Ac* gene. The factors, which vary from country to country and even within a country from region to region, were very critical to the success of the transgenic cotton seeds.

The effectiveness of Bt cotton was dependent on the interaction of a range of genetic and environmental variables. For example, the cultivation and management practices of a particular region would influence the expression of the gene.[21] Because Bt technology with the *Cry1Ac* gene was originally developed in the US, using the American cotton variety Cocker 312, it was less suitable for the cotton varieties cultivated outside the US.[22] The suitability of Bt cotton for the 15 agro-climatic zones and 120 sub-zones in India would depend on careful consideration of such variables. But this variation was ignored in the process of universalizing the technology. The myth of precision of genetic engineering and

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

22 "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.

the universal solution to cotton pests were instruments of control deployed to aid the transnational business of biotechnology.

While genetic reductionism served a pure marketing logic, the selected nomenclature of the technology did the same. The generic labelling of this technology as Bt, instead of the specific gene (*Cry1Ac*) that the cotton seeds carried, had another purpose. The bacterial spray that was previously used had found a market niche because of some appealing features. The Bt spray was touted as naturally derived, biodegradable and species specific. By using the blanket term of Bt, the process of genetic reductionism inherent in Bt technology was concealed, whereby a complex problem of cotton pests was reduced to a single gene. *Cry1Ac* is one of a large family of *Cry* genes,[23] which produce 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 *Cry1Ac* gene would have no effect on a host of pests that thrived in different agro-climatic zones. The potential for failure of Bt technology was carefully hidden behind the selected generic nomenclature, and problematic issues were black-boxed in this new technological package.

23 Biotechnologists claim that other insecticidal crystal protein genes (Cry genes) from Bacillus thuringiensis have been cloned and sequenced. Researchers have proposed a naming system for the Cry genes based on their protein sequence and the types of insects for which they are toxic: The proteins encoded by the Cry 1 genes are toxic only to caterpillars, that is larvae of moths and butterflies (Lepidoptera); Cry II genes encode proteins toxic to flies and mosquitoes; Cry III genes produce proteins active against beetle larvae; and Cry IV proteins are only active against fly larvae. Within these major groupings, smaller divisions have been made by considering the similarities and differences between the different protein sequences. For example, the Cry I group was originally divided into Cry 1A, 1B and 1C (it is now up to Cry 1G). Finer subdivisions have also been made and Cry 1A now consists of Cry1Aa, Cry1Ab, and Cy1Ac. See, "The Science behind Transgenic Cotton Plants," available at http://www.cottoncrc.org.au/communities/cotton_Info/The_Science_... (accessed on November 11, 2012).

The generic name of Bt would allow Monsanto to capitalize on the familiarity of the previously existing technology in public perception. This would deflect attention from the fact that the new *Bt* seeds did not function the way Bt spray did. Because the bacterial spray was applied at specific points in the crop cycle, the toxic protein would degrade quickly in the soil. Besides, the insects were faced with the toxin in large concentrations for short periods of time. This made it harder for Bt-resistance to evolve in the insects. With genetically engineered cotton, the resistance of the lepidopteran pests to Bt toxin increased. The toxin would be produced at all times, thereby increasing the selection pressure on the insects. The pests would respond to the persistent exposure to the toxic cotton plants by increasingly evolving their resistance against Bt toxin.

DEPLOYING STRATEGIES OF CONTROL

Technology Transfer as Control

Upon getting a patent on Bt cotton in the US, Monsanto deployed the technology in its transboundary expansionist project in which the aim was to monopolize the seed markets across the territorial boundaries. Against the background of a weakened discourse of indigeneity of biotechnology in India, the government agencies like CCI and DBT rationalized Monsanto's *Bt* cotton as a suitable pest control strategy in cotton cultivation. The technology was deemed necessary for disciplining nature in the form of cotton plants for an efficient extraction of agricultural resources in the new economy. It implied that any life form in crop fields, be it plants or organisms, that did not increase agricultural production was pathological, thus worthy of extermination. Because the corporation wanted to transfer its technology to India for profits, the Indian government was asked to pay a high fee for it. The technology transfer fee was a device by which the corporation retained control of the flow of its technology in a deregulated global market.

In order to penetrate the Indian seed market, Monsanto negotiated a technology transfer arrangement with the Indian

government. The talks broke down after the negotiating parties failed to reach an agreement on the financial terms of the transfer (Serageldin and Persley 2003). The main reason behind the failed negotiation was an exorbitant technology transfer fee that the corporation wanted from the Indian government. The officials in DBT revealed that the Indian government was asked to pay about four million dollars to Monsanto to get the gene transfer know-how, a deal that the government declined.

To transfer the technology to India on predetermined terms, the corporation opted for a backdoor entry into the Indian seed market. For this, Monsanto enlisted the interests of new local allies. Initially, the corporation approached the biggest Indian seed company, Mahyco,[24] with its technology. This was a strategic move in various ways. The director of Mahyco, Dr. Barwale, was a well-respected member of the Indian agricultural industry. Earlier, he was honoured by the Indian government for his contributions to the agricultural sector (Gupta 2000). His connections within the government extended beyond DBT to many of the key agencies involved in biosafety regulation (Newell 2003). The alliance with Mahyco was crucial for Monsanto to understand the dynamics of the domestic market, and to get an easy official approval on the transfer of its technology.

By forging the link with the influential local entrepreneur, the corporation extended its powerful arm into the Indian seed industry. Monsanto influenced Mahyco to import its transgenic cotton seeds as part of a license agreement.[25] Under the terms of this alliance, Mahyco took permission from DBT to import one hundred grams of Monsanto's Bt cotton seeds. To consolidate its position in the market, Monsanto bought a twenty-six per cent

24 Mahyco stands for Maharashtra Hybrid Seeds Company Limited. The company was established in 1964 in the Indian state of Maharashtra by a plant scientist, B.R. Barwale.

25 "*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).

stake in Mahyco and went on to create a joint venture Monsanto-Mahyco Biotech India Limited (MMB) with fifty per cent equity holding for each. The corporation not only transferred its technology to India through this strategic alliance, but laid a strong foundation for capturing the Indian seed market.

Following the calculated partnership with the local seed company, Monsanto adopted a multipronged strategy to enroll more allies into the network. Linkages were forged with key knowledge sites and the local seed industry. For instance, it opened a research facility with one of the best schools in India, the Indian Institute of Science (IISc). Apart from the purchase of the state-of-the-art center for research in twenty million dollars, the corporation spent roughly four billion dollars to acquire several leading seed enterprises, including Mahyco, so as to improve access to the Indian market (Assayag 2005). Over time, the corporation sublicensed Bt technology to numerous local seed companies in order to dissolve the market competition, and to earn royalty on its technology from these companies.[26] Monsanto also entered into agreements with other transnational seed corporations through acquisitions, joint ventures and strategic alliances (Howard 2009). A greater control over seed and agrichemical business was achieved globally, thus putting the corporation in a strong commercial position as a supplier of transgenic seeds.[27] In a way, Monsanto converted Bt technology into an obligatory passage point within the emerging network (Callon 1986). And the allies were convinced that it was

26 There are around 30 local seed companies that have license for Monsanto's Bt cotton (Outlook Business 2012).

27 Some newspaper reports show that Monsanto's patented Bt cotton seeds account for a staggering 90 per cent market share in India. See, for example, "Monsanto holds 90% market share of Bt cotton seeds" *The Economic Times*, available at http://economictimes.indiatimes.com/cmpnewsdisp.cms?companyid=13395&newsid=334815 (accessed on March 30, 2014). Anti-agbiotech activists claim that Monsanto controls 95 percent of India's cotton seed market. See, Vandana Shiva's "Seeds of suicide: How Monsanto Destroys Farming," available at http://www.globalresearch.ca/the-seeds-of-suicide-how-monsanto-destroys-farming/5329947 (accessed on April 3, 2014).

necessary for them to pass through this passage point to fulfill their interest of profit maximization.

Backed by the powerful neoliberal actors, Monsanto gradually shaped the political economy of Bt technology. The corporation possessed the technical, political and economic resources to shape the expensive technoscientific project. The incorporation of *Cry1Ac* gene into cotton plants required elaborate, high-tech laboratory equipment and resources. Unlike the fund-strapped domestic seed companies and public research institutions, a resource-rich Monsanto was capable of enrolling complex and expensive laboratory apparatus into the hybrid network (Latour 1987; Callon 1986). Those included electron microscopes, ultracentrifuges, electrophoresis, spectroscopy, x-ray diffraction, isotopes and scintillation counters. Besides, these instruments were linked with the information-processing capacities of computers, and information-disseminating capacities of the internet (Rose 2001, p15). The resource richness of the corporation enhanced its capability to undertake such hi-tech research in agricultural biotechnology. This, in turn, provided the transnational corporation with greater room for market maneuver.

The capital-intensive research and development of Bt technology gave Monsanto an advantage over the resource-deficit local allies. Because of the necessity of an expensive R&D, the technology became political by ordering power relations (Winner 1986). The powerful nexus between technoscience and capital facilitated a wave of mergers and acquisitions. Other agbiotech seed corporations also pursued these acquisitions as part of a broader strategy of integrating crop development, agricultural production and seed distribution in India. And, within the emergent sociotechnical network, Monsanto occupied a hegemonic position. The development and governance of Bt technology was dominated by actors that moved between transboundary spaces with ease. For instance, biotechnology laboratories and institutions were linked globally to flows of finance, expertise and technology (Scoones 2007). Bt cotton was introduced in India within this context of an emergent political economy that was diffused in time and space. It

was network-based (Castells 1996), so different from the economy within which the green revolution took place.

Hybridization as Control

Between 2002 and 2006, some sixty-two Bt cotton hybrids were developed by private companies in India. Almost all the hybrids had the Monsanto's Bt gene inserted into them, which had been sublicensed to various local seed companies (DBT 2006). The commercial production of Bt cotton involved two steps. In the first step, scientists at Monsanto's laboratory in St. Louis, in the US, inserted Cry1Ac gene into cotton seeds through a single genetic transformation event called 'Monsanto-531' (MON-531 event). The term 'event' denoted the supposed site of integration of Bt gene at the desired location on the chromosome of a cotton seed. The transgene, Cry1Ac, was attached to the DNA of a parasitic bacterium, *Agrobacterium*. The latter was selected as the carrier of the gene due to its property of crossing species barriers and surviving in alien host cells. Using Agrobacterium as a vector, the Cry1Ac coding sequence was inserted into cotton plant cells in Monsanto's sophisticated laboratory. From the transformed host cells, the first generation of Bt cotton plants were developed using tissue culture techniques. Seeds of these plants were, then, transferred to the laboratories in India.

In the second step, Bt cotton underwent subsequent innovation in India. The development of commercially viable Bt cotton in the country relied on a method of backcrossing, a conventional plant breeding technique based on cross-pollination. After importing Bt cotton seeds, the gene *Cry1A*c was incorporated into the local Indian varieties through the process of backcrossing. The scientists at the laboratories in the local industries crossed the transgenic seeds from the primary event, Mon-531, with three Indian hybrid cotton varieties.[28] As a result of the conventional backcrossing of Bt gene into local cotton hybrid varieties, three Bt cotton hybrid lines

28 MECH-12, MECH-162 and MECH-184.

were developed.[29] Traditionally, the hybridization process had characterized the cotton production in the country. In the changed scenario, the introduction of Bt gene into hybrid cotton varieties brought about a hybridity of hybridities. As the hybridization of cotton seeds intensified, the control of the seed corporations over the production of those seeds also increased.

The developers of Bt cotton claimed that backcrossing would enable the production of transgenic cotton plants with uniform expression of the gene and a reliable performance on the Indian fields. However, some scientists contested Monsanto's claim of a site-directed, non-random insertion of Cry1Ac gene into cotton hybrids. Various technical aspects regarding the backcrossing process were challenged. These included the reliability of the Indian varieties that were used in the backcrossing process and the way in which these varieties were chosen. It was suspected that MMB had used very high-yielding hybrid lines as acceptors of the transgene from the primary transformant. The increased yields of Bt cotton would emerge from the use of high yielding varieties as acceptor host, and not due to the inherent attribute of the inserted transgene. Besides, it was uncertain whether two years of backcrossing was a sufficient time to evaluate the stability of the backcrossed varieties of Bt cotton (Bharathan 2000). By neglecting such technical issues, the hegemonic actors created a condition in which the sociotechnical linkages could be forged systematically.

EXCLUDING ALTERNATIVES

In the formation of the network, certain potential elements were excluded that did not fit the interests of the hegemonic actors. For decades, the entomologists and agricultural scientists in public research institutions had recommended the use of alternative techniques of pest management for achieving sustainability in agriculture. Contrary to their advice, the state did not encourage the cheaper and more effective alternatives to Bt cotton. Such

29 Bollgard-MECH-12, Bollgard-MECH-162, and Bollgard-MECH-184.

exclusion of alternatives constructed a conducive space for the adoption of Bt technology. Under the emerging political-economic order, the agricultural extension services were gradually withdrawn. This was coupled with an increasing privatization of agricultural research and development (refer to Chapter 4). These factors severely curtailed the infrastructure that was necessary to sustain the alternative pest control approaches, such as Integrated Pest Management (IPM) and Non-Pesticidal Management (NPM) projects.

Building almost exclusively on the locally available and non-chemical inputs, the alternative technologies were more sustainable than chemical and biotechnological options. The strongest evidence for the appropriateness of the alternative approach came from a major experiment conducted by the National Centre for Integrated Pest Management. The experiment was carried out a couple of years prior to the commercial release of Bt cotton. In this experiment, the scientists of the institute used two hundred hectares of farmers' land in Maharashtra to produce one thousand kilogram of cotton per hectare. The yield was three times the national average. The most significant aspect of the experiment was that this high yield of cotton was possible without the use of pesticides or transgenic seeds (Jayaraman 2002). Similarly, in the late 1980s, the Non-Pesticidal Management Project was adopted as a non-chemical pest management strategy for small and marginal farming communities in Andhra Pradesh (Quartz 2011).

As eco-friendly approaches to managing pests, these alternative technologies combined mechanical, biological and chemical pest control techniques. Such techniques had the potential to control economic losses and minimize the side-effects of chemical pesticides. Prior to the commercialization of Bt cotton, the scientists had launched concerted efforts to develop and hone these practices for various crops, including cotton (GOI 2003). Essentially, both IPM and NPM were knowledge intensive pest control mechanisms. These methods necessitated that technical knowledge was provided to the extension functionaries and farmers in various states to deal with cotton pest complex (GOI 2003, p.6). For the success of these options, a continuous monitoring of cotton fields was required.

The guidance to farmers about the behavioral pattern of the pests in different cotton-growing regions was also essential.[30] This could be facilitated by the technical inputs from experts and situated in various government institutions.[31] Despite the astonishing results of the alternative technologies of pest management, the government of India did not promote IPM approach or its radical version, NPM. Instead, the government supported Bt cotton that was believed to be technologically superior to other alternatives.

The policy rationale that Bt technology had a "proven" track record at scale, which the alternative technologies did not have, was unfounded in a study that created a fresh wave of controversy around Bt technology. The team of scientists in the Central Institute of Cotton Research (CICR) claimed that Bt cotton planted in India was not as efficient in killing bollworms as in the US (Kranthi et al. 2005). The study suggested that Bt cotton was not designed for India's long ripening season. The transgenic cotton commercially grown in India expressed less than critical levels of the Cry1Ac toxin required for full protection against bollworms late in the season. The findings of the study meant that a decline in the concentration of the toxin in the transgenic plant late in the season could cause resistance in *Helicoverpa armigera*. That would necessitate more supplemental insecticide sprays than were being used on Bt cotton varieties elsewhere in the world (Jayaraman 2005).

Subsequently, researchers observed that bollworm larvae of a particular size and age needed supplemental treatment of chemical pesticides. This discovery further strengthened the position that Bt technology would not eliminate the pesticide consumption completely (Kranthi et al. 2005; Narayanamurthy and Kalmkar 2006).[32] The dominant discourse of the cotton-

30 See, CICR Technical Bulletin No. 22, page 3: "*Transgenic Bt Cotton,*" Available at www.cicr.org.in (accessed on September 2, 2013).

31 Some of these institutions were the Indian Council of Agricultural Research (ICAR), the State Agricultural Universities (SAUs), and the Central Directorate of Plant Protection (CDPP) under the Ministry of Agriculture.

32 Also see: "Transgenic Bt technology: Benefits," available at: http://www.monsanto.com/biotech-gmo/asp/biotech_blogs.

pest control overlooked the fact that Bt cotton was developed to provide resistance to American bollworms in the context of the North American agriculture. 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 problem. Through this process of simplification (Scott 1998), the neoliberal actors privileged a high technology over the evolutionary, ecological and organismic aspects of local agriculture (Bharathan 2000). The adoption of Bt cotton provided policymakers a market-oriented calculus to balance the costs and benefits of cotton cultivation in the country.

Moreover, the toxin expression in the transgenic seeds was found to be higher in leaves than in boll-rind, bud and flower. Thus, this type of protection worked well against *Heliothis virescens (*tobacco budworm), a major pest in the US that feeds on the leaves. But it did not work against *Helicoverpa armigera*, the major pest in India that feeds mostly on bolls. The scientists claimed that the major Indian cotton pest was variably susceptible to Cry1Ac protein and could quickly evolve resistance against the toxin. This then gave rise to the question as to why was Cry1Ac gene introduced in Indian cotton varieties if it was not optimal? The expression of the specific gene under the controlled conditions of Monsanto's laboratory did not mean that the gene would be expressed optimally on the Indian cotton fields. If suitability of the gene was not established for Indian conditions prior to its commercialization, then choice of that gene contributed to the failure of Bt cotton on the Indian fields subsequently. The new technology embodied a universalized technological solution that was unsuitable for the local agricultural problem. Yet, the hegemonic actors rationalized the technology in such a manner that an acceptance was generated for it.

---

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.

CREATING DISCURSIVE HEGEMONY

Using several powerful frames, the pro-Bt lobby created a discursive hegemony that stabilized the emergent sociotechnical network (Pinch and Bijker 1987). The TNCs and the state agencies used the central frames of environmental sustainability and food security to justify the need for agricultural biotechnology. In the publicity material of the corporations, these narratives portrayed biotechnology as a functional imperative and a fix for the pest menace on Indian farms. The narrative depicting Bt technology as a sustainable, environment-friendly and developmental technology emerged in part from the frames used by the global institutions.[33] The objective of this discourse was to expand the reach of the seed corporations into the Indian seed market, gain consumer confidence and facilitate regulatory approval.

When the seed corporations represented Bt cotton in environmentalist terms, an intricate link was forged between the economic rationality and the environmental rationality in this discourse. The notion of environment as separate from humans has been integral to Western economic thought and its project of the capitalization of nature ever since the industrial revolution. Underlying such thought lies a sense of instrumentality that connects the rational and efficient exploitation of nature with economic growth. The ideology of developmentalism aimed to transform the untamed nature into manageable economic resource. Even though the concept of sustainable development became a catchphrase in recent times, it was debatable as to what was being sustained---economic growth or global ecosystem, or both (Banerjee 2002). The apparent reconciliation of economic growth and environment in the discourse of sustainability was simply a green sleight-of-hand, which failed to address genuine ecological problems that beset agriculture (Escobar 1995; Redclift 1987). In a strategic move, then, the seed corporations linked the

33 World Bank, 1986. "Poverty and Hunger: Issues and Options for Food Security in Developing Countries" A world Bank Policy Study. Number 9275. February 1986.

frames of economic growth and environmental sustainability to that of food security.

In order to construct a dominant rationale for Bt technology, the corporations emphasized improved efficiency of transgenic seeds in tackling the issue of "food insecurity." The strategies of invoking the images of hunger had existed throughout the development era, whether it was the period of Green Revolution or Integrated Rural Development programs. A whole economy of discourses and unequal power relations were encoded in the body of the malnourished (Escobar 1995). Through its publicity strategies, for example, Monsanto claimed that agricultural biotechnology could directly tackle the issues of food security in India. The corporation claimed the following on its Indian website:

> India has to increase food production by 105 million tons by 2020. . . Biotechnology can grow more food without affecting the environment. With advanced life sciences, we help feed the world and sustain and nurture the environment. The major objective is to develop technologies aimed at meeting India's food security needs in the next millennium.[34]

Through the discourse of 'food security' Monsanto linked the issue of hunger with agricultural biotechnology. The 'food security' frame, though not directly applicable to Bt cotton, located the causes of hunger and malnutrition to the constructed problem of low crop yields due to pest menace on the Indian fields.

In the dominant discourse, then, Bt technology was represented as a solution to the pest menace afflicting the crops in the country. Because of an emphasis on the development of cotton monocultures for exports in the new economy, Monsanto promised its Indian allies that its insect-protected transgenic cotton offered advantage to farmers. The transgenic cotton would require fewer agrochemicals, thus controlling the attack of pests, weeds and diseases. Further, the pro-Bt lobby represented farmers as bold, intelligent and rational experimenters who would be able to maximize their benefits through utilizing Bt cotton. This was

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

contrary to the competing discourse of the anti-agbiotech activists who represented farmers as vulnerable consumers who had lost their traditional knowledge and agency. The farmers were seen to be in need of re-education in order to make them reclaim their sustainable and indigenous ways of farming (Pearson 2006, p 313). The struggle between competing discourses around *Bt* cotton was dissolved through the hegemonic intervention of the state that favored the corporations. The state agencies and the seed corporations created a need for the technology among farmers through strategies that forged a relationship between the new technology and its potential users.

FRAMING USER-TECHNOLOGY RELATIONSHIP

Various technologies of advertising were deployed to create the need for Bt cotton among farmers. To popularize the transgenic seeds, newspaper adverts and workshops were used to persuade the skeptical publics. The corporations sent out video trucks into the targeted regions to organize shows of documentary and fictional films on the technology. To convince the farmers that the new technology was an ally in their interest, brochures and leaflets translated into diverse regional languages were read aloud at village gatherings. The technology was thus dispersed through such cognitive campaigns.[35]

Simultaneously, the corporations 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). Implied in the diffusion of know-how was the control and communication of do-how of the technology (Luke 2006). Earlier, the public sector extension scientists provided farmers with information about best available farming practices. In the changing policy environment, such extension services were gradually withdrawn. Instead, the private extension system of the seed corporations pushed their preferred

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

solution to the farmers in order to shift the cotton cultivation practices towards Bt technology.

Concurrently, the seed corporations tapped into the cultural symbols of the targeted populations. Various religious festivals were sponsored in villages, and the images of gods and saints were deployed for advertising the product. For instance, 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 respected saints or displayed the name of various deities (Assayag 2005). The appropriation of cultural symbols highlighted the sign value of the technology over its utility value (Oudshoorn and Pinch 2003). The cultural packaging of the technology was intended to influence the users to integrate the technology into their farming practices.

By incorporating the cultural symbols of the farmers into their capitalist project, the seed corporations transformed an unfamiliar technology into a familiar object that the farmers could identify in their everyday lives. Through such a regime of representation, a new technology that created both excitement and insecurity among the public was domesticated. The pro-Bt lobby used the resources of knowledge, money and communicative skills to garner the acceptance for the new technology. It partly succeeded in extending the control over the cognitive and emotional aspects of farmers' lives, thereby shaping their technological choice.

CONCLUSION

The rationalization of Bt technology unfolded as a complexly layered process. A combination of technical, institutional and discursive mechanisms was deployed to rationalize the technology. Along with restructuring the Indian economy, the network of actors created a powerful rationale for subjecting cotton crops to genetic control. They articulated the government-technoscience-capital relationship into a new form of command over plant life. Such biopolitical process inscribed cotton into the emerging order of the global capital.

Within the emerging neoliberal context, Bt technology became a vehicle for the expansion of the transnational hegemonic power. The resultant nexus of the technology and neoliberalism led to a new paradigm of rule that controlled the state policies, seed market and agricultural crops from the interior. With a shift in the ideology of the Indian state from a welfare-oriented development to its neoliberal variant, the logic of capital accumulation guided the adoption of Bt technology. The notion of progress was redefined and recast as the pursuit of economic profits through Bt technology in the global marketplace.

The political agency and economic power of the global neoliberal institutions were linked up with Bt technology inextricably. The hegemonic actors rationalized the technology that laid down the foundation for the sociotechnical order at the local level. The new paradigm of ruleopened up the space for a universal biotechnological solution to cotton pest problem across territorial and agronomic boundaries. The transnational seed corporations, which were backed by the global neoliberal institutions, played a central role in situating agricultural biotechnology at the heart of the contemporary molecular biopolitics. The co-production of the policies of structural adjustment and commercialization of Bt cotton in India constituted a crucial imperial moment. The birth of the bioempire was tied to the potent nexus between the hegemonic power of the state, the transnational capital and the new technoscience.

CHAPTER 3

Regulating *Bt* Technology

Prior to the commercialization of Bt cotton in India, the regulatory apparatus for biotechnology was set up. The inspiration to regulate the technology came from the United Nations Conference on Human Environment that took place in 1972. The decisions of the conference formed the basis for the rise of the Indian environmental state[1] that had a regulatory role. The statist environmentalism embodied specific assumptions about nature as a built-up environment that had to be preserved. The disconnection between such a directive and the destruction of nature in the production process was not comprehended under this technocratic ideology (Ravi Rajan 2005). The state adopted a reductionist approach to environment that separated man from nature, privileging the former over the latter. Such approach differed from an ecological approach that would have looked at the relationship between man and the environment holistically. At a deeper level, the statist environmentalism provided a benign dressing for the oppressive

1 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 (Herring, 1999).

emergency regime[2] of the then prime minister, Indira Gandhi. As a strategic response of the Indian state to the new social movements[3] that opposed the state model of development (Vishwanathan, 1987), the ruling regime depoliticized the implications of the ecologically inspired social movements[4] by advocating concern for the environment (Vishwanathan, 1987; Alvares, 1988; Shiva, 1989, 1991, 1993). The state projected its commitment to save the environment institutionalizing the regulatory regime.

With the category of 'environment' naturalized in the statist discourse, policies were formulated to protect the environment on predefined terms. The state defined "pollutants" to the environment selectively, where some man-made substances were to be allowed into the environment and others not. The then ruling Congress government led by Rajiv Gandhi enacted the Environment Protection Act (EPA) of 1986[5] that called for the regulation of environmental pollutants. The pollutant was 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, p 2). Among other pollutants, the genetically engineered organisms (GEOs) were considered as hazardous substances that could pollute the environment. The broad definition of the pollutants was vague in terms of the 'concentration' that would make the genetically engineered seeds injurious to the environment. The unknown and uncertain consequences of the technology were bracketed as "risks" that could be assessed and controlled by the state.

The recognition of the need to govern the transgenic seeds set the tone for the incorporation of agriculture into a regime of legibility

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

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

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

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

(Scott 1998). The state used the set definition of pollutants to issue legally binding rules to govern the agricultural biotechnology. The biosafety rules, or the safety considerations associated with biotechnology, were inscribed into the regulatory grid to discipline the release of transgenic seeds into the environment.[6] Significantly, the risk assessment guidelines were drawn upon models used by the United States Department of Agricultural Plant and Animal Health Inspection Service (APHIS) and from biosafety guidelines elaborated by other OECD[7] countries. The policymakers overlooked that the constitution of the boundaries of 'risks' and the creation of expert enclosures in any regulatory regime were closely tied to the risk philosophies prevalent in those contexts (Gottweis 1998; Jasanoff 2005). The reliance on the regulatory models from other countries stemmed from a lack of prudence of the policymakers and their political will to think and act independently. The dependency of the technocrats on the borrowed regulatory knowledge hinged upon another practical consideration to some extent. The appropriation of the regulatory guidelines saved time for the over-burdened bureaucracy in the concerned regulatory agencies. Although the regulatory framework did not develop organically in the country, its relevance to the Indian context was established through a discourse of scientism.

SCIENTISM IN REGULATION

The standardization of regulation was closely tied to scientism that based regulation on scientific standards. Scientism is the belief in the universality of scientific knowledge. The belief implied that the regulatory standards relied on expert knowledge and scientific language, which made the standards applicable anywhere in the

6 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).

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

world. The regulation of biotechnology was represented as a strictly scientific endeavor that transcended the human values and interests in the local contexts (Jasanoff 1995; Kleinman et, al. 2008). Such an approach to regulation was an inherently technocratic process, which was insulated from the democratic inputs.[8] Over the decade prior to the commercialization of Bt cotton, the regulators linked the regulation of the technology to science. The domain of 'risk' related to Bt technology constituted a specific form of scientism. The experts in the Department of Biotechnology cultivated science-based policy narratives to define the risks of the technology (Gottweis 1998). The risks of Bt cotton were regarded as quantifiable that could be assessed using rational and objective science.[9]

The impetus to scientism came from a powerful institution, the World Trade Organization (WTO), that called for the standardized global parameters for the risk-assessment of transgenic products. The institution legitimized the "risk-based" approach to regulation that based the risk assessment on "sound science" (Halfon 2010). The risk assessment was scientifically "sound" when it was carried out in an objective manner using recognized quantitative techniques (UNEP 2000, article 15). The sound science approach was directly opposed to the precautionary approach. The former required evidence of harm from Bt cotton seeds before regulatory action could be taken. The latter emphasized that the transgenic seeds could be regulated or banned until proven safe (Halfon 2007 b). The standardized framework required an affirmative scientific evidence of harm from the seeds, rather than the proof of safety. This stance towards uncertainty related to the risks of biotechnology was considered more "scientific" than precaution. The precautionary principle was 'unsound' by this definition.

8 For a discussion on technocratic approach to policymaking, see Jasanoff 2004; Miller 2004; Kingsbury et al. 2005.

9 For instance, the Sanitary and Phyto-Sanitary (SPS) agreement and Technical Barriers to Trade (TBT) agreement of WTO required the use of sound science criteria for evaluating risks related to agbiotechnology.

The global trade regime emphasized the adoption of regulatory standards based on science while pushing for the deregulation of the Indian market. Over time, the pressure for standardization increased on the Indian regulators through the threat of sanctions imposed for non-compliance with the WTO directive. The global trade institution maintained that free transboundary flow of biotechnology was not to be hampered by the application of a domestic protectionist policy, which was based on standards and procedures not universally agreed to. The free trade advocates argued that standardized regulatory procedures had limited ambiguity and strict protocols. This would encourage the foreign direct investment in biotechnology in the deregulated Indian market (Scoones 2002). The transnational investors would not shy away from investments in agricultural biotechnology if there was no uncertainty surrounding the regulatory process, and thus no threat to the possibility of payback on investments. While the seed corporations did not take a stance against regulation as such, they opposed regulation that derived from political rather than technical criteria. Because the latter they could control, whereas the former were unpredictable.

After the cold war, the American capitalist hegemony began to operate not only through the global trade organization, the WTO, but through epistemic communities such as the architects of the Washington Consensus. As a set of economic policy prescriptions considered as the standard reform package for the developing countries, the Consensus was formulated by the experts in Washington-based institutions such as International Monetary Fund, World Bank, and the United States Department of the Treasury. These institutions laid the foundation for the new political-economic doctrine that came to be known as neoliberalism. The global capitalist relations embodied in neoliberalism represented a new thrust to liberal capitalism that was based on the principles of market deregulation and privatization of public sector, among other measures.

The regulation of biotechnology became a site where relationships of transnational domination and control were forged. The power of the globally connected actors, such as the World

Trade Organization (WTO) and the US based transnational seed corporations (TNCs), over plant life converged with their control over the ideological initiatives and regulatory policies of the Indian state. The push for the standardization of the economic policies and the regulatory guidelines provided a veneer of legitimacy to the free-market oriented ideology that made inroads into the country. A new logic of rule was embodied in the regulatory standards established through the control of the dominant global institutions with the consent of the Indian government (Gramsci 1971). The technologies of biopower and standardization, thus, merged to give rise to a new mechanism of transnational control that was consensual, thus hegemonic, in nature.

The hegemony was sustained by the articulated knowledge of the experts in the state agencies. The imperative of scientific standards in regulation of biotechnology made the regulatory process of Bt cotton inherently expert-driven. The knowledge-based experts lodged across different ministries networked to tackle risks related to Bt technology. The Review Committee on Genetic Manipulation (RCGM)[10] was constituted under the Department of Biotechnology (DBT) in the Ministry of Science and Technology. It was authorized to regulate ongoing research in agricultural biotechnology and to carry out multi-locational field-trials in small plots. An inter-ministerial Genetic Engineering Approval Committee (GEAC) was set up under the Ministry of Environment and Forests. It had to oversee the deliberate release and commercialization of transgenic products. Its function included granting approval for large scale uses and industrial production of GEOs, and their release into the environment. The GEAC had to follow the key decisions emerging from the expert-led, science-based RCGM. Unlike the latter, GEAC had

10 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.

representatives from a wide range of ministries and departments[11] Both of these committees consisted of scientists from public sector research institutions as well as government bureaucrats.

The experts in RCGM engaged in boundary work to establish the epistemic authority of science in the regulation of Bt cotton (Gieryn 1999). The regulation was represented as a cognitive endeavour that had to be protected from the participation of the public. In this manner, a technocratic approach to policymaking was adopted than a democratic one (Dickson 1984, Jasanoff 1990). In a highly technocratic context, then, the regulation was conceived as a linear, rational and science-based process. The experts justified their science as 'sound' and that mobilized by the public in its critique of the technology as 'unsound.' Such representation of the soundness of the scientific knowledge often took a rhetorical form. The public anxiety on the risks of Bt cotton was dismissed as "irrational, unscientific, emotional and hypothetical."[12] The public was represented as being essentially "ignorant and uneducated about the complex scientific issues."[13] The boundary work entrenched the technocratic control of the regulatory process, thereby disempowering the broader public in decision-making. The tightly technocratic approach depoliticized the regulatory process. The politics of risk assessment transformed fundamentally political issues into those of scientific expertise (Beck 1997). The boundary of science was established and policed in order to demarcate science from politics (Gieryn 1999), thereby ignoring the fact that the two spheres were not separate. As a result, the democratic space for public sharing of information and open deliberation on the regulation did not materialize.

11 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.

12 Interviews with regulators in the Department of Biotechnology and its expert committee RCGM.

13 Ibid.

Under the biosafety guidelines, a range of scientific studies had to be undertaken at the field level including basic agronomic monitoring, pest incidence, pollen flow, allergenicity and so on. The field trials were required to test the transgenic seeds in contained conditions over a number of years. Following that, the trials had to be conducted in the open environment. A minimum of four replications were required in the agro-ecological zone for which the transgenic seeds were intended. The impact of Bt cotton on pest resistance dynamics had to be assessed as well (DBT 1998; Ghosh and Ramanaiah 2000). The network of government actors controlled the cognitive framing of the Bt cotton field tests. Terms like "experimental data," "scientific approach," and "objectivity" in the risk assessment procedure entrenched the power of the experts in the regulatory process. The 'risks' related to Bt technology were framed in such a manner that broader issues were cut out or downplayed. The social impact criteria and the ecological implications of the technology were excluded from the domain of risks (Moore et al. 2011). Thus, the technocrats not only assessed the risks, but manufactured them (Beck 1992). The risks were constructed in a narrow sense to maneuver regulation in favor of the dominant capitalist class that had transnational linkages.

ENTRENCHMENT OF HEGEMONY

For commercializing Bt cotton, the regulators opted for promotional policies than the precautionary ones. The promotional policies would accelerate the spread of transgenic seeds, while the precautionary policies would slow it down (Paalberg 2000). Paradoxically, this happened around a time when the country signed and ratified the global biosafety protocol.[14] The Cartagena Biosafety Protocol (CBP) was one of the first transnational efforts to

14 While the regulators in Delhi were busy negotiating the commercialization of *Bt* cotton, the Indian government signed the Cartagena Biosafety Protocol (CBP) in 2000.

formulate legally binding rules for biosafety.[15] As an environmental agreement, the protocol would restrict the trade in transgenic seeds and manage the biotechnological flows in the global world. The CBP tackled uncertain risks of bioengineered products under the precautionary principle. The principle implied that the involved parties had to establish the scientific proof of safety of transgenic seeds, rather than proof of harm from them. The use of the precautionary principle in the Biosafety Protocol employed a broader notion of risk. The protocol did not rely exclusively on the option of sound-science and its support for expert-driven, technocratic modes of regulation.

As an international agreement signed by parties with multitude of intentions, CBP left much of its plain text wording open to country-specific interpretation. The country-level choice in biosafety was accompanied by an imperative of standardization of rules governing such choice. The standardization was aimed to enhance predictability and reduce differences in biosafety decision-making between countries (Gupta 2000). Embedded in the protocol was, thus, this contradiction between the national discretion in policy-making and the enforcement of global standards in regulation. The domestication of the global biosafety policy set in a period of bureaucratic infighting over the interpretation and implementation of CBP, mainly over how to give weight to different elements of the protocol. This resulted in competition over mandates between different ministries and departments within the Indian government.

In contrast to the precautionary principle underlying CBP, the World Trade Organization put in place a "risk-based" regulatory framework. Thus, the global trade regime strengthened the contradiction in the terms of the biosafety protocol. This contradiction was difficult to resolve for the Indian government. While CBP and WTO formulated international regulation differently, the combined effect of these regimes was arduous for

15 Cartegena 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).

the Indian state. 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 condition of the sound-science approach of the WTO agreements (Safrin 2002). Much in line with the precautionary framework of CBP, the regulation of Bt cotton began within a context of case-by-case and precautionary emphasis of the domestic biosafety regulation. Later, WTO encouraged the country to adopt a universalized model of regulation that would be minimally disruptive of trade (Newell 2003). Consequently, the universal, one-size-fits-all regulatory standards were pushed into the country. The governance of agricultural biotechnology in India thus moved towards harmonization, even when CBP did not specifically do this.

Notwithstanding the complex context-specific risks of the technology, the global hegemonic regime emphasized narrow science-based risks. The confusion that the regulators faced regarding the central conflict between the WTO agreements and the Biosafety Protocol could not be resolved. A fierce contestation emerged over technocratic authority and policy goals. And, the technical regulatory standards along the lines advocated by the global regime faced challenges on the ground. The expectation regarding the implementation of standardized regulatory rules ran up against the reality of capacity deficit, shortfall in resources and competition between state regulatory agencies. The selective interpretation, conflict over priorities, and politicking at the highest levels of government had the potential to subvert areas prescribed in CBP (Newell 2008). Besides, the translation of policy commitments contained in the global regulatory agreements into workable national policies was difficult. It meant loss of policy autonomy in a global environment of high commercial interest and aggressive political lobbying. The tension between domestic regulatory autonomy and global harmonization standards became one of the key features in the ensuing crisis of regulation.

Various development agencies engaged the Indian regulators in capacity-building that had to be exercised in accordance with the CBP guidelines. The capacity building efforts were undertaken

with significant donor support of such global agencies as USAID, UNEP/GEF, OECD and others.[16] The intense involvement of the US-government aid agency in supporting the capacity building efforts further imposed a US view of technoscientific progress in India (Mayet 2003).[17] There was a marked shift in the policy thrust of the Indian government towards the biotechnology mediated agricultural development. The Indian state had set for itself the twin goals of protecting the environment along with promoting the technoscience driven development. The goals of achieving biotechnology led development and the protection of the environment from genetically engineered pollutants were conflicting state projects. A technology seen as revolutionary but not well understood in terms of its interaction with the environment had given rise to the contradictory objectives of both advancing and containing it. The competition and conflict between the state agencies intensified because of the inherent contradiction in the twin policy goals of the state.

Two committees,[18] RCGM and GEAC, were set up under different ministries to allow the dual regimes of governability. The push of the Cartagena Biosafety Protocol for contained field-trials of transgenic seeds meant that RCGM within the Department of Biotechnology (DBT) maintained control over the biosafety evaluations of the transgenic seeds. The biosafety rules standardized the legally binding regulatory framework that mediated the twin policy goals of protecting the environment and promoting agricultural biotechnology. Populated by scientists and headed by a specialist technocrat, DBT carried out much of the regulatory oversight of biotechnology. It defined risks of the technology and oversaw the regulatory process. Despite its regulatory role, the

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

17 "USAID project to promote GM crops" *Financial Express*, 29 August, 2005.

18 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.

department supported the scientific community pursuing research in life sciences. Over a period of time, the role of DBT to both promote and regulate the technology created a tension within the risk-promotion paradigm. A new breed of scientist-entrepreneurs began to populate the commissions, task forces and advisory groups within the regulatory agency. Since promotion and regulation were both part of the formal mission of DBT, this resulted in a situation where scientists came to regulate themselves. Given the pro-biotech bias of the technocrats in DBT, a situation emerged where the experts also committed to the agenda of economic restructuring put the regulatory concerns on the backburner.

MANIPULATING FIELD-TRIALS

The field-trials of Bt cotton highlighted the contradictions existing within the regulatory framework. A technophile authority like DBT presided over the field trials instead of the one best suited to take a cautious stance in assessing the risks of the technology. As the field-trials constituted a deliberate release of transgenic seeds into the environment, the presiding authority should have been the Ministry of Environment rather than the Ministry of Science and Technology. The Department of Biotechnology (DBT) under the latter ministry and its regulatory committee, RCGM, were chosen to regulate the technology. Simultaneously, Monsanto-Mahyco Biotech Ltd (MMB) obtained an improper permission to field test the transgenic seeds. Later, the regulators in the state agencies accepted unconditionally the results of the field-trials generated by the applicant, MMB.

Between 1996 and 1998, Monsanto-Mahyco Biotech Ltd (MMB) developed three backcrossed lines of Bt cotton.[19] Subsequently, the Review Committee of Genetic Manipulation (RCGM) permitted MMB to carry out forty small field trials of Bt cotton in nine states. Field trials were formally approved by DBT in 1998, but in practice they were ongoing before the department gave its formal permission to MMB (Shiva et al 1999; Bhargava 2002). Following

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

the review of the 1998 data, RCGM requested an additional ten trials in 1999. MMB presented the results of the field trials to DBT in April 2000, after which RCGM gave clearance to the technology. Next, GEAC granted permission to MMB for large scale field trials. There were four hundred trial locations in six states,[20] thus allowing MMB to treat the country as a big laboratory for testing the transgenic seeds.

The regulators performed science from a situated location of theory and politics. In theory, the field trials of Bt technology were meant to generate data about the germination rates, gene flows, invasiveness potential, weed formation, toxicity and allergenicity. Data was also required on the long-term susceptibility of the transgenic crops to diseases and pests. Besides, the comparison between the engineered and non-engineered plants to pest susceptibility had to be carried out (DBT 1998). In practice, the science around Bt cotton was conducted in a fragmented manner and a range of uncertainties associated with the technology were bracketed. Besides, no validation of the data was undertaken prior to the commercial release of Bt cotton (Journal of Biosciences 2009). Thus, the experimental design and analysis adopted in field trials had many loopholes (Bharathan 2000). The focus on the technical issues of environmental risks relegated broader concerns to the background. These included technological desirability, farmers' livelihoods and societal future.

As clear from Table 2, the duration of field-trials and number of locations for making informed policy decisions regarding the effectiveness of Bt cotton in the field were inadequate within the set scientific criteria. The scale and timespan of the field-trials reduced the regulation to a mere ritual. In spite of such inadequacy, the regulators defended the field trials as rational, objective and scientific. The regulators in DBT claimed that the tests had focused on issues of agronomic performance and laboratory assessments of safety, including allergenicity and toxicity of the transgenic cotton. Nonetheless, such rational policy decisions were not conceived

20 These included Maharashtra (180), Karnataka (89), Gujarat (23), Madhya Pradesh (23), Andhra Pradesh (49) and Tamil Nadu (11).

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) in the Department of Biotechnology (DBT) under the 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 Bt cotton is "safe" based on data from small-scale field trials

July 2000	MMB	Genetic Engineering Approval Committee (GEAC) under the 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

and implemented in a transparent way. The details about the kind of data generated, the rigor of the trials, and the number of tests needed before the commercial release were withheld from the public.

Thus, the question whether MMB deployed the objective scientific criteria in the field-trials, or not, remained uncertain. The lack of data disclosure undermined the transparency in the field-trials,[21] and the process remained exclusive and secretive. By upholding scientific standards to gain legitimacy in the field trials, the state complied with the demands of the global institutions. And, to enable the transnational seed corporations to market their technology in India, the state bent scientific rules in field trials. This kind of duplicity was adopted to accommodate the demands of the transnational capitalist class of which the state constituted a consensual partner. The gap between the projects of the state and the non-state actors was thus bridged to create a hegemony that was sustained through other mechanism. As the inadequate field-trials destabilized expert framings of the 'risks,' it led to a renegotiation of the boundary between the bureaucratic process and the scientific research.

Following the review of the results of the trials in June 2001, GEAC denied approval for commercialization of Bt cotton. It recognized that a number of conditions and requirements for the on-going monitoring had been neglected in these trials.[22] The disapproval of GEAC was the only blip in the process and proved out to be a temporary setback for the pro-Bt lobby. In order to pre-empt the growing public criticism and to increase the credibility of field trials, GEAC then enrolled the Indian Council of Agricultural Research (ICAR) in the regulatory network to provide an independent advice to the regulators. The ICAR is a nodal government agency that networks the agricultural

21 See "Make field trial results of GM crops public," *Financial Express*, 18 November, 2002.

22 See, "The transgenosis debate," *Frontline*. Volume 18, Issue 14, July 7-20, 2001. Available at www.frontline.in/static/html/fl1814/18141070.htm (accessed on July 23, 2010).

universities. Over a period of eight months, ICAR conducted field trials in eleven locations in six states. The delegation of the supervision to ICAR meant a shift in the locus of governance, but not in the quality of field trials. The responsibility of regulation was transferred from a technology promotion agency, DBT, to an agricultural research institution, ICAR, that was deeply supportive of agricultural biotechnology.

Subsequently, the tests conducted by ICAR could not garner more credibility than the ones that had been carried out by MMB. This was because the involvement of ICAR in the field trials did not change the policy culture, as the network was also engaged in the scientific research to produce transgenic crops. While carrying out the field-trials, the institution continued to function within the risk-promotion paradigm that marked the state regulatory agencies. In its report to the government, ICAR concluded that Bt cotton was both economic and effective. Curiously, the issue of safety gave way to the criterion of economic performance of the transgenic seeds (APCoAB Report 2006; ISAAA 2002). The market-oriented thrust of ICAR was evident, but the meaning of the bottom-line variables of the economic and effective nature of Bt cotton was undefined. Notwithstanding the ensuing public protest, GEAC formally approved the commercial release of Monsanto's Bt cotton in 2002. The new regulatory philosophy of "compromise and accommodate" took roots with the commercial approval of the technology.

SCIENCE AS RESOURCE

Clearly, science was used as a political resource to provide legitimacy and authority to the regulatory process. In case of the field trials, the belief that science spoke truth to power appeared simplistic (Price 1965, Wildavsky 1979). The regulation of Bt cotton revealed a much more complex scenario, where the scientific criteria ultimately gave way to economic considerations. To cover-up the deliberate lapses, the field tests were represented as experimental research in contained conditions rather the deliberate release. Earlier, the regulatory guidelines were constructed

against a particular definition of 'risks,' conceptualized as threats to the safety of the environment. So, the containment could be accomplished by erecting biological and physical barriers, which would prevent the transgenic organisms from interacting with the environment. Nonetheless, there was a fuzziness of the boundary between research activity and deliberate release of Bt seeds into the environment.

As the debate around *Bt* cotton intensified, the official position that the decisions were simply science-based appeared hollow. The manner in which the technocracy in the Department of Biotechnology functioned created doubts about the efficacy of the science advisers in regulation. The science advisers in the regulatory process were expected to take politics out of policymaking, thus rationalizing the regulatory decisions (Jasanoff 1990). The decisions taken within DBT showed the increasing vulnerability of the experts to the demands of the transnational capitalist class. The field trials of Bt cotton showed that the regulators did not follow science based, standardized guidelines and procedures exclusively. Those were adopted in a discretionary manner at the level of negotiations between actors on the ground.

The standardized framework was meant to ensure scientific objectivity in risk assessment. However, the regulatory regime flouted significant requirements of a science-based procedure along the way. For instance, an important change was made to the 1989 Biosafety Rules in the treatment of deliberate release of GEOs. While the 1989 Rules banned such releases, the new guidelines permitted them. The revocation of the prohibition on deliberate release paved the way for the commercial release of Bt cotton. The regulation precariously straddled the line between a narrow, technical, risk assessment approach and the wider political-economic context within which the approval was given (Scoones 2003). In effect, the policy decisions were politicized even when the risks were framed in a narrow, technical way. A policy space was, thus, created where the realms of science and politics overlapped.

The field experiments that were initially conceived as knowledge acquisition enterprise turned into the subpolitics of state-technoscience-capital nexus. As hybrid spaces between the

laboratory and the farms, the trials subsumed the experimental norms to market exigency. As a result, the divide between the technical and the political did not hold as the two were deeply intertwined in the processes of mutual construction (Jasanoff 1990). Within this hybrid space, the discretionary choices arising from ambiguity, secrecy and complexity of the regulatory process ended up serving the interests of the hegemonic actors. The enlisting of science in field-trials was a marker of the commitment to a particular ideology of technoscientific progress and was meant to defend the commercial release of Bt cotton against its critics. In the regulatory process, then, science itself became a political-economic resource (Ezrahi 1990). A hasty commercial approval of Bt cotton revealed that the standardized criteria of sound science[23] provided a veneer of legitimation to the market-oriented practices of the state.

CRISIS OF LEGITIMACY

The regulation of Bt cotton received critical scrutiny from the civil society. Various activists challenged the field-trials of the transgenic cotton seeds.[24] A well-known activist, Vandana Shiva, regarded the field-trials of Bt cotton as illegal. Her organization filed public interest litigation in the Supreme Court against Monsanto and the regulatory agencies.[25] Another activist, Devinder Sharma, released an open letter to the then Prime Minister of India, Atal Bihari Vajpayee, at a press conference in Delhi. He called attention to the "scientific fraud" involved in the way the field trials had been conducted and monitored. Calling the field trials "the biggest

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

24 Among them were Vandana Shiva, the Director of an NGO called the Research Foundation for Science, Technology and Ecology (RFSTE); and Devinder Sharma, the director of an NGO called the Ecological Foundation.

25 Specifically, the Department of Biotechnology, the Ministry of Environment and Forests, and the Ministry of Agriculture.

scientific scam to have ever hit India,"[26] Sharma claimed that the field-trial data had been hyped as showing economic benefits and effective results.

Ignoring the protests by the activists, the policymakers in Delhi continued to deliberate on the final decision to commercialize Bt cotton. At this point, news broke out that illegal Bt cotton had been planted over several years in the state of Gujarat.[27] 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 markedup price. The widespread adoption of Bt cotton prior to formal regulatory approval pointed the needle of suspicion to Monsanto-Mahyco Biotech Ltd (MMB). Although a connection between MMB and Navbharat Seeds in this illegal activity was speculated (Ramani 2008), the lack of evidence absolved the corporation from any legal action. Meanwhile, the exposure of the illegal Bt cotton crops put the regulatory authorities in a tight spot. Notwithstanding the public protest against the illegal practices related to the regulation of Bt technology, the policymakers in Delhi formally approved the commercial release of Bt cotton.

On the surface, the three events —the controversial field-trials of Bt cotton, the illegal cultivation of the transgenic cotton seeds, and the hasty commercialization of the technology—appeared to be disconnected. At a deeper level, these events constituted the significant moments in the process of technological misgovernance that stemmed from a decline in the regulatory power of the Indian state. The decreased regulatory power was a conspicuous effect of the new hegemonic order. The regulation of Bt technology took

26 "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).

27 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.

place within the context of the increasing deregulation of the Indian market. Through a series of overlapping technical practices, the expert-driven regulation was subsumed under the market-driven promotion of the technology. The inability of the state to regulate the technological flows was symptomatic of the arrival of a new form of hegemonic power that had transnational linkages.

Although the technology of standardization was supposed to make the governance of the technology efficient, the process of regulation displayed discrepancies. The ambiguity embedded in the regulatory framework led to the loss of public trust in the legitimacy of the field-trials of Bt cotton. Yet, the same ambiguity made the policy environment hospitable for the technology. For, what was vague and unclear could be manipulated to suit the hegemonic goals. In the process of regulation, then, the globally networked capitalist actors used science as a political ally. However, with mounting pressure from the critics of the field-trials, the regulators could not shield their policy decisions behind the pronouncements of science. They put a spin on the issue of the science-based regulation by claiming that the market would decide the fate of Bt cotton, and not the experts.[28] This implied that the state agencies increasingly relied on the non-scientific criteria in field-trials, rather than the scientific-knowledge exclusively. The change in the policy stance indicated that the regulation of biotechnology had taken a corporatist turn, whereby the transnational seed corporations appropriated the regulatory domain.

The global neoliberal institutions, such as WTO, IMF and World Bank, influenced the policies of the Indian government to favor the transnational corporations. Backed by the hegemonic institutions, the transnational seed corporations developed strong channels of formal and informal engagement with the state agencies, thereby influencing the policy decisions of the latter. For instance, Monsanto deployed a two-pronged strategy to appropriate the regulatory process. It linked up with the local seed company, Mahyco, in order to capitalize on the political connections of the director of

28 Interviews with regulators in the Ministry of Science and Technology (MOST) and its Department of Biotechnology (DBT).

the latter, B.R. Barwale. Through this strategic partnership, the corporation forged significant linkages with the regulators in the government. Moreover, the corporation established a regulatory affairs office in Delhi. This would allow the corporation to engage in routine interactions with the government officials over policy developments. Having influenced the state regulators, Monsanto got the permission to run the field-trials of Bt cotton. Subsequently, the commercial approval was granted on the technology that was field tested by the applicant, MMB, itself.

The regulatory maneuvers of Monsanto smoothened the way for other transnational seed corporations that followed in its trail. As of 2003, there were more than a dozen transnational seed corporations operating in India. These corporations deployed Bt technology to create a host of transgenic crops,[29] and many other transgenic seeds were in the pipeline for the official approval. Because the approval process was dispersed across too many departments with poorly defined and highly contested roles, the winners were invariably the seed corporations that influenced the policy decisions. In addition to the upfront network-building approaches, behind the scenes lobbying was also part of their interessement (Callon 1986, Latour 1987). Through a series of translations, the transnational seed corporations aligned the interests of the state actors with their own interest. In response, the Indian state redefined national interest as economic growth through hi-tech development in the agricultural sector (Levy and Newell 2005). The newly articulated government definition of national interest was to align with the interests of the transnational capitalist class through such translations.

The hegemonic relationship between the Indian State and the transnational capitalist class became intense in the subsequent period. The representatives of the biotechnology industry participated as experts in individual capacities during specific sessions of the central committees (DBT 1994, 1998). However, there were cases when petitions of NGOs to participate in particular sessions had been turned down (Gupta 2000). Within

29 Such as tobacco, rice, potato, tomato, brinjal, cauliflower, cabbage, tomato and mustard (Ghosh and Ramanaiah 2000).

this partisan regulatory culture, the risk assessment procedure was amenable to bureaucratic maneuvers that pushed the interests of the commercial actors. The controversy around the field-trials of Bt cotton became a dangerous moment for the government as the lawsuits filed by the activists challenged its authority (Foucault 1979; Ezrahi 1990). When Bt cotton was commercialized, the court case was still going on. In absence of an injunction pending resolution of a court case, and with court cases in India dragging on for years, the judiciary was rendered ineffective at stopping the commercialization of the technology. The regulators just moved ahead as they wished in the interim.

When the case of the illegal growing of Bt cotton in Gujarat by Navbharat Seeds came to light, it became clear that micro-managing the seed trade was difficult in a large country like India. The seed markets were heavily deregulated and the unregulated sellers operated all over the country. The problem of the non-enforceability of biosafety regulation and the ungovernablilty of the transgenic seeds left many unresolved questions. The main question was about the reconciliation of the commitment of the Indian state to trade liberalization and the application of the biosafety guideline to the global flows of biotechnology.

RECASTING REGULATORY FRAMEWORK

The transnational capitalist class coopted the regulators into the hegemonic order to sustain its control over the Indian agriculture. The influential seed corporations lobbied with the Indian government for a consolidated one-step approval process of agricultural biotechnology. The TNCs found the existing multi-tier system of regulation in India too cumbersome (Newell 2003). As many Bt crops were in the pipeline, a new policy would recast the Indian regulatory framework. As a response to the lobbying of the agribusiness, the government drafted a new regulatory policy in 2008. Named as the Biotechnology Regulatory Authority of India (BRAI) bill, the new legislature envisioned an apex autonomous and statutory regulatory authority (DBT 2008, p 1). The policy would collapse the original regulatory framework into a single window

mechanism for biosafety clearance on transgenic organisms (DBT 2008, 2013). In effect, the single-window system would compromise the thoroughness of the biosafety testing (Freeman et al. 2011). This shift to BRAI was preferred over renovating GEAC and RCGM, the existing regulatory bodies that were criticized for their role in the commercialization of Bt cotton. The setting up of a centralized single window clearance system would further lower the bar for the approval of transgenic seeds. The new policy would further entrench the control of the transnational capitalist class over the regulation of biotechnology.

The reconfigured regulatory framework would speed up the commercialization of the transgenic seeds. The proposed legislature embodied the aspirations of the ruling regime to fast-track the entry of the transgenic seeds into the country. If passed by the Parliament, BRAI would make the existing regulatory committees such as GEAC redundant. In the existing regulatory framework, GEAC was a multi-ministerial, broad-based committee with members from the Ministry of Environment also. The proposed new authority with its minimalistic composition of five members would work only under the Ministry of Science and Technology. If constituted, BRAI would thus eliminate the existing risk-promotion paradigm of regulation. This would resolve the conflict of interest between the two ministries that was structurally embedded in the existing regulatory framework. Instead of laying an emphasis on the assessment of 'risks,' the proposed bill proclaimed the official intent to "promote" the use of biotechnology by "enhancing the effectiveness of regulatory procedures" (DBT 2013, p 1). However, the mechanism through which the regulatory effectiveness could be achieved remained ambiguous in the document. The shrewd ruling regime perpetuated the regulatory ambiguity in the new bill to further weaken the effectiveness of the regulatory apparatus.

An added advantage for agribusiness came from the clause 28(1) of the bill. The decision to disclose information declared as "confidential commercial information" was placed within BRAI. This would keep the decisions of the new regulatory authority outside the purview of a more democratic Right to Information Act

2005.[30] The civil society actors would not be able to challenge the regulatory decisions of BRAI if the latter declared any information related to agricultural biotechnology confidential. Thus, the control of agribusiness over the regulation of transgenic seeds would be strengthened by this clause. Significantly, the bill provided legal immunity to the regulatory authority,[31] as any opposition to the authority would be a criminal offence. Anyone making a false or misleading statement against the decision of BRAI would be punished with imprisonment up to three months and a fine of up to five lakh rupees.[32] The bill debarred civil courts from having jurisdiction over any matter which the Appellate Court of BRAI was empowered to determine.

The most undemocratic aspect of the BRAI bill was an anti-PIL (public interest litigation) clause built into this policy.[33] As a vital tool in the democratization of law, the PIL was used by the civil society to insert itself into the process of governance. The anti-PIL clause meant that no longer could the litigation regarding the regulation of the transgenic seeds be filed in the public interest. This bar on jurisdiction would remove a powerful legal instrument with which the civil society activists and farmers responded to regulatory policies. The new authority was undemocratic also in the sense that there was no representation of farmers or members of civil society on it. Such instrument of coercive power would legally enforce discipline on those groups who did not consent to the regulatory decisions of the state. In effect, BRAI would strengthen the corporatization of regulation in the following ways. It would give an easy clearance to transgenic seeds, keep the biosafety data hidden from the public under the confidentiality clause,

30 See, DBT 2013, Clause 28: 1, p. 16.

31 See, DBT 2013, Clauses 77 and 79, p. 28.

32 See, DBT 2013, Clause 64, p. 25.

33 The bill stated that "with effect from the date of establishment of the Authority, no civil court or other authority shall have the jurisdiction to entertain any appeal in respect of any matter with which the authority is so empowered by or under this act." (NBRA 2008, p. 13).

and eliminate the intervention of the civil society in regulation. Clearly, the hegemonic actors were less interested in the regulation and oversight of agricultural biotechnology than in facilitating its promotion.

Significantly, the timing of the introduction of the BRAI bill in the Parliament coincided with the passage of the Agricultural Appropriations Act 2013 in the US House of Representatives. Popularly known as the Monsanto Protection Act (MPA), the provision stripped the US federal courts of the authority to halt the planting and sale of transgenic crops regardless of any consumer health concerns. The globalization of the repressive legal instruments indicated the transnational diffusion of the imperial devices of control, albeit with different terminology. When the US president Barack Obama quietly signed MPA, he provided legal protection to the corporations engaged in the production of transgenic seeds.[34] Back in India, critics of the BRAI bill saw a close connection between the two legal instruments that were introduced around the same time.[35] The relation between MPA and the BRAI bill hinged around a common concern. The neoliberal actors viewed an effective risk-assessment of the transgenic technology as a risk to the profit-making in the global market. Hence, the control of the state over the regulation of agricultural biotechnology had to be slackened through such legal instruments.

Vehemently opposed by the civil society organizations for leaning towards the seed corporations,[36] the controversial BRAI bill was not tabled in the Parliament over ten Parliamentary sessions

34 See, "Monsanto Protection Act" quietly extended by Congress," available at www.rt.com/usa/monsanto-protection-extended-house-741/ (accessed on October 13, 2013). See also, "Obama signs 'Monsanto Protection Act' written by Monsanto-Sponsored Senator," available at http://ireport.cnn.com/docs/DOC-948797 (accessed on October 14, 2013).

35 See, "BRAI bill, 2013—India's Monsanto Promotion and Protection Act?" Available at www.greenpeace.org/india (accessed on August 20, 2013).

36 See, for example, "No BRAI Bill, please" *The Hindu Business Line.* August 23, 2013.Available at http://www.thehindubusinessline.com/

following its creation. When the environment minister Jairam Ramesh imposed a moratorium on Bt brinjal in 2010[37] (refer to Chapter 5), the Ministry of Science and Technology came under increasing pressure from the Prime Minister's office to table the BRAI bill in the parliament.[38] As the main shaper of the neoliberal policies in the country, the outgoing UPA (United Progressive Alliance) government favoured the BRAI bill as it would further strengthen the government-technoscience-capital nexus. Under the new NDA (National Democratic Alliance) government, the bill remained a bone of contention between the members of the civil society and the hegemonic ruling class; and the controversy has yet not been resolved.

CONCLUSION

The regulation of Bt cotton was a site where the technology linked up to the elements of the global neoliberal order. The collapse of the public/private distinction in regulation manifested as hybridization of the governmental functions. The hybridity of governance allowed the transnational capitalist class to dominate the regulatory regime in the country. The regulation was 'decentered' in the sense that it was not tied exclusively or even pre-dominantly to the state actors. Actors other than the state were harnessed in the network of the hybrid mechanisms of domination and control.

The global disciplining regimes regulated the Indian state in the face of a rising tide of the networked capital. A narrowly scientistic orientation to regulation of Bt technology was yoked to the political-economic goals of the transnational capitalist class. The global actors that were guided by the doctrine of neoliberalism emphasized that scientific knowledge was the sound form of

---

opinion/no-brai-bill-please/article5052683.ece (accessed on October 23, 2013).

37 The issue of moratorium on Bt brinjal is discussed in detail in Chapter 5.

38 See, "Stage set for GM crops." *Down To Earth.* May 31, 2013. Available at http://www.downtoearth.org.in (accessed on Nov 16, 2013).

knowledge, thus the decisive authority in risk-assessment of agricultural biotechnology. The scientism in regulation was meant to delegitimize the messy political contestations in favour of value-free risk assessment of the technology. Science was deployed to define and bound the risks, which could then be dealt by using universal, science-based standards. The universalization of the scientific standards in regulation was a way to remove uncertainty in regulation, hence to ensure control of the global capitalist class over the Indian state. The field-trials, however, reflected a crisis of scientific objectivity within the standardized framework. It became clear that scientism in regulation constituted a new form of politics, where science was used as a political resource to legitimize hegemonic policies.

Various factors caused the contradictions in the regulatory process. Those included a regulatory framework borrowed from other countries for an imported technology; the conflicting requirements of the global regulatory regimes; the conflicting state projects of regulating and promoting the technology placed within the same regulatory agency; an ambiguously defined regulatory authority; and, the narrowly defined 'risks' that legitimized scientific risk assessment to the neglect of the broader politics surrounding the technoscience. Such contradictions were accentuated by the reliance on science that both depoliticized and politicized regulation. In effect, the process of standardization provided a veneer of legitimacy to the regulatory process.

The neoliberal hollowing out of the state dissipated its regulatory power. The decline in the sovereign power of the state was manifested as an increasing corporatization of regulation. In the regulatory process, then, the authority of the Indian state played an ambiguous role. Reduced to an indistinct form, the state appeared and disappeared in the regulatory process than acting as a full participant in it. The transnational capitalist class constructed and sustained the state hegemony, which shaped the contours of the emerging sociotechnical order while being shaped by it.

CHAPTER 4

Privatizing Knowledge

Historically, biological knowledge and political economy have been in a mutually constitutive relationship in India. During the British rule, the imperial state employed the rationalities and techniques of biological sciences to establish the transboundary control over an alien Indian territory and its resources.[1] The agricultural resources at the peripheral Indian economy were exploited to increase the profits at the core economy in Britain (Wallerstein 1974). In this process, the interdisciplinary field of agricultural sciences within biology was deployed to grow selected crops and to exploit the commercially useful native plants.[2] The imperial state used the standardized skills and techniques of agricultural sciences to control the Indian agriculture from a distance. Underlying the standardization was the idea that universal or translatable technoscientific phenomena could be created across the territorial boundaries.[3]

After Independence from the British rule, the newly formed Indian state set the goal of nation-building within a high-modernist, planned social order (Scott 1998). In such a regime, the agricultural sciences were deployed to enable the state to attain the technology-led agricultural development. The postcolonial State developed an

1 Foucault 1991; Cohan 1996; Philip 2004; Prakash 1999.

2 MacKenzie 1990; Ravi Rajan 1996.

3 For a particularly broad discussion of standardization, see Porter 1995. Also, Latour 1983, and Fujimura 1992.

intense and highly charged relationship with agricultural sciences, using which the agricultural sector was planned and controlled centrally. This relationship reached a new high point during the period of the green revolution in the 1960s and 1970s. India's green revolution was possible due to the technical and financial assistance from the US government and private philanthropists, such as the Rockefeller and Ford Foundations (Perkins 1997). The aid was set against the background of the US policy of extending its influence across the world to combat the communist threat during the cold war. The politics of the US-aid intersected with the development project of the Indian state to establish a massive infrastructure for agricultural research and extension services in the country. With the help of the foreign donors and technical experts, an elaborate National Agricultural Research System (NARS) was established in India to usher in a new phase of political economic modernity called the 'green revolution'. The Indian Council of Agriculture Research (ICAR) with its huge network of institutes and research centres, and thirty associated state agricultural universities, constituted NARS.[4]

Although the influential external actors played an important role in setting up the first few agricultural universities and training the faculty within them, the broader research agenda and priorities in NARS were under the control of the Indian state. The participation of the non-state actors in establishing NARS did not disrupt the statist agenda of centralized planning. The planning state funded the agricultural research within NARS, rather than expanding research to private laboratories. Within the context of the welfare State, science was seen as a resource for nation-building rather than for private profits. As a result, the locus of the agricultural research and development (R&D) remained in the public sector. Nonetheless, the state funded the scientists in NARSunder the traditionally idealized notion of scientist-autonomy. This was the idea that the scientists were independently responsible for making decisions about their research choices and practices (Polanyi 1962; Merton 1973). As commercial considerations did not influence the

4 Randhawa 1979; Mruthyunjaya and Ranjitha 1998.

research agenda and priorities of the scientists within NARS, their pursuit of knowledge was largely kept separate from commerce.

However, the experimental and lab-based biologists did not receive the same state patronage as the breeders and agronomists in the green revolution period (Sopory and Maheshwari 2001). The focus of the state funding began to change following the advent of recombinant DNA technology in the 1970s. Two developments in molecular biology that occurred in the US gave birth to the state project of agricultural biotechnology in India. The use of restriction enzymes to cut and splice genes. And the ability of cell fusion to develop hybrid cells with desired characteristics that would multiply themselves. As the field of biotechnology focused on the knowledge production at the molecular level, the nature of knowledge production changed with the arrival of the new biology. Compared to the traditional agricultural sciences, the agricultural biotechnology did not possess a specific disciplinary affiliation. Based on interactions between the proliferating specializations in life sciences,[5] the hybridization of knowledge also necessitated a new skill base to carry out the research in agricultural biotechnology. By breaking the disciplinary boundaries and by shifting the focus of analysis to the sub-cellular level, the mode of knowledge production was decentered and the control over inner mechanisms of plant cells intensified. Unlike the sciences of plant breeding and agronomy,[6] which used to be carried out on open fields, the locus of knowledge production shifted to sophisticated and expensive labs and greenhouses.

The new policy discourse of molecularizing agricultural sciences continued the historical partnership of the biological sciences with the state, albeit in a new form. In the late 1980s, the Department of Biotechnology (DBT) began to fund an emerging community of agbiotechnologists, who worked on particular traits and crops in agriculture. Major efforts in building life sciences laboratories and

5 Such as molecular biology, genetics, biochemistry, biophysics, cellular ecology and so on.

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

training researchers were initiated.[7] As a result, a network of publicly funded life sciences institutions and programs[8] emerged across the country, which received the financial and training support of DBT. The dependence of the Indian science on the lead provided by the epistemic order of the west allowed biotechnology to take roots within NARS. Notwithstanding a laborious and iterative process of knowledge production in agricultural biotechnology, the scientists set out to pursue basic research in the new field. However, they viewed their enterprise as an isolated process, with industry and market coming into play only at the later stages. The science was geared towards the career reward structure of prestigious publications, awards, and membership in elite professional bodies. Besides, such publicly funded research institutions would provide the policymakers with the knowledge inputs to control the agriculture within a centralized grid of planning. This led the biotechnologists in these institutions to pursue knowledge for the sake of politically-determined policy goals, rather than for building the private profit of the industrialists.

SHIFT IN POWER/KNOWLEDGE

The cherished ideal of doing science for the sake of epistemic curiosity, academic rigor, or nation-building stood challenged as knowledge began to be privatized in the new political economy. The privatization of knowledge was triggered by a new policy that favoured the withdrawal of government funding to the public institutions. The policy was in line with the agenda of the

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

8 This includes program support for Indian Institute of Science, 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 Centre 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).

structural adjustment that pushed for the privatization of the public sector. Under the new policy rationale, the government pressured the public institutions conducting high-tech research to generate their own funds. The decreasing funds from the state and the increasing research costs in biotechnology created a situation of crisis. The reason was that the research costs in biotechnology were exorbitantly high. This was because the technique of genetic engineering was not as precise as the analogy with 'engineering' would suggest. Genetic engineering was based more on an experimental tradition of trial-and-error than precise engineering. Inserting a particular gene at the right place was more a matter of chance than calculated design. Whether the genetic manipulation process used particle bombardment or *Agrobacterium* vectors, the success of the insertion of any particular gene remained highly uncertain. This necessitated the repetition of costly experiments, thereby increasing the overall costs of transgenic research.

The research costs of genetic engineering escalated for other reasons also. Not all genes showed a one-to-one effect on protein function, and the complex interactive function of whole stretches of 'junk DNA' remained imprecise. 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. As a result, the science of screening and processing of genetic and protein data had to be perpetually developed. The exponential development of gene sequencing and data processing techniques made the genetic engineering of crops a difficult and expensive process. In addition, the higher rate of obsolescence of lab equipment and ever-increasing strictness of lab safety standards kept the research costs increasing constantly. Meeting the cost of research and maintaining laboratories equipped to a reasonable standard became increasingly difficult for the cash-deficient public labs and universities within NARS. The expensive research was coupled with the limits on high level expertise in these laboratories. The limits on funding and expertise explain why many years of research later, no publicly funded transgenic seeds could be released in India prior to Bt cotton (Scoones 2005). Although much publicity was created around some of the ongoing

experiments, the indigenously developed transgenic products remained far from sight.

The capital-intensive nature of agbiotech research made the knowledge production process political. The nature of technology ordered relations of power between those who had the necessary resources for research and those who did not have them (Winner 1986). As the tale of commercialization of Bt cotton illustrates, it took Monsanto nine years and around 40 million dollars to get its technology commercialized. The public research institutions in NARS and the local seed industry did not possess the economic resources or the political will to launch such an effort. These were partly the reasons why the local seed companies remained rooted in traditional plant breeding techniques. And, in the public research institutions, the scientists with an interest in agricultural biotechnology stayed content with the lower tech innovations. Gradually, it was recognized that unless the state-run research institutions interacted more actively with the industry, the research and development in agricultural biotechnology would lack dynamism (EPW 2000). With the easing of control over the Foreign Direct Investment into the country, the public research institutions expected a creative partnership with the resourceful global biotech industry. Over many years, the transnational seed corporations had cultivated joint ventures and strategic alliances with the local seed firms and research institutions in many developing countries.[9] The corporations capitalized on a large technical workforce in these countries that could be hired at lower labor costs. Thus, the research and development subsidiaries were established for the diffusion of technology into the local seed markets. The corporations made investments in the knowledge production first, and then that knowledge was used for the capitalist expansion across the territorial boundaries.

The resourceful corporations were eager to capitalize on the crisis generated by the lack of funds in the public research

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

institutions in India. With the opening up of the domestic market to global flows of investment and technology, the Indian research institutions gained strategic importance for TNCs. The policies of deregulation of market and privatization of public sector created a conducive environment for the linkages between the public research institutions and TNCs (Government of India 1995, 1997). With time, the global process of commercialization affecting the universities[10] began to influence the knowledge production sites in India. The manifestation of this trend was discernible from the alliance between the public and private research institutions. Such partnerships brought the university closer to the industrial needs and demands, and the public knowledge began to be subsumed within the corporate domain.

CAPITALIZING KNOWLEDGE

The privatization of agbiotech knowledge aided in the emergence of the knowledge economy that occupied and controlled the key knowledge sites. The shift in the nature and locus of agricultural sciences set in motion the transformation of a publicly funded National Agricultural Research System (NARS). The move towards the privatization of agbiotech knowledge began with the setting up of the Monsanto Research Center (MRC) on the campus of the prestigious Indian Institute of Science (IISc). The signing of the memorandum with IISc to build the research centre[11] was a necessity for the seed corporation, as its expansionist agenda had been thwarted in many countries. As a result of the widespread public protests against the genetically engineered crops, Monsanto's progress in the European markets was frozen throughout the 1990s. It was at this stage that the corporation shifted its attention to the agricultural markets in the developing countries. The huge Indian market and the skilled manpower within NARS motivated

10 For detail, refer to Derek 2003; Krimsky 1991; Etzkowitz et al. 1998; Gibbons et al. 1994.

11 See: "Monsanto Research Centre" at http://monsantoindia.com/monsanto/layout/researchcentre/ (accessed on October 20, 2008).

Monsanto to set up the state-of-art research facility on the IISc campus in Bangalore. The setting up of MRC marked a shift in the scientific orientation within NARS, with knowledge becoming a central factor of production for the seed corporations and their allies (Galbraith 1967).

Unlike the more traditional public sector research labs and institutions, IISc had recognized the significance of the emerging field of new biology decades before its alliance with Monsanto. Back in the 1970s, the then director of the institute Satish Dhawan introduced the transdisciplinary field of life sciences into the institution (Current Science2002). Academically trained in the US, Dhawan represented a group of scientists influenced by developments in the field of new biology in the west. Under his directorship, many centers and departments in life sciences were created at IISc. Subsequently, those were linked to research groups working in life sciences in other labs within NARS. The resultant network of the epistemic community became influential in policymaking at the centre and were instrumental in the establishment of the Department of Biotechnology (DBT). Prior to 1990, the DBT had channeled public funds to IISc for basic research in life sciences. But the situation changed when the government began to withdraw the financial support to the institution. Like other publicly-funded research institutions, IISc began to face a funding crunch in the capital-intensive research in agricultural biotechnology.

To counterbalance resource inadequacies, the IISc forged an alliance in agbiotech research with Monsanto (Government of India 1995, 1997). An agreement was signed with the corporation during the tenure of the former director of the institute, G. Padmanaban, that linked the public and private knowledge production. Under the agreement, the Monsanto Research Centre (MRC)[12] was set up on the premises of IISc in Bangalore. As per the terms of the agreement, the corporation paid 300,000 US dollars per year to IISc

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

as annual rent.[13] In return, the institution provided Monsanto with land on its premises to construct its laboratory and a greenhouse space. The scientific workforce of MRC was drawn from different departments of IISc, who were directed to work in the areas of crop transformation, crop protection and bioinformatics. The material transactions and academic support crystallized into the joint research center, where the partners were supposed to tap into each other's strengths. The linkage of IISc with Monsanto symbolized the beginning of the privatization of knowledge in the country, which was emblematic of a global process of commercialization of the universities.

The partnership between Monsanto and IISc signified the penetration of the global capital into the public research institutions.[14] The enrollment of the influential IISc into its expansionist project provided Monsanto a scientific window on the emergent biotechnologies. Within the changing political-economic context, Monsanto reoriented its commercial vision and outsourced its R&D activities to India. Simultaneously, the corporation made a strategic move away from crop protection products, mainly herbicides, to transgenic crop production.[15] Spurred by the neoliberal policies of value addition through technological change and the increased role of knowledge in the

13 See "India"s finest, for hire," at http://www.nature.com/nature/journal/v407/n6806/full/407830a0.html (accessed on September 9, 2008).

14 "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.

15 "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.

creation of wealth, the IISc underwent a change to incorporate an entrepreneurial mode of research. The notions of value addition, profit, and efficiency came to define the entrepreneurial science. The emerging culture of intellectual property rights (IPR) and creation of wealth from knowledge was meant to give rise to the "entrepreneur in a scientist" (CSIR Report 1996). The hybrid identity of entrepreneur-scientist motivated the knowledge workers at the institute to venture into the knowledge-market space.

The relationship between IISc and Monsanto symbolized a pattern of outsourcing and service support to the transnational corporations. This was made possible by the added 'revolution' in information technologies that networked the globally diffused R&D operations. The internet facilitated the rapid transfer of information between the corporation and IISc, which were separated by large distance in space across territorial boundaries and time zones. As a result, the headquarter in the US and the subsidiary at Bangalore could work together on the corporation's ambitious projects. Enabled by the enhanced connectivity through information technologies, the R&D capacity was constituted by a global network of researchers whose location was rendered insignificant. The global science activity was networked among different centers, as exemplified by the work on Bt cotton that was carried out through connections between the scientists in the US, India and China. While the corporation subcontracted research work to the subsidiary laboratory at IISc, the control of the research remained with the company headquarter in the US.

Asymmetrical Partnership

The control over the production of knowledge was centralized, while the process of production itself was decentralized across territorial boundaries. In contrast to the earlier state funded agricultural science that was done within the country, the researchers in MRC had regular interactions with their head office in the US. And, they frequently moved between laboratories of the corporation in Asia and the US. The work at MRC was supervised by group directors and the planning process was overseen by the head office at St.

Louis in Missouri, USA. After setting the priorities, specifying the timelines and allocating the budget, the head office expected the Indian laboratory to follow instructions. The everyday research activities and interactions were put under surveillance through strict commercial secrecy provisions (Scoones 2005). Any publication from the research had to be approved by the head office. Through such practices, the corporation maintained control over research and the secrecy of research information from its competitors. The scientists at IISc working for the corporation resented the control through such surveillance mechanisms and the resultant loss of research autonomy. But they did 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.

The collaborative research between IISc and Monsanto was tilted in favour of the corporation. The agreement between the institute and the corporation encouraged the joint use of research facilities and capacity, yet the symbiotic relationship that underlines a public-private partnership was missing in practice. 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. As a result, the market performance and the profits of the corporation showed a marked improvement in India, with sales doubling in 2000-01 to 2.68 billion Indian Rupees.[16] The IISc provided cheap intellectual labor and the corporation reaped the proceeds. The partnership met with other constraints, such as the lack of clarity in material transfer agreement and bilateral agreement for technology development. Besides, there was a lack of well-defined modality for mutual human resource development, and lack of empowerment of IISc managers to take the required administrative decisions (APCoAB 2007). Thus, the relationship could not uphold interdependence and complementarities that

16 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.

underlie a public-private partnership. Rather, it reinforced the hierarchy between the two organizations that conferred vertical control of the corporation over IISc.

The networked, global research and development gave Monsanto an advantage in terms of its ability to shift work as desired between various units dispersed in space. For instance, a year after the official approval of Bt cotton, a group of angry farmers ransacked the building of Monsanto Research Centre (MRC).[17] The farmers did not know that MRC had recently shifted from that place to an undisclosed location. Prior to this attack, MRC had become a site of protests against agricultural biotechnology. The ammunition for the protests came from a spate of farmers' suicides in the region following the introduction of *Bt* cotton.[18] Staging demonstrations against the corporation, the farmers shouted slogans demanding Monsanto to close down its operations in India. Significantly, the recent attack on the research facility was timed to draw the attention of those attending the World Trade Organization meeting in Cancun, Mexico. Although the corporation successfully evaded the attack on its research facility, the farmers confronted the hegemony of the transnational capitalist class by attacking a part of its knowledge apparatus.

When its research centre at IISc became a target of continuous protest by the activists, Monsanto wound down its operations there. It moved the research facility to a new, unmarked site. The sudden closure of MRC 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, MRC did not justify the investment currently made. Clearly, IISc had no

17 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.

18 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).

say in the matter and lost a cutting edge research facility. The unceremonious closure of MRC showed the tendency of global capital for a sudden flight in the face of uncertainty regarding its profits. The corporation evaluated the core research priorities constantly and shifted investment patterns accordingly. It was not considered necessary to give an explanation to the research subsidiary for closing down the research facility abruptly (*EPW* 2000).

With the failure of this model of public-private partnership, it became clear that the interests of the local research institutions were not safeguarded in the transnational knowledge networks. The institutions ended up becoming convenient locations for the temporary subsidiary research facilities for the headquarters of TNCs located in the parent countries. The case of MRC highlighted that public universities and research institutions engaged in agbiotech research and development had entered a precarious position. They were beginning to walk a tight rope between shallow resources and research interests on the one hand, and comfortable levels of investment of TNCs but markedly less control over research administration and priorities on the other. The change was most evident in the area of the ownership and control of knowledge that shifted to the seed corporations. This new paradigm of privatized knowledge created conditions for the emergence of a knowledge economy based on unequal power relations. While technical practices of the seed corporations and the public research institutions began to circulate in both directions (Klienman and Vallas 2001), the global agbiotech industry appeared to have an upper hand in the process.

The growing market penetration by the global seed corporations led to enormous pressure on the local seed companies to catch up with the former. The domestic seed industry struggled to cope with the pressure to deliver in the new economic context and to maintain their market share. To survive the competition in a liberalized economy, these companies began to embark on research and development in agricultural biotechnology. Some seed firms, such as JK AgriGenetics, set up separate divisions for biotechnology research in those crops in which they owned a large share in

the hybrid seed market. Despite the existence of many research institutions and universities that specialized in agbiotech research training, most of these companies did not get relevant manpower for absorption into their R&D units (Chaturvedi 2002). This was because they had to compete for highly skilled manpower with the transnational seed corporations. The latter attracted researchers due to their ability to provide access to capital, including the gene sequences, which was essential to research and development in the field of biotechnology. Because of the shortage of skilled manpower, the local companies struggled with identification of relevant gene sequences for producing transgenic seeds.

Further, the high capital costs of R&D led to resource crunch for the domestic seed industry. In order to retain their market share, most of the research took place as part of their alliances with the global life sciences corporations. The firms tied up with the transnational corporations for accessing the vast pool of gene sequences. However, their problem was compounded by the growing number of genes or gene sequences coming under patent ownership of the corporations. As a case in point, Monsanto that owned the patent on Bt technology licensed the *Cry1Ac* gene for fee to scores of Indian companies for the widespread diffusion of Bt cotton (Krishna 2004). The private ownership of genetic knowledge produced two categories in the knowledge economy; those who owned patents on knowledge and those without them. The transnational capitalist class constituted the former and the local researchers formed the latter category.

Upon entering into alliance with TNCs, the role of the local companies was restricted to backcrossing the patented genes of the corporations with local varieties. The case of Mahyco getting into alliance with Monsanto and backcrossing the Bt gene into a local variety is illustrative here. Following Monsanto, other transnational corporations like Syngenta, DuPont and Aventis began to forge linkages with local seed companies. The former possessed financial resources, science skills and technical know-how; and the latter had popular brands and extensive market penetration locally. The TNCs forged such linkages to boost their credibility as legitimate players in the local seed market, and to

tap into the trust that the local companies had built with the farmers. In addition, the linkages facilitated their understanding of the regulatory environment of the country. Consequently, the boundaries between the technoscientific, political and economic domains were further blurred.

KNOWLEDGE BASED HEGEMONY

Globalizing Patent Law

The genetic engineering techniques gave the US seed corporations commercial advantage globally. Those techniques could be understood by interested scientists in other countries, hence the know-how became a source of competitive threat for the corporations. In order to combat the threat, the patents were deployed to control the free flow of knowledge. The knowledge became the private property under the patent regime and the free exchange of knowledge was curbed. The intellectual property regime policed the agbiotech knowledge production and consolidated the networks of command around the technoscience. The violation of patent law would be punished by the legal apparatus that was institutionalized as part of the IPR regime. The secrecy in research at MRC was related to the patents[19] on knowledge, whereby the right of ownership to knowledge remained with Monsanto. Even though the immediate producers of knowledge were the Indian scientists working in an asymmetrical partnership with the corporation, the knowledge thus produced was the private property of the corporation. The patent right prevented third parties from making, selling or using the products and processes owned by the

19 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.

corporation. In order to capitalize on the knowledge produced by the knowledge workers in such research facilities, it was essential for any TNC to hide new research from the competitors. This gave the seed corporation a form of monopoly control over the genetically engineered products and created a legal means of limiting the market competition.

The hegemonic power based on knowledge manifested as the global regime of intellectual property rights. The abstract logic of domination worked through the global regime of intellectual property rights that undermined the free flow of knowledge. Historically, the inner mechanisms of a living cell were brought under the legal control in the United States. The non-patentability of the life forms changed with the landmark Supreme Court case, *Diamond v. Chakrabarty* (Lumelsky 2005*)*.[20] As a genetic engineer working for General Electric, Ananda Chakrabarty modified a strain of bacteria by inserting new genes in it. The foreign genes gave the bacterium an ability to break down hydrocarbons, which was useful for cleaning up the oil spills. The bacterium was man-made and had a new composition of matter. In order to claim patent on his invention, the 'inventor' took the case to the Supreme Court of the US. The court decided that the genetically engineered bacterium was patentable because it did not occur naturally and was a result of human efforts. The issue that the invention was alive was not considered a legitimate legal question by the Supreme Court.

By interpreting the statutory language broadly, the court made a live, man-made bacterium patentable under the US Plant Patent Act (PPA).[21]In regarding living forms as patentable biological 'objects,' the court ruling did not consider that by its very nature biotechnology was ontologically mutable. At one moment,

20 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).

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

biotechnology could refer to a material object and, at another moment, it would refer to information coded on the gene. Because of the fluid identity of biotechnology, the problem was whether the patent on a biotechnological artefact protected the material object or the information. Technically, patent law presupposed the stability of a patented object and kept abstract information outside its domain. Through the court ruling, biotechnological inventions were regarded as stable, unchanging 'objects' that could be patented (Carolan 2012). The court's generous interpretation of PPA established a new standard for invention, and the trend towards the legal acceptance of the commodification of germplasm was set into motion. Subsequently, a series of biotech patenting cases in the US expanded the legal boundaries of the patentable living matter.

The inclusion of biotechnological inventions in the realm of intellectual property regime was the most important instrument through which the commercial interests of seed corporations could be furthered (Chaturvedi 2001). The patent law narrowed the traditional seed saving exemption for farmers codified by the US Plant Variety Protection Act (PVPA) of 1970. After the emergence of the multi-billion-dollar agbiotech industry in the US, the corporations advocated the stringent patent policies beneficial for them. The nexus of industry, university and government influenced the domestic intellectual property regime in the US.

Some US corporations and the office of the United States Trade Representatives (USTR)[22] successfully linked intellectual property with the global trade regime at the Uruguay Round of multilateral trade negotiations. This eighth and last round of trade negotiations under the auspices of the General Agreement on Tariffs and Trade (GATT) led to the creation of the World Trade Organization. A dozen US corporations lobbied to link intellectual property to GATT in order to bring the Trade Related Intellectual Property Rights (TRIPS) into existence (Sell 2002). The TRIPS agreement of the WTO provided a framework for the formulation and implementation of the global Intellectual Property Rights (IPR)

22 See, Stein 2005; Sell 2002.

laws. Under the TRIPS agreement, stringent standards for the protection and enforcement of intellectual property were laid down. Many of these standards, including patents, were modelled on the domestic law of the United States. By combining the TRIPS and GATT agreements, the WTO incorporated the patent standards favorable to the US agribusinesses into the global regulatory order (Drahos 1995). This was a strategy to push an intellectual property regime favorable to the US onto the global stage.

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 possess a competitive advantage in the production of highly valued technologies (Keohane 1984). One way to control the material objects was through the control of abstract knowledge. This would allow control over the sources of capital and markets. For example, the patent right over a transgenic seed constituted a property right over an abstract knowledge. This gave the owner the power to determine the material reproduction of the technological know-how. By strengthening the rights of the owners of biotechnology through enhanced monopoly power conferred by the TRIPS regime, technology flows in a global world could be effectively controlled. Besides, the dominant interests represented by the transnational corporations could be secured.

As one instrument in a broader framework of economic liberalization, the TRIPS agreement created a global enforcement mechanism for IPR. This obligated the member countries of WTO to provide harmonized standards of IPR protection.[23] With time, TRIPS emerged as a mechanism to globally enforce and police the US intellectual property rights. The agreement obliged the member countries, including India, to provide patent

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

protection to life forms and biotechnological processes (Watal 1998a, 1998b). From the point of view of developing countries, the inclusion of intellectual property rights in the World Trade Organization (WTO) lacked a convincing rationale.[24] Clearly, it made IPR subject to the enforcement mechanism of WTO. This meant that the non-compliant WTO members would face trade sanctions if they failed to live up to the rules. As a result of the control exercised by the resourceful industrialized countries over biotechnology, the developing countries like India did not have access to the technology on reasonable terms.

Reconfiguring Indian Law

The emerging regime of global property protection posed major challenges to the Indian patent law. The patent system in the country was different from the one advocated by the global intellectual property regime. Under the Indian Patent Act of 1970, life forms that included plants and micro-organisms were excluded from patentability.[25] The law recognized that the natural processes and products did not constitute man-made inventions. Moreover, seeds were regarded as common property resource in the public domain. The patent law ensured that farmers' rights to save, exchange and improve seeds were not violated (Shiva 2003). Under the existing patent regime, then, the law did not provide the corporations monopoly in the seed sector; nor did any corporations get an exclusive marketing right[26] over agricultural technologies.

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

25 Watal 1998a, 1998b; Chaturvedi 2001, 2002; Gupta 1993. Also, see Indian Patents Act, 1970, available at http://www.patentoffice.nic.in/ipr/patent/patAct1970-3-99.html (accessed on October 22, 2009).

Also, 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).

26 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

The situation changed with the policy of deregulation that let the entry of TNCs into the market. The corporations eyed the huge seed market in the country and wanted strong patent protection for their products. One of the main objections of the transnational corporations to the Indian patent law was that it allowed for process and not product patents. The underlying fear was that it made the Indian firms find alternative processes to produce the pirated versions of a technology. The Indian agricultural and pharmaceutical companies were accused of copying technologies developed by the industrially advanced countries.[27] It was believed to have led to large-scale losses for the US economy. Such a discourse of intellectual theft was constructed to push for a change in the patent policy in India. The key was to get the Indian government enact the same standards of patent protection that the corporations had in the US. In line with the stance of its corporations, the US government considered the lack of patent protection for TNCs as unfair knowledge practice and emphasized the harmonization of patent laws across countries.

The US government used a sophisticated process of trade threat to coerce the Indian state into complying with the global intellectual property objectives. This position sharply contrasted with the demands of the Indian civil society for the localization of intellectual property laws. Under its Trade Act "Special 301," the US threatened the Indian state with trade sanctions if the intellectual property protection demanded by the former was not accepted.[28] The motivation for the use of this coercion came from the transnational seed corporations such as Monsanto. The corporations successfully convinced the US government that trade coercion was the only way to stop the theft of the US technologies

---

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).

27 See: www.iprsonline.org/ictsd/docs/ResourcesTRIPSanita_ramanna.doc (accessed on November 5, 2009).

28 Refer to Sahai 1992; Patnaik 1992. Also see: www.assocham.org, History p. 9. (accessed on November 8, 2009).

and economic profits. When the pressure for the uniform IPR standards mounted, the Indian state consented to change its patent law. There was no major domestic political constituency that favoured policy change initially. The resistance to patent reform came from both the major political parties, the Congress and the Bharatiya Janata Party (BJP). Eventually, both these parties abandoned the opposition to patent reform and adopted a pro-patent position under the compulsions of the changing economy.[29]

Other influential bodies also supported the amendment of patent laws in conformity with the provisions of TRIPS.[30] The representatives of the domestic industry, such as the Confederation of Indian Industry (CII) and the Associated Chambers of Commerce and Industry (ASSOCHAM), supported the patent reforms. Before the Gujral Committee, which wasestablished by the Indian Parliament to solicit views and prepare a report on the impact of WTO Agreements on India, the industry spokespersons emphasised that the country needed to change the patent laws. The Council of Scientific and Industrial Research, with its chain of forty laboratories, joined the chorus that the local patent laws must change. The change in the stance of such domestic constituencies reflected a shift to the global market-oriented position; and the state responded to the pressure by changing the patent law eventually. Underlying the change in stance was the fear of being left out of the global trade. This was coupled with a belief that the development in the new economy was dependent on the protected technological inventions (Eaton and Kortum 1996). The state expected that the harmonized IPR regime would attract relevant technologies and increase the flow of Foreign Direct Investment into the agricultural sector (Maskus 1998).

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

30 See, for instance, "CII's Wish List for the Government," at www.cii.org (accessed on June 10, 2011).

The living forms were non-patentable in India initially. Because of the concerted efforts of the global capitalist class, the genetically engineered organisms were brought under the intellectual property regime. The transnational hegemony was formed as a particular mix of the coercion from the non-state actors and the consent of the Indian state to change the patent law. Through the global enforcement and surveillance mechanism for IPR, the Indian patent regime was eventually brought in line with the harmonized global IPR standards. The Indian Patent Act of 1970 was amended under the Acts of 1999 and 2002 to allow process patents in plant varieties (Ramakrishna 2003). The amendments introduced the exclusive marketing rights to patent holders and the mailbox arrangements for receiving patent applications.[31] As the supranational IPR regime penetrated and reconfigured the domestic patent law (Hardt and Negri 2000), genes were made the object of economic value.

Crucially, the amendments also translated Article 27.3 (b) of TRIPS into the Indian patent law. In a complex formulation, Article 27.3 (b) stated 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."[32] Apart from the complex wording, the article was ambiguous in meaning. There was a lack of clarity on the reasoning used to decide what could and could not be excluded from patentability. The ambiguity was in the following ways. It was not clear as to 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. And, why the option of exclusion of patentability of

31 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, 2011). Also, see Chaturvedi 1999; Shiva 2003.

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

essentially biological processes did not extend to microbiological processes (Yamin 2003). The latter were also biological processes. The moving of genes across species through genetic engineering could be defined as non-biological, in the sense that such mixing of genetic material did 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). Notwithstanding the legal ambiguity of the amended patent act, the biotechnological processes were now patentable. Such legal ambiguity led to different interpretations of the TRIPS provisions; and the interpretive flexibility of the article opened the floodgate for patenting transgenic seeds.

Expropriation of Commons

The idea of the ownership of life forms marked a shift in the approach to knowledge production. Implicit in the term 'intellectual property rights' was the ownership of knowledge in private hands primarily for commercial purposes. All important components and production processes of a transgenic crop could now be patented and regarded as confidential business information (Gupta 2000). Partly, it was this confidentiality clause in IPR that provided Monsanto a right to withhold field trial data of Bt cotton from the regulators. Because the regulatory authorities were public sector scientists often engaged in similar research in agbiotechnology, the corporation was reluctant to share information related to field testing and data generation with such public sector competitors.

Various genetic components in a transgenic crop were now patentable under the new intellectual property regime (Kapur 1999). This included the plant variety germplasm, the selectable marker gene, the novel trait of the gene, the promoting and coding sequence, and the gene expression technology. Such fragmentation inherent in the patenting of genes was convenient for the commercial concerns. Nonetheless, it violated the commonly held notions about the integrity of life forms. The common intellectual property rights of farmers were also denied under the new patent regime. Until recently, farmers had the right to save, replant and

resell seeds to other farmers willing to buy seeds with desirable characteristics. The genetic composition of seeds, rather than the seed itself, was considered part of a common heritage that were bred and distributed freely in the public domain.

The political economic order of corporate capitalism set in motion a cycle of the expropriation of commons (Hardt and Negri 2000). It systematically destroyed the commons as a space of ownership. Traditionally, the integral element of the relationship of the community of farmers to their knowledge was its non-commoditized and communally owned nature. Significantly, the IPR regime on life forms devalued the community intellectual rights that used to be under community control. In the emerging global order, the rights of farmers and public scientists were subjected to the initiatives of appropriation. The seeds were no longer treated as public commons that used to be freely accessible earlier. The TRIPS/WTO regime represented the visible face of the life sciences industry that considered biodiversity as a raw material for the production of transgenic seeds. It denied that farmers made a significant intellectual contribution to agricultural biodiversity, including seeds and plant genetic resources (Kloppenburg 1988).

There were potential conflicts, more of a political nature than legal, between the TRIPS patenting regime and the Convention on Biological Diversity (CBD). The IPR regime under multilateral agreements, such as GATT and TRIPS, denied the intellectual and material contribution of the farmers to the global knowledge system. This stood in contrast to CBD, a treaty signed in 1992, that acknowledged the intellectual rights of indigenous communities. The treaty recognized the contribution of farmers to biodiversity knowledge and conservation over generations. So, it supported the need to equitable benefit sharing with the farmers. Nevertheless, the intellectual property rights on life-forms did not reward the informal system of innovation, creativity and knowledge dissemination. The lack of a reward system for past conservation, on-going collective innovation, and knowledge disclosure was one important concern in the linkage of IPR with agbiotech research and development (WIPO 2001). At stake in agbiotech knowledge

production, then, were the rights arising from the contributions of farmers in conserving, improving and making available plant genetic resources.

Along with the reconfiguration of the domestic patent law, the values that had guided the agricultural knowledge production so far were redefined. The capitalist values of self-interest and greed were stretched to the Indian context where scientists had traditionally preferred community-interest over self-interest. With the setting up of MRC, the initial shift from an idealized Mertonian science to commercial science took place. The former regarded disinterestedness as the essential norm of science, whereby the scientists gave up concern for the ownership and commercial application of their knowledge. And, the latter upheld interestedness of scientists and the private ownership of knowledge as the new ethos of science (Merton 1973). The IPR regime consolidated the step towards the propertization of knowledge, thus the private appropriation of the commons.

ENTRENCHMENT OF HEGEMONY

Consequently, a serious challenge was posed to the state reliance on public sector R&D as the mainstay of developmental goals (Gupta 1993). The definition of what constituted the "public good" in terms of knowledge production and consumption underwent a change. It changed from pursuing research in public interest to the accumulation of private profits from technoscientific knowledge. Instead of creating a level-playing field in knowledge production, the market was tilted in favor of the global agribusiness at the expense of local knowledge producers. The dominant discourse on the privatization of knowledge was reinforced 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 the patents on life forms:

> The new patent legislation would provide responsible and reasonable protection to private seed companies...There would be very few inventions, particularly in agriculture, without patent

> protection...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.[33]

Such an essentialist idea about human nature suggested that knowledge could not be produced unless there was a motive of private profit. The underlying capitalist logic guided the shift from the common rights to private property rights through the IPR regime. The propertization of knowledge was regarded essential for the knowledge economy that was driven by the scientific discoveries underpinning the gene revolution. In this process, Monsanto led the way in infusing the corporate 'for-profit' scientific practices into the domain of agbiotech knowledge production. The establishment of the Monsanto Research Centre (MRC) at the Indian Institute of Science (IISc) signaled the beginning of the institutional transformation of NARS. The proprietary view of agbiotech knowledge in an open global seed market contributed to the entrenchment of the knowledge-based hegemony. The transboundary extension of the intellectual property rights began to integrate the locally produced knowledge into the global agbiotech industry.

The latest move towards privatization was the introduction of the Indo-US Knowledge Initiative in Agriculture (KIA). It was a policy instrument that further extended the reach of the hegemonic power into the domain of knowledge production. A few years after the commercialization of Bt cotton, the then US president George Bush made an official visit to India. Among other things, he announced that India and the US would enter into an Indo-US Knowledge Initiative on Agriculture (KIA). The US president emphasized that the initiative was to promote a "Second Green Revolution" in India, which primarily meant a promotion of transgenic crops. Following this announcement, the then Indian Prime Minister, Manmohan Singh, approved the Indo-US Knowledge Initiative on Agriculture (KIA) during his visit to the

33 See: "Protect Private Sector in Farm Research: Glickman," *The Hindu*, January 30, 1996.

US. Addressing the US Congress in 2005, the then Prime Minister Manmohan Singh stressed the following:

> The Indo-US KIA will focus on basic and strategic research for sustainable development of agriculture. This will meet the challenge of raising productivity. Moreover, it will help the Indian farmers to meet phytosanitary conditions and enable them to participate more fully in global agricultural trade.[34]

The agreement encompassed a neoliberal vision of market-oriented production and consumption of agricultural knowledge. The delineated aim was to recast India's agricultural policy in order to link the agbiotech knowledge production with the global trade. The policy initiative crystallized the agenda within a patent regime that consolidated the transnational capitalist control over the production of knowledge. The global patent regime had already reconfigured the local patent policy to safeguard the interests of the influential transnational seed corporations. Under the terms of this deal, the Indian Council of Agricultural Research would provide the researchers in the United States an access to its network of laboratories and universities for research (Jayaraman 2006). Thus, the policy bound the formal scientific research in NARS to the needs of the US research institutions and corporations (Raina 2006). It would further consolidate the capitalist appropriation of knowledge produced by the skilled and cheap technical labor in India.

From the beginning, KIA focused to place the control of the Indian seed market with the US agribusiness and to weaken the agbiotech regulatory regime. The board that was set up for the implementation of KIA included the transnational corporations, such as Monsanto, Cargill and Walmart as the official US representatives.[35]The critics of the deal suspected that the latter set up the agenda for KIA, with development of transgenic strains

34 See complete text of the speech at http://pmindia.nic.in/speeches.htm (accessed on Dec 17, 2011).

35 See, "Unequal partners." *Frontline*. Volume 23, Issue 5, March 11-March 24, 2006.

of rice and wheat forming a major part of the initiative.[36] The penetration of the transnational seed corporations into the state apparatus strengthened the transboundary network of command over a highly specialized research in agricultural biotechnology. The privatization of agbiotech knowledge thus pushed along both technical and juridical paths, thereby entrenching the hegemony of the globally operating institutions and regimes. This accelerated the decentering of agbiotech knowledge production sites throughout the global space (Hardt and Negri 2000). However, the process provoked a corresponding centralization of control over knowledge production and distribution in the resource rich transnational seed corporations.

CONCLUSION

The change in the nature of agricultural knowledge facilitated the privatization of its production and distribution. The neoliberal policies paved the way for the penetration of the transnational seed corporations into the domain of the agbiotech knowledge production. As the preferred site of knowledge production moved to the private laboratories, the public sphere of knowledge began to be subsumed within the corporate domain. The alliance with transnational corporations began to link the public research institutions within NARS to the global agbiotech industry. Through a series of asymmetrical public-private alliances, the knowledge production sites in the country linked up to the global agbiotech industry. A convergence of institutional patterns via globally dispersed agbiotech knowledge production practices and intellectual property regimes thus took place.

As the State withdrew its support to the public research institutions in the neoliberal economy, the resource dependence of the agbiotech knowledge producers on the transnational corporations increased. As a result, the practices and culture of

36 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).

agbiotech knowledge production underwent a significant change that allowed the appropriation of the knowledge by the corporate sector. Through this process, the immanent relationship between the public research system and commonly owned knowledge was disrupted. It was replaced by the transcendent power of knowledge as private property that operated across the territorial boundaries. The knowledge-based hegemony operated through the institutional mechanisms of control that limited the technoscientific flows in the global world.

The propertization of knowledge through the IPR regime symbolized the materiality of power/knowledge integral to the new phase of global capitalism. The new regime redefined the relations of knowledge production and consumption in the emergent knowledge economy. The global IPR regime reconfigured the local patent law to safeguard the interests of the powerful transnational seed corporations. The process was complex and multifaceted, involving the interplay of internal and external factors. The external interference integrated the local patent regime into the harmonized global IPR regime. Through the global enforcement and surveillance mechanism for IPR, the Indian patent regime was eventually brought in line with the harmonized global IPR standards. This happened through the coercion mechanisms deployed by the transnational capitalist class that brought about the consent of the Indian government. The hegemony of the transnational actors was entrenched through measures that privatized agbiotech knowledge with the consent of the local actors.

CHAPTER 5

Mobilizing Multitude

The arrival of Bt cotton in India was not a quiet moment. A section of the civil society launched an intense struggle against the controversial technology. Against the background of the epidemic of farmer suicides, the activists contested the meaning of the new technology, challenged the form of its regulation, and articulated the needs of the farmers. In doing so, the technology was associated with the new political-economy that had necessitated the deployment of Bt cotton in the agricultural sector. Forging the relationship of the technology to the agrarian crisis, the discourse of the vulnerability of farmers and peasant dispossession powered the resistance movement. Each campaign of the activists ushered in a new framing of the power relationships embodied in the technology.

The resistance movement involved the mobilization of multitude against the technology and its political economic context. Here, the multiple and overlapping networks of subversive power constituted the multitude (Hardt and Negri 2000). The resisting multitude challenged the transnational, hegemonic sociotechnical order. Various strategies of mobilization were deployed and new subjectivities were produced in the process. A combination of science, technology, symbols and spectacle were deployed to subvert the power of the emergent hegemonic network. While doing so, a part of the movement ended up becoming a hegemonic force itself. To counter the dominant activists, the marginalized farmers mobilized the submerged networks to resist the resistance

movement. Together, these strands of the resistance led to the reconfiguration of the technoscientific policy that shaped the contours of the emergent sociotechnical network.

CONSTRUCTING COUNTER-EXPERTISE

One group of the urban, elite activists mobilized science to support their oppositional claims and to lend legitimacy to their resistance. The science performed by the activists was based on unbinding the relationship between official experts and the science of regulation (Moore et al. 2011). In opposing Bt cotton, the elite activists resorted to "rational science" to contest the regulation and the performance of the technology on the fields. They argued that the experimental designs of the field-trials conducted by Monsanto-Mahyco Biotech Ltd (MMB) were not rational as those lacked the objectivity required of scientific experiments. The campaigns of the activists against Bt cotton were empirically tethered to scientific facts that were generated through grassroots research conducted by the leading Non-Governmental Organizations (NGOs). The activists believed that they had the necessary expertise to generate scientific evidence to support their oppositional claims.

In one such study, the Research Foundation of Science, Technology and Ecology (RFSTE) headed by Vandana Shiva carried out the field surveys to probe into the details of the field trials of Bt cotton. This was after MMB got permission from the Review Committee on Genetic Manipulation (RCGM) to carry out small-scale field trials on forty locations in nine states. In their study, the RFSTE researchers claimed to have analyzed a wide range of issues:

> We 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 the field-trials, the RFSTE researchers did not depend on the external scientific expertise. They relied on their own science to dispute the official science behind regulation. Their expertise derived from socio-economic and agronomic knowledge, besides the knowledge of methodology required for surveys. The research team was composed of agricultural scientists, economists and sociologists, who relied on interviews with the farmers at various trial sites. The team claimed to have carried out a comparison of the parameters of field trial design, as specified by the biosafety guidelines, with the actual field trial practices of MMB.

The activist-scientists presented their findings in technical terms to deconstruct the scientific claims of the regulators and MMB. The key findings of the study were carried in a pioneer social sciences journal *Economic and Political Weekly* (Shiva et al. 1999). Along with the technical text of the report, the activist-scientists used a visual set of inscriptions in the form of statistical tables to mobilize support for their claims (Latour 1987). The visual display compared the actual dates of field trial plantings and the date of permission granted by DBT, the yield reported by the farmers in the trial plots, and the quantity of pesticides sprayed on Bt cotton trial plots. Other details of field trial sites in terms of the location, names of farmers owning those plots, and the size of the plots was also included. Soon, other NGOs such as the Greenpeace India, the Deccan Development Society (DDS) and the Gene Campaign conducted similar surveys and experiments. Through this plethora of studies, the grassroots researchers assessed the performance of Bt cotton on the Indian farms.[1]

1 For example, 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).

Debunking the claims of the regulators about the scientific soundness of the field trials, the activists asserted that the field trials lacked methodological rigor. The methodology of the official experts was regarded as superficial and faulty, while their own methodology was upheld as rigorous, accurate and transparent. The idea of the scientific method of the former was challenged to counter the hegemonic expertise of the regulators and their corporate partners. Some activists offered credibility to their own studies by claiming that the data collectors were village-based grassroots researchers, who had a deep understanding of agriculture (Qayum and Sakkhari 2005). The grassroots researchers had conducted season-long studies by staying close to the farmers to record their perceptions about Bt cotton. The data was collected on a regular basis over a period of time. Simultaneously, the experiences of the farmers about the performance of the crop were captured on video in some cases. The video documentations continued till the end of the crop season. The visual data provided rhetorical force to their findings, and helped them mobilize allies. By engaging laypeople in research practices typically reserved for certified scientists, such methodology challenged the very idea that a hermetic boundary could be established between the technical and the nontechnical spheres (Brown and Mikkelsen 1990).

In response to the perceived hype surrounding Bt cotton, the activist-scientists were motivated to counter the scientific claims of the official experts. The surveys conducted came up with contradictory evidence regarding the officially proclaimed efficacy of Bt technology. Hence, the field trial data of Monsanto was regarded as fabricated,[2] which supported the failure narrative of *Bt* cotton. The science deployed by the activists was meant to show that the regulatory decisions relied on partial evidence and ambiguous results that black-boxed key uncertainties related to the technology. While Monsanto claimed that the cultivation of Bt cotton dramatically improved yields and reduced pesticide use

---

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

2 See: *BBC Monitoring*, 20 July, 2000.

(MMB 2004), the studies by the activists showed only nominal yield improvements and little or no pesticide use reduction (Qayum and Sakkhari 2005). Instead, it was 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. Besides, the exorbitant price of Bt cotton seeds offset any increase in revenue from the improved yield.

The commercial release of Bt cotton was represented as a disaster in view of a range of issues.[3] The entire regulatory process was considered flawed. The main reason was attributed to Monsanto that was given improper authorization to field test transgenic Bt cotton. Besides, the existing biosafety regulations against the adverse ecological and human health effects of the transgenic crops were inadequate (RFSTE 1999a, 1999b). It was concluded that a comparative study of pest incidence in transgenic and non-transgenic fields as mandated by the biosafety guidelines had not been conducted in the field-trials of Bt cotton. In addition, the mandatory containment measures as outlined in the biosafety guidelines were neglected in these trials. For instance, 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). Moreover, the field trials were deliberately conducted at a time of the year when the infestation of pests was low (Shiva et al. 1999). This was done to give an impression of the improved efficacy of *Bt* cotton seeds over the controls used in the field-trials.

The opposition to Bt technology heated up when Vandana Shiva filed a public interest petition to the Supreme Court in 1999, whereby the form and content of the regulation was disputed. The statistical data generated by primary surveys of the field trial sites was submitted to the court to challenge the scientific claims of the regulators (RFSTE 1999a, 1999b). She provided the scientific evidence gathered by her team during the extensive hearings of the

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

court. Calling the field trials illegal, unscientific and fraudulent,[4] Shiva mobilized the authority of the court to garner support to counter the technology. Within the context of the legal battle with the regulators, the ecological and victimization narratives were fused with the science of flawed field trials and failed crops. The Ministry of Environment and Forests commercialized Bt cotton at a time when the case was still under judicial review. Although there were no dramatic court rulings over-turning the regulatory decision later, the legal challenges to the science of regulation put the government on caution. Similar petitions sought the judicial intervention to check alleged violation of the regulation. By opening up the regulatory domain to judicial scrutiny and public attention, the court cases proved to be an effective tactic to enforce the external accountability of the regulators. Besides, this caused bureaucratic delays in further decisions on transgenic seeds.

In what emerged as an alternative form of governance of the technology, then, the activists scrutinized the regulation of Bt cotton and its performance on cotton fields. They formed a network of counter-experts, who counterbalanced the scientific knowledge of the established experts in the government and the seed corporations. The hybrid subjectivity of the counter-experts was expressed in the production of the activist-science, which was both situated and political (Longino 1993). Because the regulatory process was ambiguous (refer to chapter 3 for details), the counter-experts took advantage of the openings in the process to challenge the experts. Within the broader political-economic milieu, the counter-experts also challenged the boundary work of the technocrats. They spoke against an unspoken axiom that considered no science other than the official science as valid and anything that challenged it as anti-science (Qayum and Sakkhari 2005). However, the activists framed and interpreted the issues within the same paradigm of positivist science and under the same conditions of uncertainty that surrounded the technology. In their

4 See: "Monsanto trials illegal, says environmentalist" *The Times of India*, 21 December 1998.

effort to delegitimize the regulatory science, the activists deployed their science that was as political in nature as the former.

TRANSBOUNDARY ACTIVIST NETWORKS

Numerous informal channels opened up to lend support to the scientific claims of the counter-experts. Foremost among them were the activist networks that were constructed across borders to facilitate flows of information and funds transnationally (Keck and Sikkink 1998). The global organizations like Greenpeace linked the transnational audiences with the local NGOs, such as Deccan Development Society, engaged in the resistance movement. The organizations provided intellectual support to elite activists like Shiva and Nanjundaswamy. The styles of activism and particular frames of interpretations of the activist leaders were communicated across the borders through a burgeoning literature on their studies. Other global organizations, such as RAFI and GRAIN, channeled the scientific information, provided expert inputs and supported any material for legal submission. The scientific knowledge produced by the counter-experts circulated through these networks in the form of surveys, reports and audio-video materials. These networks also acted as conduits of funding for research projects in alternative farming.

The information flow on the internet was maintained by various groups, lists and networks to push an alternative scientific interpretation of transgenic crops. The nodal intermediaries collected information from local sources and channeled that into transnational campaigns (Bownas 2012). Through these epistemic channels, the counter-experts pointed out a number of flaws in the field-trials of Bt technology. They relied on the knowledge claims of their transboundary allies to strengthen the epistemic authority of their science. For example, the RFSTE researchers debunked the myth of reduction in pesticide use by citing the dissident scientist Mae-Wan-Ho of the Open University of the UK. The scientist had attributed the failure of the pesticide reduction effect of Bt cotton to the unpredicted changes in the behavior of the Bt-gene. Besides, an analysis of the Pesticides Trust, conducted on behalf

of Greenpeace, concluded that the introduction of the herbicide resistant *Bt* seeds would alter the pattern of herbicide use without changing the overall amounts used (Shiva et al. 1999, p 608). The ecological damage posed by the transgenic seeds was highlighted using the Greenpeace study.

Concurrently, the counter-experts used specific evidence from across the borders to contest the success narrative of Bt cotton. For example, they cited the example of Texas in the US where *Bt* cotton had failed. The pests attacking cotton developed resistance to the built-in biopesticide of transgenic seeds, which did not reduce the pesticide use. Monsanto had faced a lawsuit by farmers of Texas over Bt cotton that suffered cotton bollworm damage. Using such evidence, the activist-scientists in India substantiated their claim that the farmers continued to use pesticides on the cotton fields. This was in spite of the "corporate propaganda that genetic engineering meant an end to the pesticide era" (Shiva et, al. 1999, p 609). They alleged that MMB was misinforming the public about the performance of Bt cotton. The objective of such mobilization was to establish that the non-transgenic local cotton varieties outperformed the *Bt* variety of cotton.

The transnationally connected elite activists collected information produced both locally and globally, then presented that in different forms in different contexts. In the context of legal submissions, the information was presented as alternative experimental and survey data. These were projected as collected within 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 used for projecting arguments in the media. Acting as the spokespersons of the farmers, the counter-experts presented field-level interviews to the media. Besides, often the same activist actor played a charismatic role in one context and a technocratic role in another (Bownas 2012). For instance, by giving a political speech to a mass audience in public campaigns and providing technical details in court, the counter-experts at once mobilized the charismatic and technocratic modes of their epistemic authority.

One such context where the linkages between the local and global activists were highlighted was a *bija panchayat* (seed council) held in Bangalore in 2000. The tribunal brought together some fifty farmers' organizations,[5] including those from other countries,[6] as well as local and global NGOs. In the words of the activists, the broader objective of the 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."[7]The activists acted as the spokespersons for the farmers and claimed that the jury was designed to represent the marginalized or excluded farmers. The activists employed divergent frames to construct a troubled relationship between farmers and Bt technology. Within the discursive formation, they deployed the qualitative information for the public consumption.

In a courtroom format, the Bt cotton debate was opened up to wider public discussion. The transnational activists represented the farmers as being implicated into an inappropriate technological frame of the gene revolution. Presenting the farmers as 'vulnerable,' the activists reiterated that their dependence on agro-chemicals had led the farmers into a debt trap. This, in turn, had made some of them to sell their vital organs or to commit suicide. Through this tribunal, the political thread of the activists' narrative linking suicides, organ transplants and Monsanto was fused in the public imagination (Vishwanathan and Parmar 2002). This narrative was further solidified by the testimonies of the victims of the technological frame of intensive agriculture that used expensive agricultural inputs.

Defying the cognitive authority of the technocrats in the government, the activists debated the technical issues related to Bt technology. Those issues included the control over seeds,

5 Notably the KRRS, the Andhra Pradesh Ryota Sangha, and the Bharata Kisan Union.

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

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

the costs and risks of genetic engineering, the implications of property rights and seed monopolies. The activists argued that Bt technology would perpetuate the technological frame of the green revolution, which had already created an overdependence of farmers on the capital-intensive technologies. The counter-experts concluded that Bt technology was inappropriate for the farmers as it intensified their technological vulnerability. The seed tribunal proposed a ten-year moratorium on the commercialization of genetically engineered agricultural products. It also articulated a need to develop the indigenous system of intellectual property to protect the seed sovereignty of the farmers.

Even though the transnational activists evoked the romantic image of traditional farming practices, the use of scientific rationality in their discourse kept the resistance movement rooted in the dominant ideology of scientism. Missing in their discourse was an acknowledgment of the hybridities that characterized agricultural epistemologies and farming practices in the postcolonial world (Gupta 1998). The situated epistemologies of the disadvantaged farmers remained muted or selectively represented in the transnational resistance movement. While countering the hegemonic sociotechnical order, then, the counter-experts became an alternative hegemonic force. They constituted alternative networks of power/knowledge flows and exchanges across the territorial boundaries.

MOBILIZATION THROUGH SPECTACLE

The elite activist leaders played a significant role in mobilizing allies across the territorial borders into the network of resistance. One political leader with a mass following, M.D. Nanjundaswamy, 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.[8] The Caravan represented

8 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

alliances and solidarities between activists from around seventeen countries, including India. Three years later, about four hundred farmers from the Indian states of Karnataka and Uttar Pradesh joined hundreds of members of farmers' organizations gathered below the Eiffel Tower in Paris.[9] These farmers were relatively well-off as they could travel to Europe to rally behind Nanjundaswamy. Whether those farmers represented the interests of the poor peasants back in India was thus uncertain.

The most obvious face of the transnational activism was the colorful and mediagenic political theater associated with the Caravan. Such mobilization consolidated the persuasion and pressure tactics of the activist leaders (Keck and Sikkink 1998). Moving from place to place across territorial boundaries, the Caravan was a public spectacle of the activist demonstrations (Madsen 2001). From Paris, the protestors moved on to demonstrate at Cologne in Germany. The meeting of the eight rich and powerful countries of the world, the G8, was being held there. The demonstrations continued to Geneva in Switzerland to protest at the WTO headquarters, and the offices of some TNCs and global financial institutions. The power relations embedded in the new global order were made visible when those were effectively contested by the activists (Featherstone 2003). Thus, the geography of resistance was formed right at the points where relations of power were exercised (Foucault 1980).

The Caravan articulated a range of issues into two key strands of resistance. One strand opposed the forces of global capitalism, and the other resisted agricultural biotechnology.[10] During

---

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.

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

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

their demonstrations, the activists applied a general critique of global capitalism and pledged to fight any form of imperialism in the contemporary world (Madsen 2001). They condemned the new kind of imperialism that worked through the global financial institutions and WTO. The neoliberal order constituted a universalistic, antidemocratic and imperialist system for the activists (Halfon 2010). Simultaneously, a protest was launched against the genetically engineered crops and capital-intensive agriculture.[11] The agricultural biotechnology was represented as a symbol of an impending dependence of farmers on the transnational seed corporations. The TNCs were held responsible for the spread of capital-intensive farming across the territorial boundaries, which kept farmers indebted to the moneylenders in countries like India.

The two strands of resistance were interwoven in the contentious politics of the activists like Nanjundaswamy. His organization, the Karnataka State Farmers' Association (KRRS),[12] contested the transnational hegemonic power through its "Cremate Monsanto" campaign. The campaign advocated agriculture through rural self-management and demanded the decentralization of the control over agriculture. Targeting the field trials of Bt cotton, Nanjundaswamy announced that KRRS activists would burn down all trial sites of Bt cotton crops in Karnataka.[13] The event was widely publicized through the internet across the spatially constructed network of resistance. This dramatic challenge launched against the authority of the state was potentially disruptive in form (Tarrow 1998). The state responded by providing police protection to the transnational

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

12 In local language, KRRS stands for Karnataka Rajya Ryota Sangha.

13 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.

corporations in Bangalore;[14] and, in particular, the sites and property of Monsanto were offered intense security.[15]

Continuing his politics of mobilization through spectacle, Nanjundaswamy stayed true to the theatrical approach of his transnational allies. Under the media gaze, the first burning of the Bt cotton crop took place in November 1998. This cycle of protest brought together activists in a contentious collective action against the emerging sociotechnical order. Activists from a range of organizations such as the Progressive Front, Action Front for the Untouchables, Karnataka Liberation Front, and the Organization of the Landless, attended the event, and so did the members of the Geneva based Global Peoples Action Group.[16] All through the campaign, the farmers who owned the trial fields let the protestors burn their crops after having accepted compensation from the KRRS activists. The network of transnational activists coopted the interests of the farmers into their politics of spectacle.

Significantly, Nanjundaswamy had a track-record of organizing mass rallies since the early 1990s. Through his speeches at these rallies, he systematically constructed a binary between the west and the non-west to critique the new global order. He argued that the western countries were animated by the spirit of capitalism that preserved their hegemonic control over the non-West. The west was seen to perpetuate its global domination by various strategies. The western countries exported their technologies and directed trade to their advantage through lopsided policies of WTO. Those countries also imposed the Euro-American system of production and consumption to promote a lifestyle conforming to Western market values.[17] Paradoxically, the carefully constructed boundary between the west and the non-west collapsed when

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

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

16 According to *Indian Express*, 30 November 1998.

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

Nanjundaswamy forged linkages with the activists situated in the west. The political exigency of mobilizing support of the transnational activist networks overrode his nationalist sentiment.

INVOKING NATIONALIST SYMBOLS

In another kind of campaign, Vandana Shiva mobilized people around identifiable symbols drawn from the cultural frames of meaning. She appropriated symbols of the Indian independence movement to underscore the imperial dimensions of the emerging sociotechnical order. Shiva appropriated the symbols of the Gandhian nationalist struggle to oppose the emergent sociotechnical order. In commemoration of the Quit India message given by M.K. Gandhi to the British, she launched a citizen's movement on August 9, 1998. Under her leadership, the activists set out to mobilize farmers, consumers and scientists using "Monsanto Quit India" as the rallying slogan for their campaign.[18] The public memory of the colonial occupation by the British was invoked to resist the hegemonic neoliberal regime that pushed the transgenic seeds and new policies into the country.

The elite 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 seed corporations.[19] While EIC was

---

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).

18 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.

19 "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).

regarded the first transnational corporation that consolidated the relationship of imperialism to capitalism, the agency for the contemporary phase of imperialism or neo-imperialism was assigned to transnational seed corporations. These corporations had deployed biotechnology to capture the agricultural markets of the third world. The expansionist project of the corporations was inextricably linked with the hegemonic policies of the neoliberal regime. The national and imperial imaginings converged in the discourse of neo-imperialism (Anderson 1983). In March 1999, Shiva borrowed the tactics of the Gandhian nationalist movement and launched a *Bija Satyagraha* (seed protest).[20] 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. In her typically provocative manner, she proclaimed:

> 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.[21]

Shiva regarded the resistance to agricultural biotechnology as a new kind of freedom struggle. The following year, she announced a *Bija Yatra* (seed march) and a *Bija Panchayat* (seed tribunal) to usher in seed sovereignty and democracy.[22] In such discourse, the seed sovereignty meant the independence of farmers to save, exchange or reuse seeds from harvest to harvest.

More than the other activists, Shiva imputed substantial symbolism to Bt seeds. In her layered representation, the transgenic seeds embodied the reductionist, violent and patriarchal

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

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

22 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.

technology. For her, biotechnology perpetuated the modernist dichotomy between human and non-human nature, where the former was privileged over the latter. Previously, Shiva (1991) had critiqued the green revolution as being inherently violent. This was because that revolution was based on a reductionist view of an inert earth in need of artificial fertilizers and a monocultural view of production (Shiva 1993). Extending the metaphor of violence to gene revolution, Shiva saw genetic engineering as destructive of the seed itself. Biotechnology also constituted seed as a passive female by locating the activity and creativity in the male engineering mind. This technology was believed to rob the seed of its regenerative capacity by bringing it under the control of the capitalist ideals and an oppressive legal system.

Shiva's symbolism energized other campaigns. Together these campaigns represented Bt technology as a threat posed to the familiar modes of agricultural production and consumption in the country (Nagaraj 1996). Although driven by their nationalist vision of protecting the Indian agriculture from technology-driven foreign intrusion, both Shiva and Nanjundaswamy entered into transboundary alliances with activist groups. In the politics of both the leaders, the resistance was carried out in a dynamic and networked way. Yet, even the long transnational networks of resistance remained local at all points (Latour 1993).[23]

TERMINATOR, THE ALLY

As their struggle gained momentum, the transboundary network of activists appropriated a controversial gene into its politics of resistance. Colloquially known as the terminator gene, the trait when inserted in a plant could terminate its ability to reproduce. The genetically engineered plants carrying this gene produced

23 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).

one crop, but the seeds of that crop did not germinate in the next generation. The activists held that the impact of this technology on the poor farmers was huge. Generally, the farmers depended on harvested seeds for the planting in next season. The terminator gene in seeds forced the farmers to return to buy new seeds each season. The 'terminator' seeds did not allow the poor peasants to save their own seeds, and to exchange those seeds through non-market redistribution practices. This generated a dependence of farmers on the seed corporations, thus dispossessing the farmers of their seed sovereignty. Besides, the activists believed that the corporate scientists took over the intellectual contribution made by the farmers through centuries of conservation, breeding, domestication and development of the crop.

The worries about the right of farmers to own seeds were exacerbated by the threat of terminator technology. It was a technology that would produce sterile seeds, thus forcing farmers to buy new seeds every season.[24] The coupling of Bt technology with the terminator technology symbolized an intensification of the technology mediated biopower.[25] Significantly, there was no proof that Monsanto has deployed terminator technology in the genetic engineering of cotton seeds. Yet, the activists used terminator gene as an ally to construct a discourse of farmer dispossession. The reason why terminator gene was inextricably linked to Bt cotton can be traced back to the beginning of the controversy over terminator gene.[26] A cotton-seed enterprise called Delta and Pine Land Company held the patent for terminator technology in

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

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

26 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," *The Hindu*, 2 December, 1998; "India gears up to face the threat posed by the terminator gene," *Indian Express*,

collaboration with the United States Department of Agriculture (Kluger 1999).[27] In 1998, Monsanto planned to purchase Delta and Pine Land Company. Much before the deal was finalized, the global activist groups like the Canada-based RAFI[28] and Spain-based GRAIN[29] issued press briefings to link Monsanto with the terminator technology. As significant nodes in the oppositional network, these groups set in motion global protests against the terminator technology and its perceived relationship with Monsanto.

Because the timing of the field trials of Bt cotton in India coincided with the global protests against the terminator technology, the activists in the country perceived a relationship of the gene to Monsanto's Bt cotton. In response to such protests, the corporation issued a 'Statement in the Public Interest' whereby it denied having used the technology in Bt seeds.[30] Concurrently, the government of India tried to pacify the activists by issuing a ban on the terminator technology.[31] Meanwhile, the terminator/Bt seeds narrative came under scathing attack by the promotional network of Bt technology. A series of articles critiqued the activists for inducing doubts in the minds of the public by constructing a threat narrative (Herring 2006, 2007, 2009). The policymakers in the department of biotechnology (DBT) took advantage of such epistemic challenges posed to the activists and questioned the technoscientific understanding of the latter. The government

---

10 September,, 1998; "Stop entry of terminator into India, urge scientists," *Indian Express*, 28 July, 1998; "Infamous Invention," *Hindu*, 19 July, 1998.

27 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).

28 RAFI stands for Rural Advancement Foundation International.

29 GRAIN stands for Genetic Resources Action International.

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

31 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.

believed that the terminator threat had created panic without any scientific basis. Reinforcing their epistemic authority, the state regulators portrayed the knowledge claims of the activists as utterly biased and ill-informed. Through the denial of the linkage between the terminator gene and Bt cotton, the carefully constructed boundary between legitimate official-science and unscientific activist-knowledge was reinforced (Gieryn 1983).

Despite the denials by the officials of the corporation and the government, the activists continued to link Bt technology with the terminator gene. In a way, it was almost irrelevant whether the terminator gene was actually used in Bt cotton or not. The terminator technology served as a stark symbol of a process that was already underway through legal rather than technological means. The terminator gene narrative helped the activists to nail the argument against unbridled technoscientific progress with reference to the Intellectual Property Regime (IPR). Their target was the process of private appropriation of seeds and increased capitalization of agriculture. The juridical framework of the global intellectual property regimes, such as GATT and TRIPS,[32] had already regarded the saving and replanting of the patented transgenic seeds as a violation of law. However, terminator technology was a not yet realized technical embodiment of an already realized legal regime of IPR. The latter would delegate its disciplinary power to terminator gene, which would order the relations of power when inserted into transgenic seeds (Latour 1992). It was the possibility of the dispossession of farmers of their right to store seeds for the next season that intensified the resistance movement. The activists exercised their will against the disciplinary regimes of the global order working through technoscience (Hardt and Negri 2000).

The fears about terminator technology circulated easily despite the lack of any concrete evidence to support its presence in Bt cotton. This was because the technology crystallized in stark terms a pre-existing fear. The activists saw farmers' suicides as a symptom

32 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.

of corporate capitalism that had a link to transgenic seeds. The notion of 'suicide seeds' carrying the terminator gene strengthened the discursive linkages between Bt technology, intellectual property and corporate monopolies (Shiva 2000, 2004). The control of the scientists over the genetic resources, such as seeds, was regarded a form of institutionalized piracy that was already embodied in the idea of patenting (Shiva 1999; Sahai 2005; Sharma 2002b, 2003). Since the terminator gene made the farmer dependent on the breeder for further stock, the locus of power shifted from the farmer to the cotton seed industry. Together, a powerful discursive frame emerged that connected corporate globalization, transgenic seeds and patents as instruments of control over the Indian agriculture.

The convergence of the threats posed by Bt technology and terminator gene took a central place in the globally contentious politics of transgenic seeds. Through the 'suicide seeds' narrative, the Indian agriculture emerged as a "key battle line in the global war over GM crops", with both sides interpreting the suicides as supporting their position (Stone 2002, p.1). The terminator threat continued to circulate in other countries on the authority of the Indian experience, largely through the transboundary campaign of the activists (Herring 2009, p.18). The conflict over 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 cotton to terminator gene, the activists succeeded in highlighting the possibilities inherent in genetic engineering; that, if taken to the extreme, could dispossess the farmers of their means of production.

MOBILIZING SUBMERGED NETWORKS

The struggle of the elite activists reduced the less privileged and poor farmers to the status of the implicated actors in the resistance movement (Oudshoorn and Pinch 2003). Both the advocacy groups, those for and against Bt technology, denied voice and technological choice to the marginalized farmers. Implied in their positions was a suggestion that the poor and marginal farmers did not know what was good for them. Thus, the elite spokespersons

had taken up the responsibility of representing the needs of the farmers. One group of elite activists showed an abiding faith in Bt technology that had the potential to liberate the farmers. For example, the president of the Andhra Pradesh based Federation of Farmers Association, P. Chengal Reddy, hailed the arrival of agricultural biotechnology that had emerged from "the laboratory of the white-man, whose technologies had helped people make progress in the past" (Pimbert and Wakeford 2002, p.22). Implicit in this argument was a belief in the superiority of the western technologies that had an emancipatory potential.

Through selective interpretation of the transgenic seeds, another group of the elite spokespersons contested Bt technology and constructed its relationship to the agrarian crisis. Critiquing this group of activists, pro-agbiotech lobby argued that the Green Revolution had produced a class of well-off farmers who now denied the less-privileged peasants the benefits of the new technology. The resistance movement had this class of well-off farmers rallying behind the elite activists. Besides, the claims made by the anti-agbiotech activists distracted from salient factors such as small landholdings, lack of irrigation, and poor information networks in the countryside. Similarly, the long-term historical factors like feudal social relations, subsistence agriculture, and changing power dynamics in the villages were neglected in the resistance movement of the elite activists. The mobilization against Bt technology was thus interpreted as the marginalization of small peasants.

While the two camps of the elite activists engaged in a rhetorical battle, farmers themselves were divided in their relationship to the technology. While some farmers openly rallied behind the activists to oppose the technology, another group of farmers constructed their relationship with the technology in a subterranean manner. To counter the hegemony of the dominant actors and institutions, this group of farmers resisted the resistance movement itself by growing Bt cotton illegally. They produced, diffused and adopted an illegal variant of Bt cotton through locally situated submerged networks (Melucci 1989). These subversive farmers defied the state laws and evaded the attempts of mobilization by the elite activists.

By growing Bt cotton seeds illegally, the hitherto silenced farmers showed resistance to the hegemonic forces that represented their farming needs and technological choices.

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, Nb151, came to light when cotton bollworm devastated crops across Gujarat in 2001, but spared certain fields that cultivated this variety. On testing the unaffected crops, the patented *Cry1Ac* gene of Monsanto was found in them. The official investigation that followed revealed that the pirated transgenic seed[33] had been supplied by an Ahmedabad[34] 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 sold the transgenic seed as a new hybrid variety to the farmers. Although Monsanto 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 pirated seed 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 Monsanto's Bt cotton, 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.[35] However, the state government in certain states did not implement the directive of the central government entirely, since the illegal crop was not destroyed in some villages (Yamaguchi 2004). As a result, the farmers continued growing not the variety sold by MMB, but the

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

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

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

locally multiplied seeds sold by several local seed companies and farmers themselves.

After the exposure of the illegal Bt seeds, the underground market of pirated seeds was invigorated. Other local seed companies produced and sold illegal variety of transgenic cotton seeds. 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 then sold to other farmers from the same social or kinship groups. Alternatively, the seed companies gave contracts to farmers to multiply the seeds, which when brought back were packaged and sold to other farmers. Within the new economy, the agricultural extension services in villages had been withdrawn gradually. As a result, the agents of the seed companies became the interface between the new technology and the farmers (IFPRI Report 2008, p15). Usually, the companies sold both seeds and pesticides. A lack of information available to the farmers, and perverse incentives of dealers, continued the excessive pesticide spraying regime with Bt cotton seeds (Bownas 2012). To counter the costly and well-advertised seeds of MMB, the farmers mobilized the existing social networks to diffuse the locally grown and sold Bt seeds.

Together with the farmers, the local seed industry used the Nb 151 germplasm in new combinations to produce hybrids with new names.[36] In order to facilitate this process, two types of foundational seeds were supplied to the farmers—Bt male and hybrid female. The farmers believed that the Bt parental line was essential but not the key input. 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 conceptualization 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 viewed as desirable and worth adopting in the local hybrid varieties. The Bt seeds of Monsanto showed a dismal performance in a number of locations and had failed in some places. The cross pollination of

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

local and global lines had produced stable and well-performing crops. The pirated seeds performed better owing to the inputs of local knowledge in their production. Besides, these seeds provided the agronomic advantage at a lower price than the officially approved Bt seeds.

The farmers invoked the informal channels of known people to carry out the transactions of the locally multiplied brands of the generic Nb151 seeds. The pirated seeds moved through the channels of trust and solidarity, mainly the caste and kinship relationships (Yamaguchi 2004; Shah 2005). The social networks linking seed merchants, cotton agents and farmers assisted in the diffusion of the illegal seeds. However, some states like Maharashtra presented an exception to this scenario. As information about seeds and other inputs was mainly available through caste networks, this excluded small farmers who were from lower caste groups. They lacked the social networks necessary to thrive under the new economy (Mohanty 2005). The small cotton farmers had low access to information about when to spray crops with insecticides and the quality of Bt seeds, especially the illegal varieties. This also meant inadequate feedback from farmers to seed merchants about the seed varieties that worked best in particular conditions. This kind of feedback had helped illegal cotton seeds to thrive in states like Gujarat. The adoption and diffusion of the pirated Bt seeds showed that agriculture in postcolonial India was not a closed field of meaning and action. It was profoundly shaped by the complex relations of caste and class differentiation.

The pirated Bt seeds partly succeeded due to a perceived need of farmers to resist the hegemonic representation of their technological needs by the elite actors. This led to the desire of the farmers 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. The production, diffusion and adoption of the illegal variety of Bt cotton seeds emerged as the weapon of the weak against the hegemonic forces (Scott 1985). The resistance through the adoption of pirated seeds decolonized the representations of the hegemonic actors. With the farmers voting in favour of the pirated seeds, it became increasingly clear

that it was not Monsanto's Bt seeds that had succeeded; rather, the Bt gene as hybridized by farmers through local practices and social channels had been successful. The success was limited to the illegal variety of transgenic seeds, not those sold by Monsanto legally. In other words, the Bt technology had not succeeded or failed as an artefact as such. But the technological network used by the farmers had succeeded over the network formed by the local and global elite.

Although Monsanto saw the steadily increasing numbers of farmers planting the pirated Bt seeds as a testimony to the success of its technology and the benefits that farmers derived from it (Monsanto 2006), the rational evaluation of the technology by the farmers played a negligible role in the seed choice. An ethnographic study in Warangal concluded that the spread of these seeds was partly because of the channeling of information within social networks that influenced the farmers to adopt the seeds. The farmers adopted Bt seeds in numbers that resembled a fad, much similar to seed fads preceding Bt cotton (Stone 2007). 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 in their network.[37]

Essentially, the mobilization of submerged networks manifested the patent power of the transnational seed corporations. The strong intellectual property rights of Monsanto made the official transgenic seeds expensive, which revitalized the underground piracy market. Besides, the necessity of biosafety approval on Bt cotton seeds conferred monopolistic property rights on Monsanto. This was because the smaller local firms were unable to spend the time and money required for the regulatory procedure on their seeds. The Nb 151 seeds were ruled illegal on the grounds of not obtaining the biosafety approval from the regulators. The

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

elite activists accused GEAC of market-rigging through costly and time-consuming regulation that had given an advantage to the transnational seed corporations. The small firms lacked the resources to go through a regulatory process that Monsanto could sustain for nine long years (see Chapter 2). By banning Nb 151 on biosafety grounds, the regulators left the field of market maneuver open to Monsanto.

The failure of the surveillance mechanism of the regulatory state allowed the submerged network to escape the panopticon of biosafety and bioproperty regimes (Foucault 1979). Although Monsanto is known to sue farmers for violating its patent rights, 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. It protected only invented processes and excluded products *per se* from patentability. The law did not prevent any firm from taking up the production locally of a product imported by another company holding patent on the same. 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 regarded the cultivation of Bt cotton seeds other than those marketed by Monsanto as the violation of law, the local seed companies and farmers silently appropriated the new technology in their farming practices. The hybridity of the local agricultural practices was embodied in the production, adoption and diffusion of the pirated *Bt* seeds. The hybridization of Bt seeds allowed the subversion of the submerged network to emerge as a counter-hegemonic force. The network challenged the hegemony of elite actors who hadrepresented farmers and their needs. The submerged network of resistance destabilized the hegemonic narratives of cotton-development through high technology and the romanticized

notions of indigenous farming. The hybridity entailed in the pirated seeds led to a cultural recreation of the technology, which was then partially re-inscribed in the hegemonic constellation (Escobar 1995). The subversive politics was incorporated into the dominant representation of the promotional network of Bt technology. The pro-Bt lobby continued to assert that the spread of the pirated seeds reflected the actual need of farmers who had demonstrated that they wanted the technology.

ENTRENCHING COUNTER-HEGEMONY

Stabilizing Oppositional Network

The resistance to Bt cotton touched a point of sharp contention when the government commercialized the transgenic cotton seeds. Subsequently, the activists extended the mobilization against the technology to other sites, thus strengthening the oppositional network. From the commercialization of Bt cotton, the contestation shifted to the performance of the technology on the cotton fields of the farmers. In the first few years after the official approval of Bt cotton, starkly divergent accounts emerged on the performance of the seeds. Two polarized narratives dominated the public and academic discourse; one claimed the triumph of Bt cotton and the other its failure (Stone 2012). Both the promotional and oppositional networks employed their respective knowledge-claims on the performance of the seeds to mobilize allies. The agbiotech industry and their allies constructed "empirical facts" to claim that the technology was a success.[38] The promotional network also enrolled the media as an ally to garner the public support for the technology.

On the contrary, the elite activists represented Bt cotton as a failure and the cause of farmers' suicides.[39] Through various

38 See, for instance, Choudhary and Gaur 2010; Herring and Rao 2012; James 2012; GOI 2012.

39 This position was held by Sainath, 2009; Shiva 2011; Kurungati 2012.

strategies, they destabilized the 'success' narratives of Bt cotton to stabilize the oppositional network. One way was to challenge the role of advertising in constructing the triumph narrative of the technology. Responding to a full-page success story of Bt cotton in a leading English newspaper, a distinguished activist-journalist P. Sainath underlined the role of advertising in shaping the meaning of Bt cotton (Sainath, 2012). As an impressive script of Bt technology's success in India, the newspaper had carried the same full-page story twice in three years, word for word. The first time as a news story in 2008, and the second time as an advertisement in 2011. The report was from two cotton-growing villages, Bambraja and Antargaon, in the state of Maharashtra. The newspaper claimed that the switchover from the conventional cotton to Bt cotton had led to social and economic transformation in the villages (*TOI* 2008, 2011).

Such media manipulation of the public perceptions produced and regulated the political discourse of the activists. For example, Sainath regarded the newspaper report as the "consumer connect initiative" or a "paid-for advertisement" (Sainath 2012, p7). While the by-lines of the story were those of the professional reporters and photographers of the newspaper, the report had acknowledged that their trip to the villages was arranged by the Monsanto-Mahyco Biotech Ltd. (MMB). Significantly, this newspaper story was not an isolated event in the promotion of Bt cotton. It was a crucial part of a larger advertising campaign that the MMB had launched in the leading newspapers of India. A large amount of corporate money was poured into creating an appealing aura around Bt technology through these advertisements. The media used advertising to construct a spectacle of the success of the new technology (Hardt and Negri 2000).The repertoire of contention challenged the promotional strategies, thus extending and strengthening the oppositional network (Tarrow 1998).

Reconfiguring Policy

The activists launched another cycle of protests in opposition to a related technology and revisited the policy issues. After the

commercialization of Bt cotton, Monsanto developed another transgenic seed, Bt brinjal, by inserting the toxin producing gene from the same soil bacterium *Bacillus thuringiensis* (Bt) into the brinjal seeds. Subsequently, the Genetic Engineering Approval Committee (GEAC) ruled that Bt brinjal was safe and could be commercialized. The prospect of commercialization of other transgenic food crops that were in the pipeline became a point of heightened contention. In the politics of resistance, a discursive shift took place from farmers' rights in the Bt cotton controversy towards consumer rights in the case of Bt brinjal. The risks of pesticide exposure to farmers were projected as different from the risks of the consumers from eating Bt brinjal. The possibility of the interference of a foreign gene into the life processes of the consumers exacerbated the threat narrative. And, the use of biotechnology in the food crops was seen as an extension of the hegemonic control to the interiors of the human bodies.

The two controversies around Bt cotton and Bt brinjal were inextricably intertwined in the resistance movement. As a legacy to the Bt cotton controversy, the concern was raised about the inadequacy of the biosafety assessment and the risk to indigenous biodiversity. The activists maintained that the guideline for field-trials of transgenic crops was deeply flawed. An added concern was that through cross-pollination, *Bt* brinjal would wipe out thousands of indigenous brinjal varieties (The Economist 2010). Hence, there was an imminent danger that the technology would induce monocultures of the crops. The activists mobilized the consumers, medical groups, farmers, state governments, and political parties against the edible transgenic crops. The Coalition for GM-Free India, an organization that represented more than a hundred NGOs from different Indian states, campaigned in various settings. The issue was debated at the village councils, farmers' meetings, political rallies, newspapers and blogosphere. The dispersion of the subversive power through these channels of mobilization set the movement into high gear. The pressure on the government to reconfigure its policies mounted with such large-scale mobilization against the technology.

The decisive moment in this struggle arrived when the then minister of environment and forests, Jairam Ramesh, was enrolled into the oppositional network. The minister had a month-long public consultation on Bt brinjal in seven cities and these meetings were attended by thousands of people. As a result, a democratic space opened up in the field of hegemonic power, although for short-term. The minister imposed a ten-year moratorium on the release of the transgenic brinjal. Such decision was attributed to the following factors:

> The lack of clear consensus among the scientific community, opposition from the major brinjal-producing state governments, questions raised about the safety and testing process, the lack of an independent biotechnology regulatory authority, negative public sentiment and fears among consumers, and a lack of global precedent.[40]

Even though the activists influenced the minister to reconfigure *Bt* related policy, Jairam Ramesh was a partial ally in the oppositional network. While he opposed the commercial release of *Bt* brinjal, he supported the dominant paradigm of the biotechnology mediated agricultural development. Significantly, he stated that his decision was not to be read as an indictment of genetic engineering or discourage research to develop crop technologies. The moratorium was a rejection of a particular case of Bt technology for the time being, and would not extend to "Bt rice or tomato in future".[41] Thus, the biotechnological intervention in agriculture was selectively and temporarily stalled. The Minister wanted the moratorium period to be used to reform the testing process, such as conduct toxicity tests for longer period, which would restore public confidence in *Bt* brinjal.[42] Through the multipronged strategy of mobilization, the activists had succeeded

40 See "Moratorium on Btbrinjal," *The Hindu*, February 9, 2010. Available at www.thehindu.com/news/natinal/moratorium-on-bt-brinjal/article103642.ece?css=print (accessed on 26 July, 2012).

41 Ibid.

42 Ibid.

in constructing the public distrust in the government and the technology. The minister recognized that the acceptance of the technology required trust from the public in the government institutions and its technoscientific policies.

However, the official verdict on the technology was not unanimous. The dissent within the government created a political environment for the perpetuation of the existing hegemonic order. Given the commitment of the government to promote Bt technology, Jairam Ramesh was quickly isolated in his policy-decision. Some other actors came together to launch a campaign to reverse the minister's decision. The union agriculture minister Sharad Pawar was on the forefront of this campaign, with the scientists from the Indian Agricultural Research Institute (IARI) and Indian Council of Agricultural Research (ICAR) backing him (TOI 2013). Despite the fissured official position on *Bt* brinjal, the hegemony of the transnational capitalist class was not dismantled. Ironically, the state actors reiterated that the moratorium period would be used to operationalize a new independent regulatory authority and to hold a parliamentary debate on private investment in agricultural biotechnology.[43]

More than a decade after the commercialization of Bt cotton, civil society activists hit the roads of the major Indian cities again to protest against a controversial bill--the Biotechnology Regulation Authority of India (BRAI) bill. The bill was tabled in the Indian parliament in 2013. Transforming the earlier regulatory framework, the bill proposed to create a new centralized regulatory authority with unprecedented powers (see Chapter 3 for details). The BRAI bill generated public anxiety for the implications it might have on the regulation of agricultural biotechnology in India. While the policymakers justified the need for the new institution, the activists labelled it as unconstitutional, unscientific and unethical.[44] In their nationwide campaign since 2008, the anti-Bt activists wanted the central government to discard the BRAI bill.[45]

43 Ibid.

44 For the major critiques of BRAI, seeBhargava 2011, Frontline 2013.

45 See "A joint campaign against GM crops, Biotechnology Bill," *The Hindu,* June 26, 2013.

Participating in the campaign were civil society groups, leaders of the farmers' organizations,[46] and several leaders from the political parties sitting in opposition in the parliament.[47] The organizers of the movement actively engaged in a process of purposive framing work whereby they articulated the discourses around Bt cotton and Bt brinjal to resist agricultural biotechnology (Snow and Benford 1988). Evidently, the dominance of the promotional network was countered by the countervailing force of the activist network. Nevertheless, the marginalized farmers remained distant bystanders to a drama being performed on their behalf.

CONCLUSION

The resistance of the multitude was not marginal, but central, and worked through multiple and overlapping networks. While countering the hegemonic forces, the multitude contested the emerging sociotechnical order of which they constituted a part. The political task of the resistance was to invent new democratic spaces and to constitute power as a creative force. The multitude not only resisted the hegemonic policies and politics, but reorganized them towards new ends.

Because the transnational seed corporations and global regulatory regimes constituted crucial nodes in the hegemonic network, the resistance was closely linked to the anti-globalization movement. Because the subversive politics itself was linked up to the global network of activism, the term 'counter-globalization' captures the phenomenon in a better way. The resistance to Bt cotton was tied up with network of transboundary actors engaged in a wider struggle against the dominance of transnational capital and the neoliberal institutions. At stake in the struggle were issues related to capitalist-imperialism, national sovereignty, and farmers' rights. The elite activists were linked to the transboundary, anti-biotechnology and anti-globalization coalitions.

46 Such as Bhartiya Kisan Union.

47 Such as the Communist Party of India (Marxist) and the Hindu-nationalist party, Bhartiya Janata Party (BJP).

Various strategies of mobilization were deployed by the elite activists. They used technical and discursive strategies to construct an adverse relationship of farmers to the technology. The intervention of the activists became a frontline force in the shaping of the debate around the corporate capitalism, regulatory regimes and technoscientific instrumentality. Each campaign ushered in a new framing of the power relationship embedded in agricultural biotechnology. The movement deployed its repertoire of contention in various settings. The network of counter-experts constructed scientific facts to dispute the official science behind regulation. This strategy opened up the regulatory domain to judicial scrutiny and public attention. Besides, the activists appropriated the symbols of the nationalist struggle, emphasized the reductionist nature of agbiotechnology, and focused on the neo-imperial dimensions of the emerging sociotechnical order.

In contrast to the farmers who openly rallied behind the elite activists, another section of farmers chose to subvert the hegemonic power of the activist-scientists and expert-regulators in an ingenious way. The desire of such farmers to re-represent themselves led to a submerged form of resistance that posed a serious challenge to their elite spokespersons. By choosing an underhanded mechanism to subvert the power of the elite, the farmers resisted the hegemonic forces that represented their farming and technological needs. In this manner, such farmers put up a resistance to the resistance movement itself.

The strategies adopted by the activists and farmers reveal that the process of mobilization was not unified or univocal. The political subjectivities of the activists and farmers emerged as new hybridities of activist-experts and farmer-activists. The intervention of such hybrid subjectivities constituted alternative political organization of technoscientific flows and modes of governance. The subversive politics of the farmer-activists was co-opted into the hegemonic politics of both the promotional and oppositional networks of Bt technology. The hegemony of the transnational capitalist class was not overthrown by the resistance movement, but the contours of the former were reconfigured by the strategies of the latter.

CHAPTER 6

Conclusion

During the annual session of the Indian Science Congress in 2014, the then prime minister of India, Manmohan Singh, reinforced the statist ideology of developmentalism. He reiterated the commitment of his government to technology-intensive agricultural development within the new economy. In his speech, the Prime Minister said:

> "The use of bio-technology has great potential to improve yields. While safety must be ensured, we should not succumb to unscientific prejudices against Bt crops. Our government remains committed to promoting the use of these new technologies for agricultural development."[1]

The prime minister invoked the dominant discourse of crop productivity to garner public support for Bt technology. The technology was imputed with an agency to increase crop yields that would then fetch high profits in the global market. He constructed the Indian publics as "prejudiced" against Bt crops and urged them to give up their "unscientific" bias against the technology. Clearly, the boundary that was already drawn between the science and non-science was reinforced, thus privileging the former over the latter. Soon after, the regulatory agencies gave a hasty approval to

1 See, "Prime Minister's address at 101st Indian Science Congress in Jammu," Press Information Bureau, Government of India: Prime Minister's Office. Available at: http://pib.nic.in/newsite/PrintRelease.aspx?relid=10292r8 (accessed on June 23, 2014).

open field trials for a range of transgenic seeds, such as rice and brinjal (Bhutani et. al 2014). This was done while the case over the moratorium on Bt crops was still pending with the Supreme Court of India. Behind the hurried decision to field-test other transgenic seeds was the pressure on the government from the lobbies of the seed corporations, agricultural biotechnologists and neoliberal economists. These interest-based lobbies were instrumental in making the executive sidestep the judiciary in order to make a space for the commercialization of the genetically engineered seeds.

Thus, more than a decade after the commercial release of *Bt* cotton, the linkages between the Indian state, Bt technology, and the global capital were still being forged. The network embodying the nexus between the government, the technoscience and the global capital had hegemonic effects. In the preceding chapters, the emergence and stabilization of this sociotechnical network as a context-specific phenomenon were analyzed.In tracing the formation of the network it was shown that Bt technology and neoliberal order were internally connected in a system of power relations, that I call bioempire. When the Indian government adopted neoliberal policies and commercialized Bt technology, the bioempire began to take shape in the country.A new paradigm of rule materialized when the technology and the elements of the neoliberal order linked up to constitute the heterogeneous network that had the hegemonic effects.The technology mediated the manipulation of the governed, both plants and publics, and the non-state actors interfered in the internal policies of the country.

UNDERLYING PROCESSES

The linkages between Bt technology, the Indian state and the transnational capital were forged through four interconnected processes of rationalization, standardization, privatization and mobilization. The processes account for the ways in which the Indian state and its body of experts bought into the hegemonic sociotechnical project of which they increasingly formed a part. Underlying the formation of the new order was a technoscientific

rationality that offered universalized solutions to local agricultural problems. The crops were characterized as diseased due to pest attacks, and the solution to the reduced crop yields was sought in the genetically engineered seeds. Such technoscientific rationality was linked to the expansionist logic of the global capital. The imperative of maximizing profits in the global market provided a powerful rationale for subjecting cotton crops to genetic control. A regime of techno biopower was invented in which Bt technology mediated power not only over plant life, but over publics also.

Through a range of discursive strategies, the new technology was rationalized. The political economy of transgenic seeds partially relied on the carefully constructed discursive regime. The hegemonic actors envisioned a 'revolution' in agricultural productivity that would shape the neoliberal goals. Those included, making crops competitive in the global market and maximizing profits for the agbiotech industry. The pro-Bt policy narratives of the Indian state drew upon the dominant discourse of the global neoliberal institutions. The narratives of increasing productivity, efficiency and competitiveness of crops in a global economy rationalized the technoscientific policies of the Indian state. The most influential seed corporation, Monsanto, used the same discursive frames as the global trade regime to justify the introduction of Bt technology into India. Thus, the network of actors located in various state agencies and global neoliberal institutions inscribed agricultural crops into the emerging political-economic order.

The regulation of Bt technology became one crucial site for the formation of linkages between the Indian state, biotechnology and the global capital. The state derived its regulatory framework from the models of Europe and the United States, rather than evolving the guidelines and practices of regulation organically. The technical lag generated between the local agricultural problem and the borrowed regulatory framework was complicated when the transnational seed corporation, Monanto, was authorized to carry out the field-trials of its own Bt technology. Despite the dominant discourse of scientism within the regulatory regime, the actors involved in the regulation of Bt cotton did not follow the science-

based standards exclusively. The standardized criteria of sound-science in regulation provided a facade legitimating the market-oriented practices of the regulators. The secretive negotiations around the approval process of Bt cotton furthered the commercial interests of the business-technoscience elite.

The negotiations around the regulation of Bt technology took place within a hybrid space where science, politics and economics intertwined inextricably. As a result of the corporatization of the regulatory process, the field experiments of Bt technology became a site for the state-technoscience-industrial nexus that consolidated the hegemonic linkages. As the elements of technoscience linked up with that of the political-economic order, the micropolitics of regulation advanced the interests of the transnational seed corporations over the lay public. This situation was further complexified when the global neoliberal institutions pushed for the harmonization of the regulatory standards to facilitate global trade. As a result, the local biosafety policies were reconfigured to align with the requirements of the global policy regimes. Through the process of standardization, then, the transboundary power materialized at the site of the regulation of the technology.

Simultaneously, the new policy of the privatization of public sector extended the arms of the network of power into the domain of knowledge production. The neoliberal regime set into motion a cycle of expropriation of the commons, which included the privatization of the publicly-funded agbiotech knowledge. Under the imperative of the global capital, the publicly owned agbiotech knowledge production sites began to be subsumed under the corporate domain. The latter could now appropriate the ownership and control of the knowledge produced in those sites. The global neoliberal institutions facilitated this process by pushing for uniform patent laws across the territorial boundaries. With the formalization of the TRIPS agreement of WTO, stringent standards for the protection and enforcement of intellectual property were laid down. Under the new regime, the Indian state was obligated to adopt harmonized, global standards of intellectual property protection; so the freedom of the Indian state to choose patent laws was severely curtailed.

The revised patent law provided a competitive edge to the transnational seed corporations over the Indian public research institutions, the life scientists in those institutions, and the domestic seed industry. The privately controlled knowledge economy began to emerge as a diffused network in time and space, and the dispersal of agbiotech knowledge production took place across the territorial boundaries. Such deterritorialization reflected the transformation of the nature and locus of agricultural research and development. Nonetheless, the decentering of the knowledge production did not bring about a decentralization of control over the knowledge thus produced. The ownership rights over the agbiotech knowledge and material seeds were transferred to the resource rich seed corporations. This ushered in an era of the capitalization of knowledge for private profits, rather than the welfare of the farmers.

The formation of the hegemonic sociotechnical order also created a space for the mobilization of the multitude against it. The resistance to *Bt* technology was tied up to a wider struggle against the dominance of the neoliberal institutions that pushed a particular type of technoscientific rationality. The anti-Bt activists contested the meaning of *Bt* technology, challenged its form of regulation, and articulated the needs of farmers. They linked these issues to the broader concerns of capitalist imperialism, national sovereignty and farmers' rights within the neoliberal order. Significantly, the activists carved out a democratic space to contest the emergent sociotechnical order. Their efforts energized the policy debate and reconfigured the user-technology relationship.

The educated, urban-based and transnationally connected activists mobilized science to contest Bt technology. They performed the role of counter-experts to generate the scientific evidence against the field-trials of Bt cotton and its performance after commercialization. Paradoxically, as the activists challenged the technoscientific rationality embodied in Bt technology, their activism remained entrenched in the positivist science. The activists characterized the farmers as scientifically and politically ignorant. Such elite spokespersons of the farmers had to represent the latter for their technological needs and democratic rights.

Thus, the activism of the counter-experts emerged as yet another kind of hegemonic force. The subversive politics of the activists meant a loss of voice for the marginalized farmers.

In defiance of the dominant actors, a submerged network of farmers resisted the resistance movement itself. They produced, circulated and used the illegal Bt cotton seeds stealthily. With time, the resistance of the subterranean network of farmers was coopted into the politics of the hegemonic actors. Nonetheless, the subversion launched by the activist-experts and farmer-activists contributed to the constitution of the bioempire. The struggle to contest and subvert the emergent sociotechnical order, as well as to create an alternative to it, took place on the same terrain of the emergent sociotechnical order. The hybrid identities and plural exchanges in the process of mobilization worked through modulating networks of command that reconfigured the emerging network.

As evident, the struggles over Bt technology were simultaneously struggles over technology-state-market relationship, the organization and control of knowledge, and the self-determination of local communities. By the four processes analyzed in this book, the bioempire was constituted as a heterogeneous network through which transnational power circulated freely. The power circulated through the emergent sociotechnical network that linked global with local, micro with macro, and social with technical. The relations of power were not in a position of exteriority with respect to other types of relationships--such as economic relations, political relations, and knowledge relations—but were immanent in them.

RETHINKING EMPIRE

The symptoms of the changing global order have been recognized by scholars since long. Some of them do not provide a comprehensive vocabulary to capture this change, for example Sassen (1996). Others use a distinct conceptual framework of 'Empire' to explain the changes underway in the contemporary world (Hardt and Negri 2000). The theory of Empire is an important contribution to our understanding of the new logic of global rule. Drawing upon this

theory, we suggest that 'bioempire' is one specific expression of the Empire in a local context. While Empire has been conceptualized as a decentered and deterritorialized apparatus of global rule, the bioempire is characterized as both decentered and centered, deterritorialized and territorialized regime of governance.

The apparatus of rule was decentered in the sense that power was not tied exclusively or predominantly to one element of the sociotechnical network. The diffused network of power had transnational linkages. The network was deterritorialized since actors other than the state were linked up in the transboundary exercise of power. As the global regimes posed new challenges to the protectionist policies of the Indian state, the latter tackled them by adopting the technologies of governance pushed by the former. With the consent of the Indian state to external interference into its policies, the relationship between the transnational actors became hegemonic. In the forgoing analysis, a departure from the dominant sovereignty narrative of the state was undertaken to grasp the coercive aspects of global politics.

The new technology became a significant vehicle for the transboundary hegemonic power to reach the interiors of the Indian agriculture. The global and local regimes were intertwined in the hybrid mechanisms of governance mediated through Bt technology. The network of experts located in the global neoliberal institutions and various state agencies inscribed agricultural crops into the emerging order of global capital. Backed by the hegemonic regimes, the seed corporations deployed Bt technology to capitalize on the changing political-economic condition within the country. The expansionist ambition of the corporations linked up with the obligation of the Indian state towards the transnational capitalist class. A range of discursive, technical and institutional strategies were deployed to fulfill the neoliberal goals of the hegemonic actors.

Simultaneously, the apparatus of governance was recentered and reterritorialized as the hegemonic power worked through the agency of the Indian state. The deregulation of the Indian economy went hand in hand with the regulation of the Indian state by the supranational institutions and regimes. The global disciplining

regimes penetrated and reconfigured the domestic policies. In the face of the rising tide of networked capital, the adoption of both Bt technology and the neoliberal policies presented a curious situation in India. In a policy milieu that combined the elements of the welfare-statist and the neoliberal technocracies, the policy decisions were conceived and implemented in an ambiguous manner. The formal authority of the state agencies played an ambiguous role, and the control mechanisms played out through the hybrid identities of the actors. A new breed of scientist-regulators, scientist-entrepreneurs, and scientist-activists emerged. Such a process of hybridization led to the ambiguity of the roles of various actors that, in turn, decreased the legitimacy of the government.

Although we witness an active agency of the Indian state in the making of the neoliberal political-economic order, its participation in the governance of Bt technology was reduced to an indistinct form. The participation of the state in the modes of governance was of compliance and subordination to the global regimes. A close relationship between the transnational capitalist class and the state agencies lowered the effectiveness of the government. Oddly, the state appeared and disappeared in the governance process. As power began to be concentrated in the prominent nodes of the network, there was a progressive decline in the sovereignty of the Indian state. Instead, a kind of supranational sovereignty emerged where the global and the local political-economic regimes converged under a single logic of rule.

In the material functioning of the new logic of rule, the agricultural sector in the country was subsumed within the network of transboundary power. Traditionally, social scientists think about power with little attention to its materiality, but this analysis linked power to material technology. The network of power extended control through the entirety of relations around Bt technology, down to the molecular level in cotton plant populations. Such biopolitical production in which the technoscientific, the political and the economic spheres increasingly overlapped and invested one another, was a crucial marker in the emergence of the sociotechnical order in the country.

In the constitution of the sociotechnical network, then, the sovereignty of the Indian state was rearticulated as a capitalist social form. In this form of sovereignty, the transnational capitalist class and the Indian state entered into a hegemonic relationship. Because of the nexus between the state and the global political-economic order, the capacity of the Indian state to regulate the transboundary flow of the agricultural biotechnology was decreased. The declining regulatory powers of the state made the regulatory apparatus ineffective in controlling the flows of the technoscience across the territorial borders. Such decline in the sovereignty of the state was not given at the outset. It emerged as an effect of the contingent relations of power that are still evolving.

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.

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.

Assadi, Muzaffar. 1998. Farmers' Suicides: Signs of Distress in Rural Economy. *Economic and Political Weekly.* 33 (13): 747-748.

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.

Amankwah, H.A. 2007. Traditional Values and .Modern Challenges in Property Law. *Journal of South Pacific Law.* 11 (1):18-38.

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.

Banerjee, Arindam. 2009. Peasant Classes under Neo-liberalism: A class analysis of two states. *Economic and Political Weekly.* 44(15), April 11, 2009.

Banerjee, Subhabrata. 2002. "Reinvented Colonialism: Biotechnology, Intellectual Property Rights and the New Economics of Sustainable Development." Paper presented at the 9th Biennial Conference of the International Association for the Study of Common Property. June 17-21, 2002, Victoria Falls, Zimbabwe.

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).

Beck, Ulrich. 1992. *Risk Society: Towards a New Modernity*. London: Sage publications.

Beck, Ulrich. 1997. *The Reinvention of Politics: Rethinking Modernity in the Global Social Order.* Cambridge: Polity Press.

Bharathan, Geeta. 2000. *Bt*-Cotton in India: Anatomy of a controversy in *Current Science*, 79(8), (October 25): 1067-75.

Bhargava, Pushpa M. 2002. "GMOs: Need for Appropriate Risk Assessment System." *Economic and Political Weekly.* (Aril 13): 1402-1406.

Bhargava, Pushpa M. 2011. "Unconstitutional, unethical, unscientific." *The Hindu.* December 28, 2011.

Boyd, William, Scott Prudham, Rachel Schurman. 2001. Industrial

Dynamics and Problem of Nature. *Society and Natural Resources*. 14: 555-570.

Brooks, Sally. 2005. Biotechnology and the Politics of Truth: From the Green Revolution to an Evergreen Revolution. *Sociologia Ruralis*. 45(4) (October).

Bownas, Richard Antony. 2012. *Transnational Romantics: The Case of Opposition to Genetically Modified Crops in India and its Implications for Transnational Activism*. Ph.D. Dissertation submitted to Government Department. Cornell University, Ithaca, USA.

Brown, Phil and Edwin J. Mikkelson. 1990. *No Safe Place: Toxic Waste, Leukemia, and Community Action*. Berkeley, USA: University of California Press

Bush, Barbara. 2006. *Imperialism and Postcolonialism*. New York: Pearson Longman.

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 HinduBusiness 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*, 5Sept.

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.

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.

CPB. Cartegena Protocol on Biosafety to the Convention on Biological Diversity. 2000. 39 ILM 1027 (2000). http://bch.cbd.int/protocol (accessed on June 29, 2008).

Carolan, Michael S. 2010. The Mutability of Biotechnology Patents: From Unwieldy Products of Nature to Independent 'Object/s.' *Theory, Culture & Society.* Los Angeles, London, New Delhi and Singapore: SAGE. 27 (1): 110-129.

Castells, M. 1996. *The Information Age: Economy, Society and Culture. Volume 1. The Rise of Network Society. Malden, Mass:* Blackwell.

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.

Chorev, Nitsan and Sarah Babb. 2009. The crisis of neoliberalism and the future of international institutions: A comparison of the IMF and the WTO. *Theory and Society.* 38: 459-484

Choudhary, Bhagirath and Kadambini Gaur. 2010. *Bt Cotton in India: A Country Profile*. Ithaca, New York: ISAAA.

CICR Report. 2008. "Hybrid Seed Production in Cotton." *CICR technical Bulletin No: 35.* Nagpur: Central Institute for Cotton Research. Available at: www.cicr.org.in (accessed on May 15, 2013).

Cohan, Bernard S. 1996. *Colonialism and Its Forms of Knowledge.* Princeton: Princeton University Press.

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.

CSIR. Council for Scientific and Industrial Research. 1996. *CSIR 2001—Vision and Strategy*. New Delhi: CSIR.

Current Science. 2002. Obituary Commentaries. 82 (2) (25 January): 222-228.

DBT. Department of Biotechnology. 1990. Recombinant DNA Safety Guidelines. DBT. Ministry of Science and Technology, Government of India. New Delhi. http://d*Bt*biosafety.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://d*Bt*biosafety.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. 2001. *Annual Report. Department of Biotechnology,* New Delhi. www.d*Bt*india.nic.in. (accessed on May 7, 2008).

DBT. Department of Biotechnology. 2001. *Biotechnology—A Vision (Ten Year Perspective*). http://d*Bt*india.nic.in/vision1.html (accessed on Nov 22, 2008).

DBT. Department of Biotechnology. 2005. *National Biotechnology Development Strategy*. www.d*Bt*india.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://d*Bt*india.nic.in/policy.reg.html. (accessed on May 18, 2008).

DBT. Department of Biotechnology. 2008. *Draft National Biotechnology Regulatory Bill.* Available athttp://dbtindia.nic.in/uniquepage.asp?id_pk=668 (accessed on 14 February, 2010).

DBT. Department of Biotechnology.2013. *The Biotechnology Regulatory Authority of India Bill, 2013.* As introduced in Lok Sabha. Bill No. 57 of 2013.

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.

Derek, Bob. 2003. *Universities in the Market-Place: The Commercialization of Higher Education*. Princeton: Princeton University Press.

Deshpande, R.S. 2002. Suicides by Farmers in Karnataka: Agrarian Distress and Possible Alleviatory Steps. *Economic and Political Weekly.*37 (26): 2601-2610.

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*, 47: 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.

Dickson, David. 1984. *The New Politics of Science.* Chicago: University of Chicago Press.

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.* 13(1): 7-19.

Dreyfus, H.S. and P. Rabinow. 1983. *Michel Foucault: Beyond Structuralism and Hermeneutics.* 2nd Edition. Chicago: Chicago 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. *The Economic Times*, 3 December.

Economic Times. 1998b. Parties undecided on Patents Bill. *The Economic Times,* 21December.

Economic Times. 1998c. Congress Support to Ensure Passage of Patents Bill. *The 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). *The 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), *The Economic Times*, 12 April.

Economic Times. 2001b. GEAC orders destruction of *Bt* cotton in Gujarat. *The Economic Times*, 19 October.

Economic Times. 2004b..Monsanto's gene-modified cotton sales in India rise. *The Economic Times*, 10 September.

Edelman, Marc. 1998. Transnational Peasant Politics in Central America. *Latin American Research Review.* 33(3): 49-86.

EPW. 2000. Creative Collaboration. *Economic and Political Weekly*. (June 17): 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, Yaron. 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: 404-421.

Financial Express. 1998. Monsanto releases educative ads. *The Financial Express*, 8 December.

Financial Express. 2002b. Make field trial results of GM crops public. *The Financial Express*, 18 November.

Financial Express. 2005. USAID project to promote GM crops. *The Financial Express*, 29 August.

Forbes, Ian. 2006. States of uncertainty: governing the empire of biotechnology. *New Genetics and Society.* 25(1)(April): 69-88.

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.

Freeman, Julia, Terre Satterfield and Milind Kandlikar. 2011. "Agricultural biotechnology and regulatory innovation in India." *Science and Public Policy.* 38(4) (May): 319-331.

Frontline. 2001. The Transgenosis Debate. *Frontline*. July 7-20, 2001

Frontline.2006. Unequal partners. *Frontline*. March 11-March 24, 2006

Frontline. 2013. Missing the Purpose. *Frontline*. July 24, 2013.

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.

Galbraith, John Kenneth. 1967. *The New Industrial State*. Boston: Houghton Mifflin

Ghosh, P.K. and T. Ramanaiah. 2000. Indian Rules, Regulations and Procedures for Handling Transgenic Plants. *Journal of Scientific and Industrial Research*. 59 (February): 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. 1983. Boundary-Work and the Demarcation of Science from Non-Science. *American Sociological Review* 48: 781-795.

Gieryn, Thomas. 1999. *Cultural Boundaries of Science: Credibility on the Line.* Chicago: University of Chicago Press.

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. pp 200-231.

Glover, Dominic. 2007. *Monsanto and Smallholder Farmers: A case study in CSR*. Third World Quarterly. 28 (4): 851-867.

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. 2003. Integrated Pest management package for Cotton. IPM Package No. 25. Ministry of Agriculture. New Delhi: Offset Press

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.

GOI, Government of India. 2012. *State of Indian Agriculture, 2011-12*. Report of the Rajya Sabha. Available at http://agricoop.nic.in/SIA111213312.pdf (accessed on October 2, 2012.)

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 PublicSsphere.* Michigan: University of Michigan Press.

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 Cartegena 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, Akhil. 1998. *Postcolonial Developments: Agriculture in the Making of Modern India.* London: Duke University Press.

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. 2006. *The Cairo Consensus: Demographic Surveys, Women's Empowerment, and Regime Change in Population Policy.* Maryland: 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.

Halfon, Saul. 2010. "Confronting the WTO: Intervention Strategies in GMO Adjudication." *Science, Technology and Human Values.* 35(3): 307-329.

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.

Haas, Peter. 1992. Introduction: Epistemic Communities and International Policy Coordination. *International Organization*, 46(1): 1-35.

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. 2006. Why Did Operation Cremate Monsanto Fail? Science and Class in India's Great Terminator-Technology Hoax. *Critical Asian Studies*, 38(4): 467-493.

Herring, Ronald. J. 2007. Stealth Seeds: Bioproperty. Biosafety, Biopolitics. *Journal of Development Studies*. January, 43(1): 130-157.

Herring, Ronald. J. 2009a. 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).

Herring, Ronald J. 2009b. Global Rifts over Biotechnology: What Does India's Experience with Bt Cotton Tell US? *V.T. Krishnamachari Memorial Lecture*, Delhi University, December 2, 2009.

Herring, Ronald J. and N. Chandrasekhara Rao. 2012. On the 'Failure of Bt Cotton': Analyzing a Decade of Experience. *Economic and Political Weekly*. XLVII(18) (May 5): 45-53

Hiskes, Richard P. 1998. *Democracy, Risk and Community: Technological Hazards and the Evolution of Liberalism*. New York: Oxford University Press.

Howard, Philip H. 2009. "Visualizing Consolidation in the Global Seed Industry: 1996-2008." *Sustainability.* 1 (December 8): 1266-1287. Available at: www.mdpi.com/journal/sustainability (accessed on May 9, 2013).

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, *The Indian Express*, 28 July.

Indian Express. 1998b. Terminator seed tech will be banned: Som Pal, *The Indian Express*, 2 December.

Indian Express. 1998c. India gears up to face the threat posed by the terminator gene, *The 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.

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.

James, Clive. 2012. *Global Status of Commercialized Biotech/GM Crops: 2011*. ISAAA Brief No. 43, Ithaca, New York.

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.* Cambridge, MA : Cambridge University Press. pp. 311-334

Jasanoff, Sheila (ed). 2004. *States of Knowledge: The Co-Production of Science and Social Order*. London: Routledge.

Jasanoff, Sheila. 2006. Biotechnology and Empire: The Global Power of Seeds and Science in *OSIRIS*, 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.

Jayaraman, K.S. 2005. "Monsanto's Bollgard potentially compromised in India." *Nature Biotechnology.* 23(11) (November).

Jayaraman, K.S. 2006. US-Indian agbiotech deal under scrutiny. *Nature Biotechnology.* 24(5) (May).

Journal of Biosciences. 2009. "Insufficient regulatory supervision prior to release of genetically modified crops for commercial cultivation in India." 34(2). (June). Available at http://www.ias.ac.in/jbiosci (accessed on 25 October 2009).

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.

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.

Kleinman, Daniel Lee, Abby J. Kinchy, and Robyn Autry. 2008. "Against Free Markets, Against Science? Regulating the Socio-Economic Effects of Biotechnology." *Rural Sociology.* 73 (2). pp 147-179.

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, 153 i4 p. 44(1).

Kranthi, Keshav R., S. Naidu, C.S. Dhawad, A. Tatwawadi, K. Mate, E.Patil, A.A. Bharose, G.T. Behere, R.M. Wadaskar, and S. Kranthi. 2005. "Temporal and intra-pant variability of Cry1Ac expression in Bt-cotton and its influence on the survival of the cotton bollworm, *Helicoverpa armigera* (Hubner) (Noctuidae: Lepidoptera)." *Current Science.* 89(2) (25 July): 291-298.

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): 2334-2335.

Laclau, Ernest and Chantel Mouffe. 1985. *Hegemony and Socialist Strategy: Towards a Radical Democratic Politics.* London: Verso Publication.

Laffey, Mark and Weldes, Jutta. 2004. Representing the International: Sovereignty after Modernity. In Paul A. Passavant and Jodi Dean (ed). *Empire's New Clothes: Reading Hardt and Negri.* London and New York: Routledge.

Latour, Bruno and Steve Woolgar. 1979. *Laboratory Life: The Construction of Scientific Facts.* Princeton, NJ: Princeton University Press.

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. 1992. Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts. In Wiebe E. Bijker and John Law (eds.)

Shaping Technology/Building Society: Studies in Sociotechnical Change. Cambridge, Mass.: MIT Press.

Latour, Bruno. 1993. *We have never been Modern*. London: Harvester Wheatsheaf.

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.

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.* 23(3) (June): 135-157.

Levidow, Les. 2001. Precautionary Uncertainty: Regulating GM Crops in Europe. *Social Studies of Science.* 31: 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): 72-85.

Llewellyn, Danny J, M. Brown, Y. Cousins, L. Hartweck, D. Last, A. Mathews, F. Murray and J. Thistleton. 1992. "The Science Behind Transgenic Cotton Plants". Proceedings of the 6th Australian Cotton Conference, Queensland, 12-14 Augus 1992

Lumelsky, Anna. 2005. Diamond v. Chakrabarty: Gauging Congress's Response to Dynamic Statutory Interpretation by the Supreme Court. University of San Francisco Law Review39 (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.

MacKenzie, J. (ed) 1990. *Imperialism and the Natural World.* Manchester: Manchester Press.

Madsen, Stig Toft. 2001. The View from Vevey. *Economic and Political Weekly*, XXXVI (39) (September 29-October 5): 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, Susan A. and James Dickinson. 1978. Obstacles to the Development of Capitalist Agriculture. *Journal of Peasant Studies*. 5: 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.

Maskus, K. 1998. The Role of IPR in Encouraging Foreign Direct Investment and Technology Transfer. *9 Duke Journal of Comparative and International Law.* 109.

Mayet, M. 2003. Africa: The new frontier for the GE industry. www.pambazuka.org/index.php?id=19721.

Merton, Robert K. 1973. *The Sociology of Science: Theoretical and Empirical Investigations*. ed. N.W. Storer. Chicago: University of Chicago Press.

Miller, Clark. 2004. "Climate science and the making of global political order." In Shiela Jasanoff (ed) *States of Knowledge.* London: Routledge. pp 46-66.

Mishra, Srijit. 2006. Farmers' Suicides in Maharashtra. *Economic and Political Weekly.*41 (16): 1538-1545.

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://d*Bt*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://d*Bt*biosaftey.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/*Bt*cotton/reco_*Bt*cotton.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[TM] cotton. Monsanto-Mahyco Biotech, Press release. March 26. Mumbai, India.

Mohanty, B.B. 2005. We are Like the Living Dead: Farmers' Suicides in Maharashtra, Western India. *Journal of Peasant Studies*. 32 (2): 243-276.

Monsanto. 2006. India: Conversations about plant biotechnology. http://www.monsanto.com/biotech-gmo (accessed May 17, 2008)

Moore, Kelly, Daniel Lee Kleinman, David Hess and Scott Frickel. 2011. Science and neoliberal globalization: a political sociological approach. *Theory and Society.*40 (5): 505-532

Mruthyunjaya and P. Ranjitha.1998. The Indian Agricultural Research System: Structure, Current Policy Issues, and Future Orientation. *World Development*, 26(6): 1089-1101.

Mukherjee, K. 2007. Indian farmer suicides spiral despite cash plans. *Reuters*, July 6.

Murgai, R., M. Ali, and D. Byerlee. 2001. Productivity Growth and Sustainability in Post-Green Revolution Agriculture: The Case for the Indian and Pakistan Punjabs. *World Bank Research Observer*. 16: 199-218.

Nagaraj, D.R. 1996. Anxious Hindu and Angry Farmer: Notes on the Culture and Politics of Two Resonses 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): 2716-2724.

NCRB. National Crime Records Bureau. 2006. *Accidental Deaths and Suicides in India.* New Delhi. India: Ministry of Home Affairs.

Nelson, Joan M. (ed). 1990. *Economic Crisis and Policy Choice: The*

Politic 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. 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*. 22(1) (January): 115-136.

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: 971-990.

Parthasarathy, G. and Shameem. 1998. Suicides of Cotton Farmers in Andhra Pradesh: An Exploratory Study. *Economic and Political Weekly*. 33 (13): 720-726.

Patnaik, Jagdish. K. 1992. India and TRIPS: some notes on the Uruguay Round Negotiations *India Quarterly.* XLVIII (4), (Oct-Dec): 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; pp 111-143.

Patnaik, Utsa. 2004. It is a crisis rooted in economic reforms. interview in *Frontline*. 21(13) (Jun. 19 - Jul. 02).

Pearson, Mark. 2006. Science, representation and resistance: the *Bt* cotton debate in Andhra Pradesh, India. *The Geographical Journal*, 172(4) (December): 306-317.

Perkins, John H. 1997. *Geopolitics and the Cold War: Genes, Wheat and the Cold War.* New York: Oxford University Press.

Philip, Kavita. 2004. *Civilizing Natures: Race, Resources and Modernity in Colonial South India.* New Jersey: Rutgers University Press.

Pimbert, Michel P. and Tom Wakeford. 2002. *Prajateerpu: A Citizens Jury/Scenario Workshop on Food and Farming Futures for Andhra Pradesh, India*. IIED, London and IDS Sussex.

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.

Porter, Theodore M. 1995. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life.* Princeton: Princeton 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.

Quartz, Julia.2011. Constructing Agrarian Alternatives: The Case of Non-Pesticidal Management in Andhra Pradesh. *Asian Biotechnology and Development Review.* 13(2): 43-61.

Raina, Rajeshwari S. 2006. Indo-US Knowledge Initiative: Need for Public Debate. *Economic and Political Weekly. (*April 29,): 1622-1624.

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.

Ravi Rajan, S. (ed.). 1996. *Imperialism, Ecology, and Politics: Perspectives on the Ecological Legacy of Imperialism*. Delhi: Sage.

Revathi, E. 1998. Farmers' Suicides: Missing Issues. *Economic and Political Weekly.*33 (20):1207

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.

Rose, Nikolas. 2001. The Politics of Life Itself. *Theory, Culture & Society.* 18 (6): 1-30.

Safrin, Sabrina. 2002. Treaties in Collision? The Biosafety Protocol and the World Trade Organization Agreements. *The American Journal of International Law.* 96(3). (July): 606-628.

Sahai, Suman. 1992. Patenting of Life Forms: What it Implies. *Economic and Political Weekly*. (April 25): 878-879.

Sahai, Suman. 2005. A Disaster called *Bt* Cotton *Gene Campaign*.http://www.genecampaign.org/Publication/Article/BT%20Cotton/A-disaster-called-*Bt*cotton.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.

Sainath, P. 2012. Reaping gold through cotton, and newsprint. *The Hindu*. May 10, 2010.

Samytka Karnataka. 1998. Police protection to all American companies in Bangalore city. *Samykta Karnataka*, 25 November.

Sassen, Saskia.1996. *Losing Control? Sovereignty in an Age of Globalization.* New York: Columbia University Press.

Scoones, Ian. 2002. Science, Policy and Regulation: Challenges for Agricultural Biotechnology in Developing Countries. *IDS Working Paper* 147. Brighton: Institute of Development Studies.

Scoones, Ian. 2003. Regulatory Manoeuvres: The *Bt* cotton Controversy in India. *IDS Working Paper 197*. Brighton: Institute of Development Studies.

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. 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.

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. 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): 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): 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): 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).

Shiva, Vandana. 2004. The suicide economy of corporate globalization. *Counter Currents.* Available at http://www.countercurrents.org/glo-shiva050404.htm (accessed on 10 January 2009).

Shiva. Vandana (ed). 2011. *The GMO Emperor Has No Clothes*. New Delhi: Navdanya.

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.

Snow, David E. and Robert Benford. 1988. Ideology, Frame Resonance, and Participation Mobilization. In Bert Klandermans, Hanspeter Kriesi, and Sidney Tarrow, eds., *From Structure to Action: Comparing Social Movement Research across Cultures.* International Social Movement Research. Vol. 1. Greenwich: JAI Press, pp. 197-217

Sopory, S. and S. Maheshwari. 2001. Plant Molecular Biology in India: the beginnings. *Current Science.* 80: 270-279.

Stallings, Barbara. 1992. International Influence on Economic Policy: De*Bt*, 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*. 3(2)(Spring).

Stone, Glenn Davis. 2002. Biotechnology and Suicide in India. *Anthropology News*. 43(5): 1-5.

Stone, Glenn Davis. 2007. Agricultural Deskilling and the Spread of Genetically Modified Cotton in Warangal. *Current Anthropology*. Volume 48, Number 1, February 2007.

Stone, Glenn Davis. 2012. Constructing Facts: Bt Cotton Narratives in India. *Economic and Political Weekly.* XLVII(38) (September 22): 62-70.

Strange, Susan. 1996. *The Retreat of the State: The Diffusion of Power in the World Economy.* Cambridge: Cambridge University Press.

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.

Tarrow, Sidney. 1998. *Power in Movement: social movements and contentious politics.* New York: Cambridge University Press.

Tarrow, Sidney. 2005. *The New Transnational Activism.* New York: Cambridge University Press.

Thacker, Eugene. 2005. *The Global Genome: Biotechnology, Politics, and Culture.* Cambridge, MA: MIT Press.
The Economist. 2010. Without Modification: A setback for GM in India. February 11, 2010.
The Hindu. 1996. Protect Private Sector in Farm Research: Glickman. *The Hindu*, 30 January.
The Hindu. 1998a. 'Infamous Invention', *The 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. *The Hindu,* February 24.
The Hindu. 2005. Biotechnology is safe, says Monsanto official. *The Hindu*, 25.
The Hindu. 2010. Moratorium on Bt brinjal. *The Hindu*, February 9.
The Hindu. 2013. A joint campaign against GM crops, Biotechnology Bill. *The Hindu,* June 26.
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. *The Times of India*, 26 November.
TOI. Times of India.1998b. Gene Terminator creates panic, *The 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. *The Times of India*, 2 December.
TOI. Times of India. 1998d. HC orders security to seed firm. *The Times of India*, 4 December.
TOI. Times of India. 1998e. Haveri farmers will resist KRRS destruction trail. *The Times of India*, 5 December.
TOI. Times of India. 1998f. Monsanto trials illegal, says environmentalist. *The Times of India*, 21 December.
TOI. Times of India. 1999a. Transgenic crop varieties spark controversy in. *The Times of India*, 2 July.
TOI. Times of India.1999b. KRRS threatens to throw out Monsanto. *The Times of India*, 23 November.
TOI. Times of India, 2000. Farmer Suicides Lead to GM Moratorium Call. *The Times of India*. September 26.

TOI. Times of India. 2008. Reaping Gold through Bt Cotton. *The Times of India (Nagpur edition)*. October 31, 2008.

TOI. Times of India. 2011. Reaping Gold through Bt Cotton. *The Times of India*. August 28, 2011.

TOI. Times of India. 2013. Balance Food security Bill by Pushing GM Crops. *The Times of India.* September 3, 2013.

The TRIPS Agreement. 1995. http://www.wto.org/english/docs_e/legal_e/27-trips.pdf (accessed on November 13, 2009).

UNEP. United Nations Environment Programme. 2000. Cartagena Protocol on Biosafety: final draft text submitted by the legal drafting group UNEP/CBD/ExCOP/1/L.5, 28 January 2000. Available at http://www.biodiv.org (accessed on June 18, 2009)

Visvanathan, Shiv. 1998. The Sadness of Cotton. *Economic and Political Weekly.*33 (7): 323-324.

Visvanathan, Shiv and Chandrika Parmar. 2002. A Biotechnology Story: Notes from India. *Economic and Political Weekly*. (6 July): 2714-2724.

Waldby, Catherine. 2000. *The Visible Human Project*. London: Routledge

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.* 1(2) (March): 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): 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.

Winner, Langdon. 1986. *The Whale and the Reactor: The Search for Limits in an Age of High Technology.* Chicago: University of Chicago Press.

World Bank, 1986. "Poverty and Hunger: Issues and Options for Food Security in Developing Countries" A World Bank Policy Study. Number 9275. February 1986.

Wynne, Brian. 2005a. 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.

Wynne, Brian. 2005b. "Reflexing Complexity: Post-genomic Knowledge and Reductionist Returns in Public Science." *Theory, Culture & Society*. 22(5): 67-94.

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.