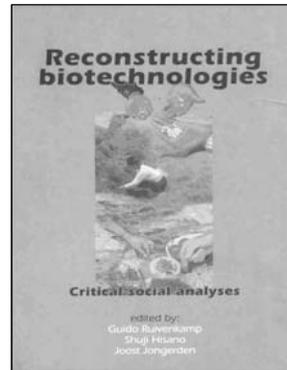


Book Review

Reconstructing Biotechnologies: Critical Social Analyses

Guido Ruivenkamp, Shuji Hisano and Joost Jongerden
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The debate on biotechnology in developing countries has been more or less a polarized debate with supporters and opponents discussing the usefulness and relevance or the problems with biotechnology respectively. Biotechnology is either seen as a boon or as a bane and often it is assumed that technology is a major determinant with society having little role in shaping it or directing its development. Over the last two decades different approaches and theoretical frameworks have been developed in sociology of science, Science and Technology Studies (STS), anthropology of science and technology and in sociology of development to study the nexus between technology and society and of these, Social Construction of Technology (SCOT) framework and Actor-Network-Theory (ANT) are well known. These theories and frameworks reject technological determinism and grand narratives about technology, development and progress. They posit that technology and society influence each other and there are technological alternatives and paths that are not chosen, not because of technical factors alone. Although the influence of post-modernism is evident, they cannot be reduced to a sub-stream of post-modernist thought. Feminist perspectives on science and technology, including feminist critiques of science and technology, have also contributed to this debate. But in most debates on biotechnology and society, these perspectives are invisible or do not get the importance they deserve. This results in not only a polarized debate but also in a poorer understanding of the issues. This volume rectifies this absence to a great extent. But the articles in the volume are informed by different perspectives and the sub-title critical social analysis is an apt one.



The volume is divided into six parts, preceded by a lengthy introduction. The editors introduce the four core issues addressed by the volume and the need for developing a multi-perspective critical social theory. Guido Ruivenkamp's article puts forth a critical-theoretical approach and discusses the possibility and potential for re-appropriation and democratization of life-sciences technologies. He underscores the need for a situational politics to understand and (re)shape the biotechnologies. His theoretically rich analysis should be developed further. But any proposal for alternative technology trajectory should also include the question of value preferences and technological choices. Considering technology as a force for emancipation is an enchanting idea but in the globalized science and technology the scope for oppositional forces getting co-opted is high. In one sense his analysis is too heavily influenced by dialectic, historical-materialist and critical approaches to take into account critical perspectives from other disciplines like bio-ethics and environmental ethics.

Rachel Schurman and William Munro, in their article question some of the assumptions of Guido on technology and the role played by those who oppose technology. They examine how the anti-GM movement politicized agricultural biotechnology and challenged the assumptions made by the state and Multinational Corporations (MNCs) on acceptance of technology. They argue that this resistance has had a profound impact and the resistance was not confined to Europe. This protest, they contend, also led to search for non-GM alternatives. Although the two articles differ considerably in their perspectives on biotechnology and the scope of the intervention, both when read together indicate the need for critical perspectives on technologies. In my view resistance to biotechnology may be necessary but not sufficient to develop a critical perspective on all aspects or applications of biotechnology. For example, the resistance or opposition to agricultural biotechnology in Europe did not result in a similar opposition to medical biotechnology or health sector biotechnology. Thus, the resistance was not to biotechnology *per se* but applications in a specific sector. The other issue which both articles ignore is the evolution of regulatory responses to technologies and how they affect the acceptance or resistance to a specific technology.

Franz Seifert analyses the opposition to GMOs in two countries, i.e. France and Austria and describes how different the opposition was. In France the attitude of the opposition was against biotechnology anywhere,

not just France while, in Austria it was NIMBY(Not In My Back Yard). In Austria the issue of contamination is raised to protect organic farmers and organic farming and organic farmers are not in the forefront of opposition to GMOs. In France the major group that was in the forefront of the opposition placed the opposition in a larger context and in ideological terms.

Les Levidow, whose writings on biotechnology regulation in Europe, particularly in UK are well known, examines the state sponsored exercises in Technology Assessment (TA) and in enhancing public participation on debates on biotechnology. The state is not a neutral player and its policies are in favour of agro-biotechnology. Participatory TA under the auspices of TA becomes an exercise in enhancing the legitimacy and acceptance of agro-biotechnology than a TA on technological choices, and, society's needs. In other words, the framing of the issues more or less decides the outcome of the participation by public. Democratizing technological choices is not an easy task and participatory TA can be used creatively but TA is not a process of technological development. But unless the larger question of technological choices and democratic decision making is addressed, there can be no satisfactory solution to this issue. Since democracy is also a question of numbers and as the choice(s) of the majority count more than that of the minority the bigger question is whether the current models of democracy provide enough space for alternative technological choices to compete equally and be assessed.

Joost Jongerden provides a sweeping overview of the peasant question and modernity. According to him the destruction of peasant production system was a goal of the modernity and it was an outcome of the modernity project. A reconstructionist approach would ultimately question the nature of the modernity and its objectives. But peasants seem to have survived the modernity project and not all observers are as skeptical as Joost is. Perhaps the reconstructed modernity will allow peasant system to survive and flourish as an alternative technological system of food production or may co-opt it and contain the resistance and opposition to the modernity project.

Wietse Vroom's article examines the attempts to develop appropriate biotechnologies for potato farmers by International Potato Centre in Peru. She contends that alternative and empowering technological trajectories are feasible. Shuj Hisano's article cautions against the 'add ethics and stir' approach to incorporating ethical concerns and stress the need to politicize the ethics of biotechnology.

Les Levidow compares and contrasts the Knowledge Based Bio-Economy (KBBE) and the Alternative Agri-Food Networks (AAFNs) approaches to agriculture and society in Europe. AAFNs challenge the quality agriculture discourse of KBBE and project an alternative framework on bio-economy. In this GM-Free is not just an expression of a technological choice for consumption but also a preference for alternative mode(l) of agricultural production and consumption.

The next three articles discuss the new food networks, regional initiatives for production and distribution of high quality food products and the symbolic and communicative aspects of food and its embodiment in a socio-cultural matrix. These articles indicate the emerging perspectives on food and agriculture and how alternative discourses challenge both the assumptions on modernization of agriculture and food and the role technology plays in it. The local and regional networks and experiments in alternative models of food production and consumption in Europe in one sense can be understood as the return of the repressed. But these models may end up as just models without bringing in major changes in technological and social organization of food production and consumption. Only sustained efforts and innovative approaches of alternative technology development that value some choices over mere productivity will take them forward. I wish that there was an article on similar experiments in USA and Canada on organic food production and community supported agriculture.

William Munro's article on the experience of small holders with GM cotton in South Africa indicates how biotechnology could become a contested terrain. In the process new spaces are created and the growers do not always consider themselves as mere consumers of technology. George Essgbey discusses the biotechnology in six countries in Africa and points out the need for developing appropriate biotechnologies in these countries. Msuya analyses GM cotton in Tanzania and argues that existing technologies are unlikely to be of much benefit to resource poor farmers and what is needed is the biotechnology that is reconstructed and appropriate.

Thus the articles in the five parts question the normally held assumptions about agricultural biotechnologies and their relevance. While some call for development of appropriate technology and stress the need for reconstructing biotechnology to suit needs of various types of farmers in developing countries, some question the very logic of applying biotechnology as a solution and discuss the alternative frameworks. The

contrast in these is evident. The question is how to reconcile these views and still argue that biotechnology deserves to be reconstructed as an appropriate technology. If the criticisms of those who support quality agriculture based on local/regional production and consumption is valid, then the issue is more of finding non-biotechnology alternatives than that of reconstructing biotechnologies. But the analyses based on the experiences in developing countries call for reconstructing biotechnologies than for switching over to regional/local food production and consumption. Does it indicate that some parts of hyper-(post)modern Europe are more suitable for returning and reinventing local/regional food production and consumption arrangements than other parts of the world? The tension between calls for rejection of agri-biotechnology and calls for re-constructing biotechnology deserves an extensive analysis and critical social analysis can help us in this.

The articles in the next section discuss common property, commons and the appropriate rights regime. Eric Deibel draws on the theoretical frameworks developed Marx, Foucault and advocates an open source approach. Kate Milberry examines the various examples of technology activism including free software, Indymedia, and the Wiki revolution. She concludes with the observation that whether these could result in radical transformation of technical sphere or not, they do indicate that another world is (still) possible. Niels Louwaars argues for developing tailoring rights in such a way that hyperownership does not erode the policy space or the rights of farmers and breeders.

Thus the volume covers a whole range of issues from different perspectives and this makes it a very interesting volume. The task of de/re constructing biotechnologies as envisaged by various contributors to this volume is not an easy one. While some authors have discussed theoretical frameworks, many others have examined the situation in the ground and the need to reorient and reconstruct biotechnologies. In sum this volume calls for a rethink of the traditional approach to biotechnology and development issues. It provides food for thought and tools for analysis. The publishers should bring out a paperback version at affordable price as early as possible so as it increase its availability and accessibility.

One would recommend it to any one interested in biotechnology and development issues.

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Book Review

The Development and Regulation of Bt Brinjal in India (Eggplant/Aubergine),

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ISAAA Brief No. 38, Ithaca, NY, USA.2009. pp.102.

The first decade (1996-2005) of commercialization of biotech crops was clearly the decades of Americas, where over 90 per cent of the global biotech hectareage was grown. On the other hand, ISAAA has projected that the second decade (2006-2015) of commercialization of biotech crops would witness stronger growth in Asia, especially in China and India. Millions of farmers in both these countries have already benefited enormously from the deployment of a biotech fibre crop, Bt Cotton. In fact, cultivation of Bt cotton was an important contribution to the alleviation of poverty in some of the developing countries.

Given the significant social welfare and economic benefits and environmental benefits of Bt cotton, the present book provides a comprehensive overview of the development and regulation of biotech brinjal in India. It also throws light on the concerted efforts put in to develop insect-pest resistant Bt brinjal the Fruit and Shoot Borer (FSB).

The book *The Development and Regulation of Bt Brinjal in India* is the outcome of the research work of the authors based at ISAAA office in New Delhi. It states that the Bt brinjal technology has been developed and donated by M/s Maharashtra Hybrid Seeds Company (MAHYCO) to public institutes in India, Bangladesh and the Philippines for use in open-pollinated varieties of brinjal in order to meet the specific needs of poor farmers. The book is broadly divided into four parts and consists of eleven comprehensive chapters followed by a detailed list of references.

Part I of the book *Biology, Production and Significance of Brinjal in India* starts with the first introductory chapter which highlights that the three significant developments in improved seeds and crop technologies have changed the face of Indian crop production and contributed to food



security and the alleviation of hunger and poverty. Three major developments were the Green Revolution in the 1960s and 1970s, introduction of hybrid seeds and application of biotechnology which led to the development of first Bt gene in hybrid cotton. It also states that success of Bt cotton and the support and willingness of farmers for the adoption of new technology has led to a widespread support to emulate the success of Bt cotton in other food crops also.

The *Origin and Genetic Diversity of Brinjal* has been presented in chapter two. It is stated that India possesses rich diversity and varieties in cultivated and closely related wild species of brinjal. Brinjal or *Baingan*, the poor man's vegetable is planted on about 550,000 ha in different parts of India and is a significant source of income of small and poor farmers.

The second chapter refers to the centre of origin and rich genetic diversity of brinjal, followed by biology of brinjal in third chapter. The economic importance of brinjal has been documented in the next chapter as along with the tomato and onion, it is the second most important vegetable after potato in India. India produces 26 per cent of the total 32 million tons of world brinjal production, where as China lead with 56 per cent. (Table 5, pg.15). However, the chapter reveals that farmers often lose a significant share of production due to insects-pests and among them FSB is the most destructive pest of brinjal which accounts for the 60-70 per cent of yield losses. In this chapter, for the benefit of the readers as well as consumers, a comprehensive list of biotech fruits and vegetables, which are at various stages of regulatory development, either at laboratory or in field trials is also given in Table 9.

The second part entitled *Biotech Crops: A Paradigm Shift in Crop Development* deals with the application of genetic engineering to develop biotech crops as insect and virus resistant, herbicide tolerant and to have better quality products. Gradually, there has been significant increase in the cultivated area under biotech crops which reached to 114.3 m ha in 2007 from 1.7 million ha in 1996. The number of countries growing biotech crops also increased from 6 in 1996 to 23 in 2007. With the adoption of new technology, the stage is all set that this trend will continue in the second decade of commercialization, i.e 2006-2015. The chapter also highlights the remarkable success story of Bt cotton which until now was the only biotech crop commercialized in India, with its area increasing from 50.000 ha in 2002 to 6.2 million ha in 2007 – an impressive 125 fold increase in six years occupying 65 per cent of the 9.55 m ha under cotton in India in 2007. With the large scale adoption of Bt cotton, which protects

against damage by bollworms, the total national cotton production significantly increased from 13.6 million bales in 2002 to 31.5 million bales in 2007. As a result, India emerged as the world's second largest cotton producer in 2006-07 and became a major exporter of cotton.

Part III of the book presents *Development of Bt Brinjal in India*. Bt brinjal which is a state-of-the-art-technology and is considered to be one of the safest, convenient and viable options to control the FSB. The chapter very clearly explains the process how the FSB infests and damages shoots and fruits of brinjal plant. The small larvae of FSB bore into tender shoots, as a result the infected shoots get paralyzed, which seriously affects the 95 per cent of plant growth and flowers. Apart from this simple process, there are other several sources of FSB infestation reported in the chapter. To overcome the great economic losses, there was a genuine need for Bt brinjal, with an inbuilt FSB protection system along with the good farming practices that can help the farmers to protect the crop and get good yields. MAHYCO has developed the FSB-resistant Bt brinjal by using genetic engineering and transformation process similar to the one deployed in Bt cotton. The development of the Bt brinjal involves introduction of cry1AC gene originally sourced from the soil bacterium called *Bacillus thuringiensis* (*Bt*). The insecticidal protein produced by this gene is specific to lepidopteron insects like FSB and is environment friendly. When FSB larvae feed on Bt brinjal plants, they ingest Bt protein which gets activated by gut proteases generating a toxic fragment. The activated insecticidal protein then binds to two different receptors in a sequential manner. The first contact of the insecticidal protein is with the cadherin receptor, triggering the formation of oligomer structure. The oligomer then has increased affinity to a second receptor, amino-peptidase (APN). The APN facilitates insertion of the oligomer into membrane causing ion pores. These sequential events disrupt the digestive processes that in turn cause the death of fruit and shoot borer.

It is a great honour for MAHYCO which had developed indigenously the first biotech food crop – Bt brinjal – and is ready for its commercialization in the near future. Above all, the company has generously donated the same technology to Tamil Nadu Agricultural University (TNAU), Coimbatore and the University of Agricultural Sciences, Dharwad. At present both these universities are conducting field trials and are hopeful that very soon these varieties are likely to be made available to farmers. Further, based on their special request, MAHYCO has already transferred FSB resistant Bt brinjal technology to Bangladesh and the Philippines.

The Concluding Part IV *Bt Brinjal :The Regulatory Framework in India* deals with the prevailing regulatory framework for GM crops in India which has been developed by the efforts of the Ministry of Environment and Forest (MoEF) and the Department of Biotechnology (DBT). The relevant authorities under the Rules 1989 have framed guidelines, protocols and procedures for evaluating biosafety, toxicity, allergenicity, food and feed safety.

Complying with the prevailing regulatory system, MAHYCO obtained permits and submitted all the relevant results of various experimental works on Bt brinjal to the competent authorities. After thorough review, the Committee confirmed that Bt brinjal is safe and equivalent to its non-Bt counterpart. The safety of Bt brinjal was further tested by the results of studies on pollen flow, impact on soil microflora and invertebrates. Given the importance of some beneficial insects in brinjal crop, the concerned authorities directed MAHYCO to conduct studies on the effect of Bt protein on non-target organisms and also proactive methods recommended for insect resistance management. A large number of field trials were conducted by MAHYCO during the period between 2004-08 to ascertain the economic benefits of Bt brinjal hybrids vis-à-vis non-Bt counterparts in different agro-climatic zones. The field trials conducted during 2007-08 generated very positive results of Bt brinjal hybrids in controlling the FSB and increasing marketable yields. The mean marketable yield of 7 Bt brinjal yields was 32.93 tons per hectare compared to 26.28 tons per hectare of non-Bt counterparts. The agronomic performance studies indicated that on average, the amount of insecticides used to control FSB was reduced by 80 per cent which translated to 42 per cent reduction in total insecticides sprayed on Bt brinjal. It is also expected that farmers are going to benefit enormously in terms of reduction in cost of production by saving on cost of insecticides and lower labour cost as a result of reduced spraying. As a result of decrease in insecticide usage, it would indirectly reduce its residues in fruit and environment as well as farmer's direct exposure to insecticides would lead to lesser health risks.

As discussed in earlier chapters, India has experienced remarkable success with Bt cotton because of the consistent and significant multiple benefits that the Bt technology offers. In this context, the development of Bt brinjal which has completed all the biosafety studies prescribed by the Indian regulatory authorities is almost ready to become the second GM crop. It is a remarkable achievement of the scientists at MAHYCO that they have successfully extended the proven significant benefits of Bt

from a fibre crop to a food crop that is the lifeline of the millions of farmers as well as consumers in the developing countries.

On the whole the book gives an indepth account of technical and scientific clarifications regarding the biosafety and benefits of the Bt brinjal. The volume is loaded with comprehensive analysis of the wide range of multi-location large scale field trials and agricultural techniques applied on Bt brinjal and its impact on human beings and environment. The book contains as many as 28 tables and 23 figures pertaining to interesting development of Bt brinjal in India. It is a great source of information for the scientists, researchers, civil societies, students and the stakeholders about the implications and prospects of Bt brinjal. It has been aptly stated that the adoption of Bt brinjal by farmers in India would be a very rich experience from which India and the world can benefit enormously by better facilitating the harnessing of the immense power that biotechnology offers to ensure an adequate supply of safe, nutritious and affordable food and contribute to become an important tool to alleviate poverty and hunger in India and other developing countries as well.

This book should serve as an important source as it provides a wealth of information about existing rigorous scientific regulatory approval process in India. To be on safer side, studies on food safety, including toxicity and allergenicity tests have been conducted on rats, rabbits, fish, chickens, goats and cows which have confirmed that Bt brinjal is as safe as its non-Bt counterpart. However, it would have been more useful if the authors had given some practical and concrete reasons to create awareness regarding the objective of selecting brinjal as compared to other popular vegetables in India and strengthen their viewpoint to convince Indian farmers for their betterment in society at large.

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