THE POLITICS OF NEW AGRICULTURAL TECHNOLOGIES: CONTESTING RISK, SCIENCE AND GOVERNANCE

A thesis submitted for the degree of Doctor of Philosophy

by

Kevin Edson Jones

Centre for Research into Innovation, Culture and Technology

Brunel University

January 2004

Acknowledgements

I would like to acknowledge the support of those individuals who volunteered time away from their busy schedules to participate in this project. More than I could have hoped these participants have provided insights into my research topic, without which this thesis would not have been possible.

Thanks are also due to friends and colleagues in both Canada and in the United Kingdom. In particular, I owe a tremendous amount to the many post-graduate students and members of staff in the Department of Human Sciences at Brunel University who have encouraged and supported me throughout this endeavour.

To my parents, Gloria and Tony, who have ceaselessly stood behind me from my first forays in academia through to the final days of this thesis, I owe a tremendous debt of gratitude, not least for their assistance, guidance and encouragement.

Finally, I would like to acknowledge the unparalleled support of my supervisor, Professor Alan Irwin. I could have not asked for more from a supervisor and mentor who has contributed greatly to my academic development, and who has generously offered me his friendship and personal encouragement. I am very much in his debt and would like to express my immense gratitude for his support and patience.

Abstract

This thesis provides a sociological exploration of the politics of new agricultural technologies in the United Kingdom. It addresses some of the key issues involved in these politics, as well as how they are discussed and fought over. Conceptually it addresses these questions by focussing on issues of risk, science and governance. In doing so, this thesis situates the politics of GM crops and foods in relation to wider normative concerns about the cultural values, relationships and institutions shaping agriculture, and British society more generally. Empirically, this thesis applies a qualitative methodology, primarily relying on data generated from a series of in-depth interviews. Through these interviews active participants in the debate were able to express a variety of opinions about the risks and benefits of agricultural biotechnology. The interview data is further supplemented by some documentary evidence, particularly as relates to several government led initiatives addressing agricultural debates in terms of contestations over risk and knowledge. Key chapters in this thesis look at the way in which the debate over GM crops and foods has been shaped by perceptions of the role and values of the life-industry, science and the Government in developing and regulating biotechnology. Finally, this thesis also addresses how society, and practices of governance in particular, are able to accommodate these political issues in managing risk and regulating technological change.

TABLE OF CONTENTS

Key Acronyms

AEBC – Agriculture and Environment Biotechnology Commission

ANT – Actor Network Theory

BSE – Bovine Spongiform Encephalopathy

CJD – Creutzfeldt Jacobs Disease

DEFRA – Department for Environment, Food and Rural Affairs

DH – Department of Health

FOE – Friends of the Earth

FSA – Food Standards Agency

FSE – Farm Scale Evaluations

FMD – Foot and Mouth Disease

GE – Genetically Engineered

GM – Genetically Modified

GMHT – Genetically Modified Herbicide Tolerant

GMO – Genetically Modified Organism

MAFF – Ministry of Agriculture, Fisheries and Food (now defunct)

NGO – Non-governmental Organization

PDSB – 'GM-Nation?' Public Debate Steering Board

SBO – Specified Bovine Offal

SCIMAC – Supply Chain Initiative on Modified Agricultural Crops

STS – Science and Technology Studies

TSE – Transmissible Spongiform Encephalopathy

vCJD – New Variant Creutzfeldt Jacobs Disease

PART ONE – THE RESEARCH PROJECT

CHAPTER ONE: INTRODUCTION

Introduction to the Research Questions

This thesis addresses the politics involved in scientific and technological controversies, particularly those pertaining to the use of genetics in agriculture. It investigates the types of arguments and motivations behind the participation of those actors who have been actively engaged in the debate over genetically modified (GM) crops and foods. Furthermore, this thesis investigates how these debates relate to the processes of governance and regulation which will be involved in making the eventual decisions concerning the commercial and scientific future of GM agriculture in the United Kingdom.

Most readers in the UK will be very familiar with the often heated disputes which have surrounded the innovation and commercialization of new agricultural technologies[1] since the second half of the 1990s. Moreover, for most, the debate over GM crops and foods will not have been seen as an isolated moment of political controversy, but inextricably tied to a decade of high profile agricultural controversies in Britain. Foremost, these include mad-cow disease, or bovine spongiform encephalopathy (BSE), and more recently, foot and mouth disease (FMD). Together these events have created an impression of an agricultural industry which is dangerously

[1] Although this thesis is specifically interested in controversies involving the application of biotechnology to agriculture, the changes in technology and farming practice facing British agriculture go beyond biotechnology itself. For example, many of the GM crops being introduced have been developed in conjunction with targeted pesticide and herbicide use. Moreover, agricultural biotechnology is seen as part of a continuing evolution of farming in Britain towards large-scale, industrial and global models of production. The use of the term "new agricultural technologies" is an attempt to reinforce that controversies over agricultural biotechnology take place within this wider context of change.

in disarray, and a countryside which is both at risk and itself becoming the source of risk to Britons. In the cases of BSE and FMD, uncomfortable images of diseased animals being led to slaughter and disposed of on mass pyres have been witnessed by most of the public either directly, or in repeated media coverage of these events. Likewise, in the case of GM agriculture there is no shortage of evocative images, or dire warnings, about the deleterious consequences of agricultural biotechnology. Take, for example, the two following images. The first, a leaflet from an environmental campaign organization called the Soil Association, dramatically evokes the image of an environment under threat (ref. Figure 1). The second, an image from an environmental protest at Watlington in 1999, displays activists 'decontaminating' the countryside by actively destroying a field of GM oilseed rape (ref. Figure 2). It suggests that not only is the countryside under threat, but further projects a feeling that GM crops pose considerable dangers to human welfare as well.

Figure 1 - An Environment Under Threat (source: Soil Association).

As these images suggest, much of the of the debate over GM agriculture has been focused around issues of risks. This has at times led to the polarization of political positions within the debate. For example, opponents of the use of genetic technologies in developing agriculture argue that GM crops potentially exacerbate the environmental problems of pollution and land burdening already associated with modern agricultural systems. Antithetically, proponents of the technology argue GM cropping provides an environmentally friendly and

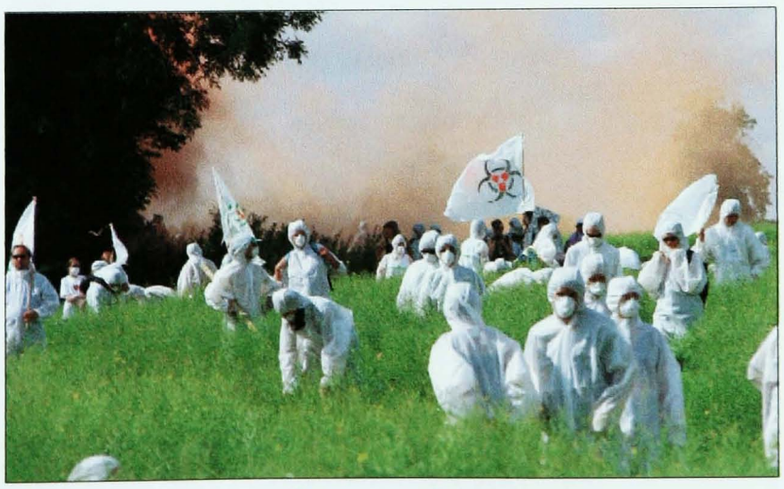

Figure 2 - A Crop Decontamination.

sustainable alternative to current agricultural practice, for example by decreasing pesticide usage. In the same vein, opponents argue that too little is known about the consequences of consuming GM foods to allow them to be declared safe and stocked on supermarket shelves. In contrast again, proponents of the technology posit that GM foods are not only safe, but potentially can provide tremendous benefits to consumers. These range from projected improvements to the taste and texture of fruit, to increases in nutritional and health values of products.

However, the debate over the risks of agricultural biotechnology has not been limited to the polarized campaigns of environmental activists and the public relations exercises of industry spokespersons and scientists at the heart of these perceptions. Before any final decision about the future of GM crops and foods in the UK can be made, the Government has been forced to take into consideration contestations over risk at some level. This can, on the one hand, be attributed to the political pressure being exerted on Government by public scepticism about biotechnology and the active lobbying of activists from both sides of the debate. At the same time, the Government has been pressured to rethink its strategy on risk and scientific innovation, following a series of failures made by scientists and ministers in recognizing and contending with the dangers of BSE[2]. In this light, ideas of risk and the potential hazards of agricultural biotechnology are now routinely debated in boardrooms and hotel conference centres across London and around the UK.

In this respect, the sociology of risk, science and technology, can make an important contribution to these ongoing debates, proposing an alternative analysis of the risks and politics of new agricultural technologies. This approach argues that understandings of risk premised solely on debates over hazard and safety are inadequate in describing the breadth of the social and political relationships involved in the debate over GM agriculture. For example, a cursory examination of the above mentioned risk debates may prompt some rather straightforward conclusions about the nature of the

---

2 Partly this pressure has come from sources close to processes of governance, such as Lord Phillips' Report from the BSE Inquiry (2000a) and the House of Lords Select Committee on Science and Technology's report on *Science and Society* (2001). Pressure has come from the non-governmental community as well. For example, please refer to Stirling and Mayer (1999).

politics of new agricultural technologies. Firstly, these debates focus political attention on the determination of the potential hazards associated with the development and application of agricultural biotechnology. Secondly, a byproduct of this focus on hazard is the suggestion that any decision about the future of GM agriculture will reflect technical conclusions about whether or not these technologies are safe. Alternatively, the sociology of risk, science and technology, places an emphasis on moving beyond a discussion of what can be presented as the 'absolute properties' of genetic technologies. It is also necessary to question the social relations and cultural contexts in which controversies over risk take place. This does not imply that the concerns about hazard should be abandoned, but that they need to be reevaluated by asking how issues of risk and acceptability are socially defined and contested.

Taking these arguments as a starting point for the analysis presented in this thesis, the following themes and questions are proposed. They have been further guided by the qualitative empirical data collected as part of this research project. Overall, this thesis asks, what are the politics of new agricultural technologies, and how are these politics discussed and fought over? In giving depth to this question, three more specific avenues of investigation are pursued. Firstly, this thesis investigates the various ways in which actors involved in the debate contest the risks of new agricultural technologies. Secondly, it questions the ways in which these actors debate risks in relation to broader political concerns involving the nature of British society. A final avenue of investigation addresses how these broadened notions of risk are being addressed in the governance and regulation of GM agriculture. To restate, this thesis thus poses three overlapping questions:

- How do concerns over risk and techno-scientific development contribute to the politics of new agricultural technologies?
- How can the risks of new agricultural technologies be understood in relation to the wider normative politics of British Society?
- How can risks, as understood sociologically, be contended with in the ongoing processes of governance involving new agricultural technologies?

The remainder of this chapter will outline these questions in greater detail, first through a brief introduction to this thesis's approach to the politics of new agricultural technologies in Britain, and then through a chapter by chapter introduction.

The Politics of New Agricultural Technologies:

The breadth of the questions posed above reflects the complexity of the controversy surrounding new agricultural technologies. It is a debate, which has rapidly risen to prominence on the British political stage, has at times been volatile and heated, and involved a multiplicity of issues, perspectives and actors. The task of this thesis is to negotiate the complexity of this debate in developing an understanding of the politics of new agricultural technologies. Although Chapter Two will provide an extensive overview of how risks and techno-scientific controversies can be understood politically, it is helpful in introducing this project to offer a short overview of this approach. The purpose is to provide some analytical depth to the research questions.

A Public / Social Debate

Although often expressed technically and referring to potentially real consequences, the approach to the politics of new agricultural technologies adopted by this thesis emphasizes the social nature of contestations over risk. Firstly, the debate over the risks of GM agriculture is recognized as both a debate between experts about specific issues of hazard and safety, and a debate involving the varied concerns of a multifaceted public. Secondly, following research in the social study of science and technology, perceptions of risk are not discriminated hierarchically between those based on scientific knowledge and those based on non-expert knowledge. Instead, the analysis is directed toward an understanding of controversies taking place between various forms of knowledge, including those involving competing moral and ethical positions.

As the considerable public and media attention being paid to the debate over agricultural biotechnology bears witness, an engagement with the controversy is not limited to scientists, bureaucrats, or members of the biotechnology industry. Instead,

the debate includes consumers, activists, farmers and numerous other members of the wider British public. The implication of the spread of the controversy into the wider social arena is that the political boundaries surrounding GM technologies have been expanded. As the debate stands now, it would appear unlikely that the future of agricultural biotechnology will be determined in scientific laboratories, by government regulators, or by industry interests alone. An analysis of the politics of new agricultural biotechnology may therefore need to look beyond these locales.

Support for these speculative comments comes from the sociology of science, technology and risk. This perspective argues that in order to understand and contend with the social complexity of risk debates it is necessary to broaden traditional conceptions of expertise. Risk research conducted by sociologists, such as Irwin and Wynne, underlines the importance of analytical approaches which engage a range of attitudes and experiences, alongside traditional sources of expert knowledge (Irwin et al., 1999; Irwin and Wynne, 1996; Wynne, 1996a & 1996b). A growing body of work in the UK has thus sought to tap into public attitudes and experiences pertaining to the risks of genetic innovations in agriculture (Kitzinger and Davison, 2001; Marris et al., 2001; Grove-White et al., 2000; Grove-White et al.,1997). This work advocates, or at least implies, that the public should, and can, be given greater influence in disputes over risk and technological innovation. Thus, in understanding the politics of risk, it is necessary to enquire if, and how, debates over GM agriculture involve struggles over the types of knowledge and expertise permitted in authoritative evaluations of technological hazards.

One of the difficulties in engaging alternative forms of knowledge is that scientific knowledge has often been given precedence over alternative forms of knowledge in determining risks[3]. This may be attributable to the acceptance of the authority often ascribed to scientific pretenses of objectivity and the autonomy of

---

3

An example with immediate pertinence to the debate over GM agriculture comes from the handling of the risks of BSE in the 1980s and 1990s. In this case both the Government and the scientific community have been heavily criticized for adopting an approach to risk which relied almost exclusively on positivistic absolutes in dictating a response to the disease and in communicating the potential hazards of BSE to the public (e.g. Frewer and Salter, 2002; Millstone and Zwanenberg, 2001; refer also to Chapter Seven).

knowledge. For example, where other knowledge is seen to be tainted by cultural values and social politics, science has been able to speak about natural facts. Challenging these perceptions, research in the area of Science and Technology Studies (STS) has thus sought to demonstrate that even facts are inherently political and open to social and normative political influences (e.g., Latour 1987, 1993). The STS approach implies that any political analysis of GM agriculture needs to come to terms with the social politics involved in the construction of factual claims about risk. In other words, addressing the ways in which authoritative accounts of risks are presented, and potentially contested, is deemed essential to an understanding the political debates surrounding new agricultural technologies.

A Politics of Convergent Uncertainties

With the public and social nature of the debate in mind, this thesis proposes an analytical approach to the politics of new agricultural technologies which focuses on the convergence of uncertainty. Firstly, as suggested above, the politics of new agricultural technologies can be investigated in relation to contested uncertainties in the scientific knowledge of GM agriculture and its potentially deleterious consequences. Secondly, this approach addresses the ways in which uncertainties about the risks and benefits of agricultural biotechnology are contested in relation to uncertainties pertaining to the nature of British Society. As Douglas (1992, 1986a; Douglas & Wildavsky, 1982) has argued, what is delineated as risky and what risks are ignored in environmental debates are inherently tied to struggles over social values and cultural ideals. These values and ideals include descriptions of appropriate forms of social relations within society, or between society and the environment. Consequently, this perspective directs the analysis of the politics of new agricultural technologies toward an examination of the contested social visions associated with risk perceptions.

Importantly, this approach can be defined as convergent in that it does not seek to prioritize either uncertainties of knowledge, or uncertainties in the social values attached to GM foods. In other words, neither aspect can be seen to determine the other in contesting risks. Risks generated from perceived uncertainties of knowledge cannot

be dismissed as simply reflecting social unease about the nature of GM development. Nor, can normative concerns about risk be seen as the consequence of insufficient knowledge of genetics as applied to agriculture. Instead, it is the process through which these uncertainties are related in the arguments of stakeholders which are of greatest interest to this research project. A convergent approach to uncertainty thus offers an important way of approaching political debates over risk by addressing how contestations involving techno-scientific discourses of risk relate to the normative politics of an uncertain society.

A Politics of Contingency

Finally, in outlining how the research questions can be analyzed politically, this thesis adopts a political view of the contingency of techno-scientific development and social relations. Again, building on research in STS, a political account emphasizing contingency suggests that techno-scientific controversies cannot be settled by simply accruing more scientific knowledge, or by better communicating this knowledge to the public. Social constructionists argue, for example, that technologies are only ever granted certainty, for example being demarcated as safe or dangerous, through processes of social negotiation (ie. Latour, 1987; Bijker and Law, 1992). This offers the basic insight that if certainties about the nature of technologies are socially constructed, then the definitions and uses ascribed to new agricultural technologies remain malleable and potentially open to change (Bijker, 1995: p.28). This perspective, thus advances the need to interrogate how stakeholders, in contesting the risks of agricultural biotechnology, contest the shape and uses of that technology.

Moreover, by addressing the politics of new agricultural technologies with an awareness of the normative uncertainty tied up in these debates, these contingent potentials are extended to the development and performance of social morals and cultural values. As Hilary Rose (1998, 2000) points out, by affixing questions about norms to debates over technological risk, sociology is able to conceive of new spaces where a democratic engagement with the ways in which technologies fit into the social world can be fostered. If the types of technologies brought forward by science and

industry are to be opened up to a politics of contingency, so too must the social and cultural contexts (pertaining specifically in this case to agricultural development) in which these technologies are embedded.

Summary

In summary, this approach to the politics of new agricultural technologies helps gives some analytical focus to the research questions put forward in this thesis. Firstly, it focuses attention on the importance of contestations over the types of knowledge, and the authority they are granted, expressed in arguments about the risks of agricultural biotechnology. Secondly, it underlines the need to address the ways in which debates over health and environmental safety relate to contrasting sets of values describing appropriate forms of social and environmental relations. Finally, this approach directs the research analysis toward the ways in which actors are able to influence social conceptions of GM technologies, and their position in British society.

The Research Project

This thesis is divided into three main sections. Part One, introduced here, outlines the research project undertaken in response to the above stated questions. Including this introduction (Chapter One), this opening series of chapters comprises a review of the theoretical position and key literature framing this project, and an outline of the research methodology and data set.

Theoretical Approaches

In order to address the aims and objectives of this research project, this thesis makes use of a variety of theoretical approaches to the study of science, technology and risk. These perspectives are drawn together and outlined in detail in Chapter Three. The aim of this literature review is to build a theoretical framework in which new agricultural technologies, and the debate over its risks, can be analyzed politically.

Primarily, although not exclusively, this thesis draws on three closely related sociological fields of study. Firstly, theories of the risk society and of social and technological change in modern societies comprise an important body of work framing this thesis. Including work by authors such as Beck and Giddens, this research situates the emergence of risk in relation to the increasing complexity of modern societies and the transformation of public perceptions of risk accompanying these changes. Cultural studies of risk and environmental controversies make up a second focus in the literature, providing information on how, and why, labels of risk are applied to particular situations or technologies. Importantly work by authors in this field, such as Mary Douglas, opens up an understanding of the politics of risk and techno-scientific controversies to take account of cultural debates over the normative nature of society. Social constructionist, or constructivist[4], perspectives of techno-scientific development make up a final theme in the literature adopted by this thesis. The contribution of this perspective stems from its ability to interrogate the social contexts in which science and technology are constructed. This involves revealing the ways in which scientific knowledge and technological objects are defined and contested. The benefit of the constructionist perspective is that it demystifies factual claims by revealing the contingent nature of development.

This literature review attempts to draw on the strengths associated with each of these three approaches, while also identifying their limitations. The purpose of which is to provide the research project with a theoretical framework from which the data can be investigated in response to the research questions.

Methodology and Data Set

This thesis adopts a qualitative methodology based on a broadly discursive analysis of the risk arguments, including claims of safety, made by active participants in the debate over new agricultural technologies.

---

4 Generally speaking, there is no academic agreement as to which term is more acceptable overall, or within specific analytical contexts. For no other reason than consistency I have chosen constructionism as the term to be applied throughout this thesis.

As will be discussed in detail in Chapter Three, this method of analysis was chosen for several reasons. To recall, the overall question put forward by this thesis asks what the politics of new agricultural technologies involved for those active in the debate. A qualitative methodology is of initial benefit in that it is able to engage the complexity of the debate. For example, the open-ended interview style adopted in this thesis provided access to a wider range of perspectives and arguments about the risks and benefits of agricultural biotechnology, than might have been achieved by a more structured methodology. Moreover, part of the task of this thesis is to link participants' perceptions of the risks of new agricultural technologies to normative uncertainties about the nature of social development. The depth of information offered by a qualitative approach is thus essential in assessing the often loosely defined cultural values and moral positions of the various actors in the debate.

Primarily, the research data was derived from a series of semi-structured interviews addressing the contributions made by the various different stakeholders involved in debating the future of new agricultural technologies. Directed by the research literature, the overall aim of this research is to tap into the diversity of experience and knowledge participants exhibited in contesting biotechnology and its application in agriculture. Thus the voices of environmental activists, consumer representatives, and farmers are heard alongside those of scientists, bureaucrats and industry representatives[5] (ref. Appendix C).

In examining this data several key analytical issues stand out as requiring attention. Although these will be discussed in detail in Chapter Four, it is helpful at this point to look ahead at what these issues are. Firstly, although sampling an array of perspectives in the GM food and crop debate, this thesis has focused on those who have been active participants in the political struggles over GM crops and foods. For example, the majority of research participants either held a vested interest in the future of the technology, or perceived the development of GM crops in relation to strong

---

5 These labels fail to do justice to the variation and complexity of standpoints and are intended only to give the reader a rough characterization of the research sample. They are not exclusive categories. For example, in many cases participants can be associated with two or more of these categories. As an illustration, research scientists might also be activists, industry representatives or government officials.

personal beliefs, or values. Thus, while talking about the various segments of the public involved in the debate, any research conclusions cannot be seen to reflect public attitudes toward the GM crop technologies in general.

Secondly, it was remarked earlier that, this thesis adopts a broadly discursive approach to analyzing the data. The use of the modifier 'broadly' is important in this instance. As this thesis is in part framed by an argument which asserts that alternative types of expertise should be valued in debates over risk it is important that the methodology allow participants to tell their own story of the controversy. Although some level of analysis remains an essential part of this research project, it is essential to avoid the temptation to overanalyze participants' statements and speak for the participants themselves. Simply stated, the aim of the interviews is to listen to what participants have to say about risk and to discuss these in an analytical fashion. The aim is not to try and find hidden meanings in their comments.

A third analytical issue raised in this research project involves the interpretation of the data in relation to the subject positions of the participants. The questions posed by this thesis do not ask what various stakeholders thought about GM, but how they debated the technology in relation to issues of risk in particular. Thus, the analysis of participant comments is not intended to provide data which could be seen as representative of a specific group (e.g., farmers, scientists or activists). Alternatively, the analytical focus is on the types of arguments which are made by participants and not on attempting to attach specific perspectives to particular groups.

Finally, although interview data comprises the primary source of data in this thesis, it is supplemented by a variety of documentary evidence. This material provides an important contribution to this thesis as it enables the analysis to keep pace with the rapid evolution of the debate. Where participants were only able to speak about the debate up until the date of their interview, Government reports and committee minutes are used to keep take account of the ongoing developments in the controversy. Furthermore, these documents are invaluable in relating the arguments put forward by the participants to the actions taken by Government in contending with risk.

Part Two of this thesis begins the analysis of the ways in which research participants made contrasting claims about risk in debating the dangers and the merits of genetic developments in agricultural practice. The section begins with a discussion of the history of the controversy over GM crops and foods, and provides a context in which the research data can be located. Building on from this history, two repeating themes are identified in the research data, with each comprising the basis of a separate chapter. Both themes raise questions about the institutional context framing the innovation and introduction of agricultural biotechnology in British agriculture. Roughly, these themes can be described as relating to the contested positions of corporate industry and of science involved in the GM controversy.

The Controversy

Chapter Four provides a selected overview of the controversy involving new agricultural technologies. It offers a background to the technologies discussed in this thesis, the reactions they have prompted in the UK and briefly outlines some of the political issues defining these debates. This chapter is not an attempt to provide a comprehensive account of the history of the debate over GM. Instead, it highlights those aspects of the story which are most relevant to placing the analysis of the research data within a political context. Thus, instead of offering a singular account of the development of the GM debate, the chapter discusses three concurrent histories. The first historical account, put forward in this chapter, discusses the rise of new agricultural technologies as a public controversy. Specifically, it highlights the growth of public interest in the governance and regulation of the technology. Secondly, the commercial growth and subsequent abatement of the agricultural biotechnology sector are discussed. This includes a recount of the failure of industry to sustain a commercial market for GM foods (e.g., GM tomato paste) in the face of public skepticism about biotechnology. A third account of the controversy outlines some of the key scientific cases around which the debate over agricultural biotechnology has developed.

Contesting the Life-Industry

Chapter Five addresses the ways in which research participants evoked contestations over the role of the agricultural biotechnology industry, also known as the life-industry, in debating the potential risks of new agricultural technologies. In general, risk debates are addressed in relation to commonly evoked perceptions of industry's dominant position and the prevalence of a corporate ethos in dictating agricultural and food policy in Britain. More specifically, this chapter questions how participants differentiated between the risks and benefits of new agricultural technologies, according to competing visions about the role of corporate industry in society. Furthermore, these debates are also addressed in relation to contestations over ideals of democracy. In particular, the way in which participants valued consumer choice and public consent in making decisions about the acceptability of GM technologies and their potential risks will be investigated.

Contesting Science

Chapter Six addresses how political debates over new agricultural technologies involved controversies over the character of science and its role in UK society. This includes an examination of the way in which research participants contest perceptions of science as a progressive force, not only in the development of agriculture, but in directing social change in general. Furthermore, this chapter looks at how valuations of the robustness of current scientific practice relate to the ways in which participants delineated the risks and benefits of new agricultural technologies. Finally, the manner in which stakeholders debated the role of science in society is examined in reference to how participants disputed the involvement of scientific authority in the governance of agricultural biotechnology.

Governing Risk and the Development of New Agricultural Technologies

Part Three of this thesis moves to a discussion of the ways in which the types of political perspectives brought forward in Chapters Five and Six can be seen in relation to the governance of risk and GM agriculture. In other words, this section investigates how parallel concerns about technological risks and normative concerns about the social contexts in which these technologies are being developed, can be involved in the regulation of agricultural biotechnology. Although relying partly on interview data, this analysis is supplemented significantly by documentary evidence. Partly, as already discussed, this is inevitable given the many developments in this area overlapping the time span of this research project. However, this information is also crucial in that it documents attempts to rethink how governments approach risk and techno-scientific controversies in agriculture.

BSE and the Phillips' Report

Chapter Seven comprises an analysis of the governance of risk and scientific uncertainty involved in the Government's botched attempts to understand and control the hazards of BSE, or 'mad-cow' disease as it is popularly known. Although the circumstances leading up the BSE epidemic are not specifically related to developments in agricultural genetics, the BSE case is still important to an analysis of the governance of agricultural biotechnology. This chapter investigates how the BSE case has challenged the ways in which governments are expected to deal with risk issues. In particular the analysis is focused on a critical discussion of Lord Phillips' final Report from the BSE Inquiry (2000a). Several issues which were key to Phillips' account of the BSE story are equally pertinent when discussing the governance of GM agriculture and its potential risks. These include issues of trust in scientific-based approaches to governance, the relationship between expert and public knowledge, trust in science and Government, and apprehensions about the direction of agricultural development in the UK.

The AEBC and Rethinking Risk

Partly, as a consequence of the BSE case, and no doubt further attributable to the scale and breadth of the public controversy over agricultural biotechnology, the British Government has been moved to reconsider its approach to contending with risk issues. Central to this project are experiments with more broadly based and less restrictive forms of government consultation in the lead up to the eventual decision over the future of GM crops and foods.

Chapter Eight offers an analysis of one of these attempts, the Agriculture and Environment Biotechnology Commission (AEBC). Established in June 2000 the AEBC was created by the Labour Government as an independent strategic advisory committee tasked with assessing the implications of biotechnology on agriculture and the environment. What makes the AEBC of significant interest is that it draws on lay expertise alongside scientific knowledge, and further seeks to incorporate social and ethical concerns into the formal debates about the future of agricultural biotechnology. This chapter thus comprises an investigation of the strengths and limitations of the AEBC in broadening the risk perspective involved in Government decision making processes. Specifically, this evaluation is centred on the AEBC's influential "Crops on Trial" (AEBC, 2001) report.

A Public Debate on GM

Chapter Nine continues the analysis of the AEBC's role in incorporating alternative risk assessments into the decision making practices of governance. In particular it addresses the importance the AEBC has placed on the provision of a public debate, in bringing these alternatives forward. Although, this debate is ongoing at the time this thesis is being written, a preliminary evaluation of the potential successes and failures of this strategy is helpful in understanding the way governments can contend with risk. Thus, Chapter Nine addresses how a broadened platform of public engagement may be successful in integrating the types of risk issues which characterized participants arguments about GM agriculture discussed in Chapters Five

and Six. Conversely, the chapter also asks how the AEBC's construction of a public debate on GM agriculture may limit, or even be detrimental to, the assessment of the risk concerns expressed by actors in the debate.

Conclusion

This chapter has introduced a programme of research aimed at developing an understanding of the politics involved in the controversy over new agricultural technologies, and those pertaining to risk perceptions in particular. In part, the research presented in the following chapters offers a greater sociological understanding of the ways in which debates over risk involve social and cultural contestations. This introduction has outlined an empirical project which attempts to bridge the gap between technical controversies based on techno-scientific uncertainties and contestations over the values and institutions shaping agricultural development in the UK. Moreover, the importance of this project also lies in its practical contribution to the understanding of how governments can approach social risk issues. In other words, this thesis is interested not only in how participants debated risks, but also in how decision making structures can take account of these politics and the diversity of meaning attributable to risk perceptions.

CHAPTER TWO: THEORETICAL APPROACHES

Introduction

In Chapter One, the sociological examination of the 'politics of new agricultural technologies' was identified as the research project undertaken by this thesis. Demarcated of specific interest were the ways in which the ongoing controversy over agricultural biotechnology relates to contestations over risks. Adopting a position from the outset which interprets the debate as intrinsically social and involving a breadth of issues, actors and subjective positions, a framework of convergent uncertainties was advanced as a means of coping with this complexity. This framework, on the one hand, sought to understand the politics of agricultural biotechnology in terms of the struggles over the technology's potential to be dangerous. For example, it suggested the need to address how actors in the controversy debated the risks the technology posed to the environment and to human health. On the other hand, it was suggested that these debates needed to be understood in relation to the broader context of social and cultural contestations over the nature of British society.

The objective of this chapter is to further elaborate on this approach through the development of a theoretical framework from which the politics of new agricultural technologies may be approached analytically. No novel theoretical approach is proposed. Rather, the purpose of this literature review is to draw on the burgeoning body of work in the area of risk and science and technology studies (STS) to develop a set of resources with which to explore and further elucidate the research questions posed. To this end, the design of the chapter takes the form of a discussion of the strengths and weaknesses of various sociological perspectives in developing a political

understanding of risk and techno-scientific controversies. It is divided into three main sections. A review of theories addressing the social production of risk opens the chapter and provides insight into the way in which risks are produced and defined in society. Sometimes linked with theories of risk, constructionist theories of science and technology, comprise a second key theoretical focus in this thesis. In particular, this body of work offers insights about the socially contested nature of scientific knowledge and technological development. The final section of this chapter looks at two further issues arising out of these theoretical traditions, both of which will comprise repeating themes throughout the remainder of the thesis. The first section investigates contestations over knowledge and expertise in debates over risk and technological development. The second section looks at the relationship between objective risks, understood as real dangers, and normative risks which are perceived as social and cultural abstractions.

The Social Production of Risk

Research accounting for the social production of risk provides an initial theoretical foundation for developing an understanding of the politics of new agricultural technologies. Although not a unified body of research, this approach has emphasized the possible hazards associated with technological innovation and society's ability, or inability, to contend with these risks. It is a particularly consequential field of work for this research project in two respects. Firstly, risk theorists outline a theory of uncertainty based on the social consequences of techno-scientific development. Risk theories speak of uncertain knowledge, unpredictable hazards and the failures of society to offer the means of contending with the potential dangers associated with techno-scientific development. Secondly, over the last decade, 'risk', and the term's emphasis on uncertainty and hazard, have become increasingly popular amongst academics in the social sciences, but also in the wider British political arena. Risk has become part of the language of the debate over agricultural biotechnology, including in relation to the governance and regulation of these technologies. Therefore, theories of risk, provide a means to understand how issues of hazards and uncertainty relate to contestations over

GM crops and GM foods. Moreover, theories of risk are themselves inextricably linked to the discourse of the politics of new agricultural technologies.

Complexity and the Risk Society Thesis

One of the most influential approaches to the study of risk and technology stems from the "risk society" thesis put forward by German sociologist Ulrich Beck (1992, 1996) and further reinforced by Anthony Giddens (1990, 1994) in the UK. At the heart of their argument is the assertion that the character of technological change and social complexity in contemporary society has transformed the way society perceives risk and the ability of social institutions to prevent or control potential hazards.

In linking risks with technological innovation, Beck and Giddens are building on the work of authors, such as Charles Perrow (1984), writing in the early 1980s. In his seminal text, *Normal Accidents*, Perrow identifies the source of risks and the vulnerability they presuppose for society as the consequences of living with "high-risk technologies." Concerned primarily with nuclear technologies, the author argues specifically that risks result from the development of increasingly complex technological systems. By complex, Perrow is referring to the interactivity of technological processes. Murphy (2001), for example, has shown that society's reliance on electricity in our day-to-day lives, coupled with a dependency on large-scale power systems requiring the transmission of electricity across vast networks, has left society vulnerable to risk. When during the winter of 1998 Eastern Canada and the United States suffered a particularly intense ice storm, an unanticipated buildup of ice on electrical wires caused transmission towers to collapse. Although an incident prompted by a so-called 'act of nature,' Murphy argues that the immediate risks, including the loss of heating, and the ability to keep water pipes from freezing, faced by the public resulted from the dependency of society on an increasingly complex power system. It is these sorts of potentially catastrophic risks, resulting from what Perrow refers to as "normal accidents," that society should be concerned with:

> "If interactive complexity and tight coupling – system characteristics – inevitably will produce an accident, I believe we are justified in calling it a *normal accident*, or a *system accident*. The odd term *normal accident* is meant to signal that, given the system characteristics, multiple and unexpected interactions of failures are inevitable. This is an expression of an integral characteristic of the system, not a statement of frequency. It is normal for us to die, but we only do it once. System accidents are uncommon, even rare; yet this is not all that reassuring, if they can produce catastrophes." (Perrow, 1984: p.5, original emphasis)

Perrow draws two primary conclusions from the presence of normal accidents. Firstly, he argues that the nature of the accidents caused by technological complexity suggests the need for a thick, as opposed to a thin, understanding of risk. A thin understanding is based around a "quantitative, precise, logically consistent, economical and value-free" approach to risks which are "predictable" and "understandable." A thick understanding of risk adopts a more socially aware account of the complexity of systems, and questions society's ability to anticipate, recognize or prevent catastrophic accidents from occurring (Perrow, 1984: p.328). Secondly, the overarching conclusion Perrow draws from his theory of risk is that once the limits of humanity's control of complex systems and the inevitability of risk are exposed, then society must identify the types of risks which would be unacceptable to take.

Where the work of Beck and Giddens marks a step change in the development of a theory of risk is that both authors argue that risks are symptomatic of much more than increasingly complex technological systems. Moreover, 'risk' is a catchall term that characterizes the rapid and profound changes that society is undergoing as it is transformed from one stage of modernity to the next. Thus, where Perrow is content to talk about society's reliance on complex technological systems, Beck and Giddens speak of risks as the inevitable outcomes of increasingly complex forms of social organization. Giddens thus proclaims that modernity – a historically specific "mode of social order or organization" (1990: p.1) – is undergoing a radical transformation. Although offering potential benefits, social change is perceived to create new risks and dangers for society. The rapidity and scope of these transformations are such that Giddens dramatically characterizes modernity as a world that has begun to hurtle out of control: "Living in a modern world is more like being aboard a careening juggernaut rather than being in a carefully controlled and well-driven motor car" (ibid.: p. 53). In other words, both

authors articulate an even thicker sociological perception of risk than proposed by Perrow. Specifically they posit that globalization and techno-scientific development are shifting societies away from the era of industrial modernity towards a new modern era characterized by the production of risks[1]. In the following statement, Beck refers to this epochal shift as the "reflexive modernization of industrial society:"

> "[This approach] is, then, about 'reflexive modernization' of industrial society... The intermingling of continuity and discontinuity is discussed with the examples of *wealth production* and *risk production*. The argument is that, while in classical industrial society the 'logic' of wealth production dominates the 'logic' of risk production, in the risk society this relationship is reversed. The productive forces have lost their innocence in the reflexivity of modern processes. The gain in power from techno-economic 'progress' is being increasingly overshadowed by the production of risks. In an early stage, these can be legitimated as 'latent side effects'. As they become globalized, and subject to public criticism and scientific investigation, they come, so to speak, out of the closet and achieve a central importance in social and political debates." (Beck, 1992: p.13, original emphasis)

As this statement and the grandness of Beck's theory suggests, the production of risks has far reaching consequences for how we can understand techno-scientific controversies. Foremost, it repositions the role and authority of scientific knowledge and expertise in society. Beck thus famously proposes that we (society) no longer fear what nature can do to us, but fear what we may have done to nature. As he puts it, "the risk society begins where nature ends" (Beck, 1998). The threats which we find in the risk society are not external risks which might strike society unexpectedly, but are manufactured from within society itself. These risks are considered the products of the "very progression of human development, especially by the progression of science and technology" (Giddens, 1998: p.28). Economic risks, global social risks, and health risks are all seen as the offspring of industrial modernity's failed belief in the ability to dominate or manage nature (Beck, 1992: pp. 80-84). Moreover, the thesis of the risk society suggests that these failures now permeate people's everyday lives. Commuting

---

[1] It is worth noting that Beck's argument is intended to counter suggestions in social theory that society is moving from an era of modernity towards post-modernity. The risk society, Beck argues, is not an alternative to modernity, but termed "late-modernity" is a redefinition of modernity outside of the "classical industrial model" (Beck, 1992: p. 10).

to work means contributing to global warming and the environmental risks created by a shrinking ozone layer. Living in a nuclear-powered society implies fearing normal accidents such as Three Mile Island and Chernobyl. Indeed, the genetic enhancement of agriculture and food production means that the public can never be entirely sure if what they are eating is good for them. Nor, through their consumption of these products, can the public be fully aware of whether they are tacitly contributing to the endangerment of the environment.

This conception of manufactured risks furthermore suggests that not only are science and technology responsible for the production of hazards, but society's delineation of these hazards as risks is influenced by the inability of science to contend with them. Beck's argument that risk begins where nature ends, thus further presupposes that risk also, "begins where tradition ends, when in all spheres of life, we can no longer take traditional certainties for granted" (Beck, 1998: p. 10). In late-modernity, science has been placed under considerable pressure to react to the risks for which it is itself responsible. The result, Beck (1992: pp. 155-182) suggests, is that science has become "demystified." Giddens makes the same point, stating that science and scientific authority have begun to lose their "sanctity" (Giddens, 1994: pp. 87-88). Thus, along with an awareness of the role of science and technological advancement in producing risk, Beck and Giddens further argue that it is impossible to faithfully accept that scientists have all the right answers or are in a position to protect us from all the potential dangers we face in our everyday lives. More eruditely, Beck states:

> "As a consequence [of the demystification of science] a momentous *demonopolization of scientific knowledge claims* comes about: science becomes more and more *necessary*, but at the same time, *less and less sufficient* for the socially binding definition of truth. This loss of function is no accident. Nor is it imposed on the sciences from outside. It arises instead as a consequence of the *triumph* and differentiation of scientific validity claims; it is a *product of the reflexivity* of techno-scientific development under conditions of risk society." (Beck, 1992: p. 156, original emphasis)

Within this context of manufactured risk and the demystification of science, traditional social institutions are perceived to be unable to cope with the protective tasks they have been assigned and upon which society depends (Beck, 1996). Beck argues

that these failures point to the wider inadequacy of society's conception of the political. Institutions, including governments, are envisioned to be stuck in the industrial modern past and unable to adequately grasp or respond to the consequences of the risk society. For example, governments have recently struggled to contend with routine uncertainty and make clear and responsible decisions when faced with opposing scientific evaluations of technological risk[2]. In order to respond to these failings, Beck demands society "reinvent" how governance can be understood and practiced in the risk society (Beck, 1997). The key point to emphasize is that the current context in which technological controversies are being contested is one characterized not only by an uncertainty in science, but also in social institutions such as government.

Normative Limitations of Risk Society

Despite the potential benefits of the risk society approach to understanding the politics of technological innovation and social change, it should be approached cautiously. Specifically, as a result of its grand pretensions in outlining broad historical processes of social change there is a danger in treating the risk society as an external reality. Of key importance is the contention that risks are the *inevitable outcomes* of an increasingly complex social and technological world with which society must now come to terms. The understanding of social action, or political activity, emphasized by the risk society thesis involves contending with risks and not directly challenging the context behind their creation. In other words, the risk society hazards going too far in addressing the social consequences of science and technology and ignoring the capacity of society to shape techno-scientific development.

Theories of the risk society potentially become preoccupied with providing a descriptive account of the consequences of social change and the urgency for social institutions to respond to the production of risk. The transformation of modernity is something that society must face and grapple with. Consequently little scrutiny is given

---

2 One symptom of the uneasiness felt by governments in making decisions in arenas where scientific risk evaluations are contested is to repeatedly call for further scientific research and attempt to reestablish certainty as a basis for decision making (Jones, 2000).

to modernity as the focus of a contestation in and of itself. To believe that society must accept that risks are inevitable creates the perception that little can be done to avoid them, other than to take the protective measures to prepare for them, limit their occurrence and minimize their consequences. If society is careening out of control, the overarching message Giddens advances is that society must become better prepared to deal with the eventual consequences and risks this infers. The emphasis is not on creating solutions to how the juggernaut might be controlled or eliminated in the first instance as Perrow (1984) suggests. David Miller thus provocatively argues that the presentation of risks as the "inevitable concomitants of technological and cultural developments threatens to leave risks in the grip of political quietism" (Miller, 1999: p. 1239). Miller, in other words, suggests that the politics of risk outlined by Giddens and Beck is largely responsive and does not allow for the imagination of political spaces in which the social shaping of technology and society are contested.

Alternatively, if we envision modernity as a context and not as an absolute, then we are able to remember that technologies and their risks are not inevitable but contingent. What types of knowledge and technology society chooses to pursue, how we apply and organize them, and the types of risks they create are not determined, but can be understood as the outcome of various cultural, political and economic relations and decisions. To believe that risks are socially constructed enables social actors to challenge the circumstances leading to their appearance, to interrogate the type of society they wish to inhabit, and most importantly to seek out alternatives (Miller, 1999: pp. 1250-1253).

The Cultural Production of Risk

Central to overcoming these barriers and developing a contextual approach to risk, is the cultural theory associated with the work of Mary Douglas. Writing two decades before Beck and Giddens began publishing about the risk society, Douglas' contribution is as relevant today as it was then (Douglas, 1999, 1992, 1986a, 1980, 1966; Douglas and Wildavsky, 1982;). This work does not necessarily refute the "risk society" hypothesis. However, its emphasis on cultural values and community refocuses the

analysis of risk presented in this thesis around contestations involving the normative nature of risk and society.

Commenting on the development of the cultural analysis of risk, Rayner identifies the overarching argument advanced by the approach as the assertion that "risks are defined, perceived, and managed according to principles that inhere in particular forms of social organization" (Rayner, 1992: p. 84). To restate, risks, although the dangers they pose can be very real, are culturally constructed abstractions which are seen in relation (either for, or against) the dominant values of a social community. This focus led authors such as Douglas and Wildavsky (1982) to ask why society defines some technologies as risky and labels others as not-risky? Luhman (1993) similarly questions how society differentiates between those hazards it deems necessary to prevent (risks), and those it does not (dangers). Taking arguments about risk at face value, Luhman observes, does not always accurately account for perceptions of the hazards facing a society. Using the following comical example, the important point made by Luhman, is that to understand risk, it is necessary to address the ways in which these hazards are socially perceived and enacted:

> "In Sweden it was politically opportune to evacuate a large number of Lapps by helicopter for the duration of missile testing in their area, although the probability and extent of loss in the event of a helicopter crash were far greater that the possibility that a single person in a sparsely inhabited area would be struck by falling debris. But the one case was apparently assessed as a risk, while the other (moreover quite incorrectly) only as a danger." (Luhman, 1993: p.31)

As Luhman's example suggests, risks are only partly a problem of the certainty, or uncertainty, of knowledge about the potential realization of risks, or their consequences. What is more important, the cultural approach posits that risk perceptions represent issues of consent over, what Douglas and Wildavsky term, the "most desired prospects" for the future (Douglas and Wildavsky, 1982: p.5). This position looks beyond the perception of physical risks towards the social norms which are being contested (Rayner, 1992: p. 91). In this sense, cultural risk theory is drawing on a broad theoretical categorization of the relationship between human society and the environment. Partly, the task of understanding risk is therefore a phenomenological one. As Douglas states, it concerns "what we believe we know about reality and with how we

come to believe it" (Douglas, 1980: p.281). The other half of the task it to understand how claims to reality, including risk claims, support moral visions of a certain kind of society. The ways in which these perceptions are contested, Douglas argues, demand as much scrutiny as the physical and environmental risks which societies face (Douglas, 1980: p. 295). Douglas gives further strength to this need to interrogate cultural conceptions of risk alongside physical determinations of hazards in the following statement:

> "[I]t is... illusory to hope for a society whose fears of pollution rest entirely on the scientists' teaching and carry no load of social and moral persuasion. We cannot hope to develop an idea of our environment which has pollution ideas only in the scientists' sense, and none which, in that strict sense, are false. Pollution ideas, however they arise, are the necessary support for a social system. How else can people induce each other to cooperate and behave if they cannot threaten with time, money, God and nature? These moral imperatives arise from social intercourse. They draw on a view of the environment to support a social order." (Douglas, 1980: p. 290)

The cultural theory of risk is not without its critics. For example, some authors have suggested that by emphasizing the relativity of risk, that cultural theory adopts an inherently conservative approach to political action. As Rayner (1992: p. 111-113) details, these critiques posit that by drawing attention away from the objective reality of dangers, cultural theories undermine risk claims. For example, critics pose the question, 'if risks are culturally relevant, then on what basis should corrective action be taken.' Others, such as Wilkinson (2001), argue that Douglas' lack of an empirical focus, and the abstractness of her view of culture, fails to account for the complexity of the ways in which people perceive and negotiate risk in their everyday lives.

However, although this chapter will return to some of these critiques in the final section, for the moment it is worth noting that for the immediate purpose of this thesis, these critiques do not necessarily discount the overall benefit of cultural theory in framing social debates over risk and controversial technologies. Tansey (2003), defending the cultural approach to risk, thus argues that the basic premises of the argument continue to stand[3]. These are, to restate, firstly that risks account for more

---

3 Refer also to Rayner (1992: pp. 98-113)

than a physical acknowledgment of hazards, but are also concepts around which the future of society is being shaped. Secondly, far from being politically impotent, cultural theories of risk highlight an alternative vision of the politics of risk which envisions risk in relation to struggles over competing social values and social institutions[4].

The Political Potential of Risk Theory

In summary, theories of the social production of risk offer several contributions to the understanding of the risk controversies characterizing the debate over new agricultural technologies. As exemplified in Beck and Giddens' theory of social change, risks are placed within a social and political context, characterized by the complexity of modern societies. The risks of new agricultural technologies, in this sense, can be investigated in relationship to processes of change such as globalization, or industrialization, both of which comprise key themes which will arise in later chapters. Likewise, the risk society hypothesis compels risk research on the debate over agricultural biotechnology to attempt to link perceptions of hazard to the ways in which social institutions, such as government, are perceived to be able to contend with risk.

Secondly, cultural theory, although not dismissing social change as an important factor in understanding risks, suggests that risks are not simply consequences of change, but represent normative contestations about the nature of those changes. In particular, the work of Mary Douglas suggests the need for social analysis to address what values, and what visions of society, lie behind the risk claims involved in the debate over GM crops and foods. For example, if the risk society thesis points to the importance of modern industrialization in generating social perceptions of risk, cultural theory focuses attention on the ways in which the cultural visions behind those changes are contested. More specifically, the cultural approach to risk directs us to interrogate the values actors ascribe key social institutions in promoting these forms of development.

---

4 Tansey makes this argument in response to suggestions that Douglas proposes a culturally deterministic vision of society, where normative values are reflected in the shape of social institutions (for example Boholm, 1993). Thus, the important point to underline is that although risks are culturally relative, they should not be seen as deterministic, but contested and subject to political dynamics of the cultures they are expressed in.

Thus, although the approaches championed by Beck and Douglas are often described as in contrast to each other (Wilkinson, 2001), taken together they offer a clearer understanding of the politics of risk, than they might alone.

Social Constructionism

Alongside theories accounting for the social production of risk, constructionist theories of science and technology comprise a second key focus in the literature guiding this thesis. Although often overlapping risk theory, it is worth contending with elements of the constructionist approach in detail in order to further frame the politics of new agricultural technologies. Thus, where the risk society thesis has already called attention to the complicity of science in generating risks, along with its inability to fully understand or contend with potential hazards, constructionism provides a deeper analysis of these failings. At its heart, the constructionist perspective provides a critical appraisal of realism's presumptions of scientific knowledge and questions the authority they are granted on this basis. Overall, Burr identifies four key propositions which offer an entry point into developing an understanding of the critical project of constructionism (1995: pp.2-5). Firstly, it takes a critical stance towards taken-for-granted ways of understanding the social and natural world. Secondly, constructionism asserts that our understanding of 'realities,' including those identified by science, is culturally relative. Thirdly, knowledge is accordingly not perceived to be determined by nature but constructed by human relations within society. Finally, as a social construction, knowledge is the outcome of social patterns of negotiation and politics.

This section will look first at Burr's principles of constructionism in more detail, first looking at their origins in the sociology of knowledge and post-structural thought, and secondly as they have been applied in science and technology studies. From this basis, the section concludes with a discussion of the benefits and limitations of the approach for understanding the politics of new agricultural technologies.

Underlying the constructionist perspective is a critique of a dualistic view of the relationship between society and the material world. Constructionism, as Latour (1993) has argued, seeks to undermine the conception that the natural world is autonomous from the social world. More specifically, it adopts this theoretical gaze in order to discount realist pretensions which suggest that it is possible to provide objective, or absolute, knowledge about the natural world. In other words, constructionism critiques a view of the world which sees nature 'out there' – an external reality which humanity can gain knowledge about through the employment of 'reasoned thought' and observation. As Shapin and Schaffer (1985) note, nature is seen to be characterized by static natural laws which society is able to bear witness to with the aid of scientific method, tools and practices. Drawing on this argument, Latour disparagingly describes this autonomous and observable nature in the following terms:

> "Inhuman, reductionist, causal, law-like, certain, cold, unanimous, absolute – all these expressions do not pertain to nature *as such*, but to nature viewed through the deforming prism of the glass vessel!" (Latour, 1999a: p.10).

At the centre of this critique is a reconceptualization of knowledge. Where a dualistic perspective envisions knowledge as a mode of deriving meaning from an external reality, according to Berger & Luckman (1967: p.15) constructionism asks how knowledge is shaped as reality. By constructed these authors, are referring to the ways in which the meanings assigned to reality are negotiated and struggled over through a variety of social relations and practices (Potter, 1996: p.12). Karl Mannheim, whose sociology of knowledge has been hugely influential in developing these arguments, thus proposes that knowledge is an idea which, when approached sociologically, links thought with social action (1936: p.237). It is in this way that the crux of the critical potential offered by a constructionist approach to the sociological understanding of science and technology can be identified. If reality, or more accurately our knowledge of reality, is constructed, it is neither unified nor static, as implied by the natural realists. Conversely reality, like any other aspect of social life, is perceived to be subject to the contestations which characterize everyday human interrelations and society's relationship with the material world. Thus, Mannheim advocates the need to recognize

the relational quality of all knowledge and experience and to further recognize this variation as the embodiment of social conflict. He states:

> "The world is known through many different orientations because there are many simultaneous and mutually contradictory trends of thought (by no means of equal value) struggling against one another with their different interpretations of 'common' experience. The clue to this conflict, therefore, is not to be found in the 'object itself' (if it were it would be impossible to understand why the object should appear in so many different variations), but in the very different expectations, purposes and impulses arising out of experience" (Mannheim, 1936: p.241).

The contention that our knowledge and experience of reality are both varied and contested can appear at odds to the way in which knowledge is commonly perceived as an absolute. Latour, for example has argued that even if social-natural dualisms and realist claims of absolute knowledge have never existed, modern societies have believed in them and on the surface, at least, have operated on this basis (1993: pp. 10-12). For example, as will be discussed in detail below, science has often held a great deal of authority in governing technological innovation based on its claims to objectivity (e.g., Jasanoff, 1990; Fuller, 2000). A great deal of constructionist research has thus sought to address how some knowledge, including scientific facts, comes to be treated as objective accounts of reality (e.g., Latour & Woolgar, 1986).

Pursuing this path of inquiry, social constructionism closely shadows post-structural theories of power and knowledge. In particular, the widely cited work of Michel Foucault is very much evident in the constructionist approach. Like Berger, Luckman and Mannheim, Foucault is not overly concerned with whether something is right or wrong when discussing knowledge. His persistent and critical challenge is to question the "teleological" and "totalising" claims to knowledge enacted throughout history (1972: pp.15-16). For example, Foucault suggests that homosexuality has historically been known as an act of abnormality through the specific languages and practices – what he refers to as discourse – related to early medicine and psychopathology (Foucault, 1979; Potter, 1996: p.86). The crucial point, as Shields (1998: pp. 38-46; refer also to Grint & Woolgar, 1997: p.32) notes, is that in providing these observations Foucault links knowledge and social action not in reference to the ways in which society makes sense of the world, but in the enactment and

materialization of truths (refer also to Foucault, 1977).

Constructing Science and Technology

The application of this perspective on knowledge and reality has been a particularly popular and fruitful area of research in science and technology studies. Here the challenge of absolute knowledge, and the assertion of the sociality of reality, takes the form of a critique of scientific and technological determinism. No singular determining force, whether ideological or natural, is perceived to stand behind any scientific fact or technological object. In other words, constructionism posits that knowledge and technologies do not embody any essential meaning in and of themselves (Latour, 1996; pp. 85-86).

John Law (1999) describes Actor Network Theory (ANT) – one of the most prevalent constructionist approaches to the sociological study of science and technology – as characterized by two main projects. The first, begins with a conception of 'relational materiality' and defines ANT as the ruthless application of a semiotics of materiality: "ANT takes the semiotic insight, that of the relationality of entities, the notion that they are produced in relations, and applies this to all materials" (Law, 1999: p.4). ANT's second project suggests that scientific facts and technological artefacts not only gain form through their relations with and between entities, but are "performed in, by and through those relations" (1999: p.4). When taken together these projects of 'relational materiality' and 'performativity' commit the study of science and technology to a sociology of complexity. As a critical project, constructionism vehemently opposes all appearances of stability and irreversibility attached to techno-scientific objects, and advocates the awareness of heterogeneity and instability. This point is most poignant when we consider some of the consequences of recent technological failures, and suggests the need to critically engage with absolute claims of technological safety. Latour, commenting on the failed attempt to develop a revolutionary public rail system in Paris, thus provocatively states:

> "There's no inertia, no irreversibility; there's not autonomy to keep alive. Behind these three words from the philosophy of technologies, words inspired by sheer cowardice, there is the ongoing work of coupling and uncoupling engines and cars, the work of local officials and engineers, strikers and customers... People talk about autonomy, irreversibility and inertia are criminals – never mind the purity of their motives. May the ashes of Chernobyl, the dust of the Challenger, and the rust of the Lorraine steel mines fall on their heads and those of their children." (Latour, 1996: p.86).

In a similar fashion as Foucault, the constructionist approach puts forward the need to engage with the dynamic and local articulation of relations of power which are involved in embedding fixed meaning within scientific and technological objects (Bijker, 1995: pp. 262-266). Simply stated, sociology is directed to address scientific facts and technological objects in relation to the context of social relations in which they are situated. Behind any technology or factual claim, the argument follows, are complex networks of social relations woven together to give the impression of fixity and stability. Callon (1986) thus directs sociology to understand power in relation to the ability of "researchers to impose themselves and their definition of the situation on others," in promoting a particular view of a technology (Callon, 1986: p.196). Stated differently, Akrich identifies the construction of technology as a process of inscribing "a vision of (or prediction about) the world in the context of the new object" (Akrich, 1992: p.208). In each of these arguments, the authors are directing social understandings of science and technology away from the subjective actions of the actors in their construction. Rather, the ability to shape the meaning of a technology is revealed in the actions taken by various actors in their efforts to negotiate, discipline or stabilize a network of social relations. In other words, scientific and technological objects only appear real, or determined, when these social negotiations reach a consensus (Latour, 1987: p.180). Constructionism thus identifies social action in relation to the processes through which order is forged out of disorder and the contested nature of science and technology is rendered invisible (Latour & Woolgar, 1986: pp.235-261).

In adopting a constructionist approach to knowledge, science and technology the purpose of this discussion has been to find a political space with which to understand the controversy over new agricultural technologies. In developing this space it is necessary to note that the critical capacity of constructionism has been contested by others in the field of science and technology studies[5]. It is therefore in the recognition of some of the limits of constructionism, or in some cases in its defense against such critiques, where the political spaces the theory opens are best revealed.

A significant critique directed against social constructionist research is that in advocating a relativist view of reality, it has been forced down a path of moral impartiality. As Pels (1996: p.277) describes, in attempting to "act symmetrically rather than asymmetrically in [the] explanation of scientific beliefs," constructionists have also strived to be "agnostic rather than normatively partial to winners and losers in the scientific game." Simply stated, in declaring all knowledge relative and socially constructed, sociologists are seen to have struggled to pay any significant attention, or give credence to any moral claims made in debates over science and technology. Hacking (1999: p. 187) thus comments that in the fervour with which constructionism makes its critiques of absolutism, it fails to grasp how controversies over science and technology involve contestations about what is 'right' or 'wrong,' and 'good' or 'bad.' The challenge for research in science and technology studies, as Haraway (1991: p. 187) explains, is only partially about relativity, but also about holding onto a knowledge of technologies and their role in societies which takes account of these values. As she puts it, "to make a no-nonsense commitment to faithful accounts of a 'real' world, one that can be partially shared and friendly to earth-wide projects of finite freedom, adequate material abundance, modest meaning in suffering and limited happiness."

The failure to live up to both sides of these challenges, has probably less to do with the capacities of constructionist theory itself, but probably more to do with the

---

5 Significant criticism has also been leveled at constructionism from outside of STS community, particularly as relate to environmental matters. These criticisms will be dealt with in the following section which discusses the relativity and reality of environmental risks and technology.

focus of research in this field. In particular, the above critiques relate to the perception that constructionists have become distracted by the spectacle of peeling apart science and technology one layer at a time and exposing the social relations behind truth claims. As Osborne states, constructionism at its worst is the performance of a 'macho' drama: "The macho constructionist likes to be iconoclastic, generating drama by saying 'Look here! You thought this or that was natural but it's not, it's constructed all along" (Osborne, 1998: p.232). It is a trick which Hacking (1998) suggests, may once have had some political merit in its shock value, but which through over use has become tiresome.

However, these criticisms should not be seen to invalidate constructionism, or render its political potential impotent. Alternatively, they propose a challenge to the way in which in a constructionist analysis might proceed in addressing the politics of new agricultural technologies. Firstly, they emphasize the need to take on a wider analytical approach to social processes of construction than simply pulling apart truth claims. Authors such as Hacking would thus likely argue that it is not sufficient to simply engage truth claims about the risks of agricultural biotechnology with the intent of undermining their objectivity. For example, this might include dispelling the safety claims of industrial science, or the risk claims of the environmental lobby. However, keeping in mind the commitment to complexity proposed above by John Law, the purpose of constructionism is not simply to deconstruct techno-scientific objects. Relativism, in other words, need not be seen as an end in and of itself. Instead, the political potential of relativism, stems from its ability to identify and engage with the varied social relationships involved in the shaping of new agricultural technologies and their role in society. Thus, absolute ascriptions of safety, or hazard, to agricultural biotechnology should be of less consequence to the constructionist than are the social and political struggles over such labels. Keeping in mind the perceptions of risk discussed in the first section of this chapter, this point is of particular importance in relation to the controversy over GM crops and foods. A cursory glance at the debate already suggests that no singular truth is likely to exist which describes the properties of these technologies. Thus, constructionism provides an opportunity to engage with the varied social relations behind the advocation of truths and accounts of safety which oppose and contradict on another.

Furthermore, the above critiques challenge constructionism to address the ways in which the knowledge of agricultural biotechnology, and of its risk properties in particular, are not only contested but also to examine the moral values tied up in those debates. In other words, it challenges a political understanding of the debate over genetic technologies to pay attention not only to the value of having alternatives, but to how struggles over those values are brought to the political table. For example, as will be discussed in Chapters Five and Six, this implies addressing how participants, in making risk claims, project images of how new agricultural technologies can be *better* developed, understood and managed.

Importantly, in taking up the challenge to accentuate the normative possibilities of constructionism, it is not necessary to speak only about values in relation to the properties of techno-scientific objects themselves. As both Law (1992: p.380) and Latour (1999b: p. 17) argue, just because constructionism has focused on the localized role of actors in networks of construction, does not mean that it is unable to speak about wider social processes. Alternatively, as Hilary Rose states: "the very idea of a socially shaped science and technology has opened the door to a self-consciously normative project of reshaping, to the possibility of a differently constructed science and technology." (Rose, 1998: p.128) Thus, in the same sense that Douglas talks about risks, constructionism is potentially able to link the ways in which actors seek to ascribe properties to technologies, in relation to the wider normative values of society and social institutions. Thus, a further challenge to the understanding of the controversy over new agricultural technologies is to link claims about the nature of the technology to these normative contexts. For example, looking ahead this includes normative debates involving global capitalism and the corporations behind the development of new agricultural technologies.

Overall then, the potential of the social constructionist perspective is derived from the contingency it affords any interpretation of scientific knowledge or technological objects (Bijker, 1995: p.28). At its least courageous, constructionism undermines the stability of techno-scientific objects and identifies those entities operating behind its construction and performance. At its most courageous, constructionism can be a "post-essentialist" political project (Grint and Woolgar, 1997:

pp. 141-168) which invites society to change the world as opposed to just accounting for it. In this sense, the potential of constructionism can be seen beyond any impartial attempt to account for the social politics of new agricultural technologies. Moreover, through constructionism's relativist approach to science and technology, this research gives legitimacy to alternative constructions of science and technology and the social contexts in which they are applied. In setting down the gauntlet to researchers studying genetic engineering, Yoxen passionately states the need to open the politics of agricultural science and technology:

> "[N]othing is inevitable. The view of technological change held by many people is that it just goes on happening relentlessly... However, I believe that new technologies, processes and products have to be dreamt, argued, battled, willed, cajoled and negotiated into existence. They arise through endless rounds of conjecture, experiment, persuasion, appraisal and promotion. They emerge from chains of activity, in which at many points their form and existence are in jeopardy. There is no unstoppable process that brings inventions to the market. They are realized only as survivors. If this view is correct, then the scale and social impact of the biotechnological revolution must be open to negotiation. There must be alternative pathways, which exploit the present scientific possibilities, but which frame them differently. Those alternatives should be capable of realisation, but only if enough people come to see their value and fight for them." (Yoxen, 1986: pp. 27, 29).

To conclude this section, the political potential of constructionism to the study of techno-scientific controversies can be summarized in the following points. Firstly, by adopting an anti-essentialist position emphasizing contingency, constructionism challenges many of society's taken for granted assumptions about the stability and fixity of technological objects and scientific truths. Secondly, by situating science and technology in networks of social relations, it provides a space in which the politics of defining agricultural biotechnology can be imagined and suggests the possibility of a social praxis in renegotiating these definitions. Thirdly, constructionism expands the political landscape by incorporating wider normative and global concerns into the local politics of construction, without reducing one to the other.

Key Issues

So far, the above discussion has presented a brief overview of theories which account for the social negotiation of risk and social constructionist theories of science and technology. In general, several benefits have been attributed to each perspective in framing the way in which the politics of new agricultural technologies can be approached analytically. In this section, the potential benefits of both perspectives are further developed around two key issues, both of which comprise important themes in the literature surrounding risk and technological controversies and, looking ahead, make up important themes in the research data. The first issue concerns research which suggests that risk debates, and particularly those concerning the regulation of risks, are best understood in relation to a far broader range of knowledge than has traditionally been allowed in decision making. This literature builds on both the opportunities afforded by Beck and Giddens' claim that science is becoming demystified, and the opening of ideas of knowledge and technology afforded by constructionism's critical challenge of realism. The second issue involves the potential for understanding culturally relativistic interpretations of science, technology and risk in relation to contestations over the environment. Of particular concern are the values ascribed to nature in debating risks, as well as the ability of relativistic theories to account for the sometimes very real dangers facing the environment.

Democracy and Scientific Citizenship

An important contribution to the understanding of controversies involving new agricultural technologies comes from research which has sought to promote a socially democratic engagement with issues of risk, science and technology. Upholding a belief in the relativity of knowledge, this research questions the authority of science in society, particularly as relates to the ability to speak about and manage technological risks.

As a starting point to addressing these arguments it is helpful to cite Arblaster's (1994) distinction between democracy as a fact and democracy as a concept. As a fact, democracy describes specific social structures, or ways of organizing public governance.

Alternatively, as a concept democracy refers to a series of contested ideals involving issues of inclusion, participation and control over the manner in which science and technology are understood and governed. It is in this sense that the democratization of decision making processes are presented as a means of contending with the potential risks of new agricultural technologies (Irwin, 2001a). Arblaster's definition of democracy as a concept thus closely relates to what has been referred to as 'scientific citizenship.' This is a term which Irwin argues comprises an attempt to embrace the heterogeneity of knowledge and expertise involved in debates over science, technology and risk (Irwin, 1995: pp. 9-36).

Before discussing the theoretical contribution of scientific citizenship and the democratization of knowledge in detail, it is essential to note that these arguments are advanced as a critique of common practices of understanding and managing risk. In particular, scientific citizenship critiques the historical tendency in modern societies to prioritize science and expert knowledge in speaking about potential risks, as well as in directing how they can be regulated and controlled (Irwin and Wynne, 1996). Simply stated, the public has been expected to trust scientists to ask the right questions and provide the right answers about matters of risk and safety. In this light, Fuller (2000) argues that science occupies a unique place in Western society in that we grant it a tremendous degree of authority despite it having no democratic foundation in society. Hence, he describes the relationship between science and the public as asymmetrical, whereby the public is expected to accept scientific authority, while that authority remains unaccountable to public scrutiny:

> "Is there anything more to the much-vaunted autonomy of science than the asymmetrical social relationships... whereby the public must make its actions accountable to science (say, by responding openly to a treatment) but scientists need not, at least not to the same extent, make themselves accountable to the public." (Fuller, 2000: p.230)

As a consequence of the asymmetrical relationship between the public and experts, ideals of democratic inclusion and democratic participation come under challenge. Public engagement, in this light, is potentially reduced to the processes by which society defers to the epistemological authority of scientific knowledge and the social authority of the scientific expert. Importantly, it is through processes of

governance where these relationships are often played out. As Ezrahi (1990) suggests, authoritative deference to science has been closely integrated into the ideals of Western democracies and formed the basis for what has been perceived as a coherent and progressive model of decision making. Wynne likewise suggests that this relationship of deference has become institutionalized in society and in social structures of governance in particular (1996b, 2002).

Taking these ideas further, Jasanoff (1990) argues that by adopting the vision of science as the exclusive knowledge provider and authoritative expert in governance, societies are led towards "technocratic" systems of governance. In these systems Government is perceived to be best able to meet its responsibilities to its citizenry by abdicating power to the perceived independence, value-neutrality, and decisiveness of scientific expertise in building policy and regulating new technologies. Politics in a technocracy is divorced from the action of science, and exists only at the level of government and the application of scientific expertise, as for example in the use of expert advisory bodies (Jasanoff, 1990). Offering an example of this perception of the autonomy of science from politics, Cozzens and Woodhouse (1995: p. 552) cite the work of Price (1965), "a longtime standard in the field of science politics." He is quoted as stating that "the notion of democracy, or ultimate rule by votes of the people, is simply irrelevant to science. For science is mainly concerned with the discovery of truths that are not affected by what the scientist thinks or hopes; its issues cannot be decided by votes." Democracy, to return to Arblaster's definition, is understood only as a fact – an institutional context in which science is applied.

Returning to the idea of scientific citizenship, authors such as Irwin (1995) and Wynne (1996a & 1996b) have been very critical of the monopolization of risk issues by science. These authors, repeating one of the central mantras of social constructionism, argue that scientific knowledge and its authority must be envisioned in context (Barnes and Edge, 1982). Wynne, for example has argued that in order to understand the development of science, its knowledge must be envisioned in relation to how it functions in the "general social context," rather than in an "esoteric scientific context" (Wynne, 1982: p.228). The argument follows that society is often poorly served by expert accounts of risk and attempts to manage risks because they have failed to acknowledge

the social assumptions and values behind their actions. For example, where science might label a product safe in the laboratory, it often takes no account of the application of a technology outside these idealised and artificial settings. This is the case Wynne (1989: pp. 36-38) describes in the risk assessment of agent orange (2,4,5-T), a herbicide used as a brush killer in agriculture and forestry beginning in the late 1940s. Where scientists declared the herbicide safe for usage under specific directions of use, they failed to acknowledge that such directions were either ignored or impossible to follow in the contexts in which it was being used. The consequence of which was that despite expert declarations of safety, the *use* of the herbicide is now notoriously associated with environmental and human health risks.

Moreover, not only have expert models of risk been inadequate in protecting society from potential hazards, but these failure are perceived as the consequence of ignoring the potentially valuable input of the lay public. As Irwin states:

> "[The prevailing approach to public policymaking remains firmly embedded in a... modernistic perspective – where science does indeed construct the definition of risk issues and all other concerns, including alternative forms of understanding and different value structures, become peripheral." (Irwin, 1995: p.62)

Irwin is thus arguing that there are potential benefits to be gained from situating science alongside other knowledges and other values, without necessarily prioritizing one over the other. To this end, a growing field of research, under the banner of the 'public understanding of science' (PUS) has developed in the UK. This research argues that governments must not only become more aware of the social values and assumptions tied up in expert risk analysis, but also recognize the potential contributions of non-expert knowledge in contending with risk (Brown, 1992; Irwin, 1995; Irwin and Wynne, 1996; Irwin et al., 1996; Irwin et al., 1999; Wynne, 1996b).

Researching public perceptions of the risks associated with a chemical plant in the northeast of England, Irwin et al. (1999; p. 1312) summarize three principal benefits of giving credence to the experiences and knowledge of lay members of the public. Firstly, listening to the public is seen to give legitimacy to decision making processes by supporting democratic ideals of inclusion and participation. Secondly, instead of seeing non-expert knowledge as deficient, or even counterproductive to the understanding of

risk, the public can potentially make important contributions to debates over risk and technology. For example, returning to Wynne's account of the regulation of agent orange, he thus asks what might farmers or forestry workers have been able to offer regulators in describing the contexts and practices in which the herbicide was applied? Therefore thirdly, on the basis of these first two benefits, the authors suggest that public observations about risk can offer cognitive gains for policymaking and decision making.

As already suggested, these potential benefits can in part be understood as a consequence of the opening up of processes of governance to a wider public. Such benefits further relate to the expansion of definitions of knowledge permitted in decision making practices. Importantly, this includes seeing the public as the source of valuable knowledge about the moral and ethical valuations of risk. Research into the public understanding of science thus potentially allows the politics of normative values to be made visible and incorporated into governance. In other words, scientific citizenship seeks to acknowledge and give credence to those values which authors such as Douglas and Hacking (refer above) argue are inherent to debates over risk and technology. It is in this sense that Wynne states the need to include "greater issues of what the proper human meanings, conditions, limits and purposes of science and technological innovation should be" (Wynne, 2002: p. 472) into the formal debate over agricultural biotechnology.

The two following statements from Wynne offer a clear delineation of the arguments put forward in advancing ideas of scientific citizenship and the democratization of knowledge, and the challenge to researchers in the field of risk studies. The first passage reflects his critique of the decontexualized and naive approach to the understanding and management of risks, and challenges the perception that the public has little to offer in this regard. He states:

> "[E]ven the most controlled, objective knowledge is embedded within a tacit framework of idealised, fixed relationships. This is what allows it to *be* controlled knowledge... The 'objective' framework floats on a sea of subjective commitments and assumptions which have to be more openly expressed and negotiated in risk assessment processes. Lack of awareness and realistic assessment of these assumptions not only risks getting the 'objective' risks wrong; it also causes socially provocative assertions to be made about the moral worth of the relationships and realities of ordinary people. In their innocence therefore, scientists peddling the 'objective risk'

> framework as a decision making standard are unwittingly sowing confusion and conflict, when they think they are the last defenders of enlightenment." (Wynne, 1989: p. 44)

In the second citation from Wynne, he argues that the problems with the current institutional risk culture is not only that it is exclusionary, but as a consequence alienates wider social and cultural issues from governance. As he more eruditely states the case, the challenge for constructionist research on risks is therefore to continue to open and expose those wider issues with the goal of incorporating them in decision making structures:

> "The definitive modern focus of public discourse on the theme of *risk* and insecurity alone, as if this were the universal natural meaning of the public issues involved over new sciences and technologies, is a key obstacle to any democratic impetus. The effortless cultural-institutional reification of risk is an essential factor in this seamless reduction of public meaning, and this institutional process seems to intensify rather than abate. The responsibility of [constructionist theories of knowledge] is to prise open these scientific, risk and environment-consequences cultures, so as to invite democratic entry. Exposing the underlying ambiguity of such discourse is crucial to that project." (Wynne, 2002: p. 472)

In summary, debates over scientific citizenship and the inclusion of lay perspectives in understanding and governing risks offer important contributions in further framing this thesis' approach to the political debates over new agricultural technologies. By building on the potential of both risk theory and constructionism, work in this area gives more depth to the understanding of the social relations, and those outside of science in particular, involved in debates over the potential risks of GM crops and foods. Firstly, ideas of scientific citizenship suggest that research in this field needs to look at how debates over risks relate to contestations over the inclusion and legitimacy of lay expertise in the debate. Secondly, ideas of scientific citizenship challenge researchers to ask how the knowledge and values the public offer can potentially contribute to the debate. Finally, expressing a fervent commitment to democratize structures of decision making, the work challenges risk research to address the ways in which lay forms of expertise are involved in formal political struggles over the governance of new agricultural technologies.

A second key issue, alongside democracy and scientific citizenship, concerns the relationship between risks and their potential 'real' consequences on the environment. Although, the debate over new agricultural technologies involves contestations over many aspects of risk, including human health and the economy, it has nevertheless been dominated by concerns about the consequences of biotechnology on environmental well-being.

In this regard, the relationships between society, techno-scientific development and the natural world have already been alluded to by each of the approaches documented above. The risk society hypothesis, to recall, in part suggests that modern societies are increasingly becoming characterized by the environmental crises they face. As Beck (1994: pp. 5-8) argues the benefits achieved by industrialization in the past, are now being overshadowed by the environmental costs which have been the byproducts of modern development. Douglas' (1980) cultural theory of risk is also concerned with environmental risks. Specifically, Douglas is interested in how environmental risks relate to struggles over the relationship between nature and society, and the normative values exposed in these debates. Finally constructionism, although seldom speaking directly to environmental issues[6], argues that society's perceptions of the natural world, including our knowledge of it, is impossible to see without acknowledging the social relations which construct its meaning.

The remainder of this section will build on these ideas and draw on related research in the field of environmental sociology to build a framework with which to understand environmental risks. Firstly, nature will be discussed as an increasingly important normative ideal in contemporary society. This is an idea which is vigorously contested in risk debates on the basis of its relativistic focus. Secondly, the ability of these arguments to speak about the relativity of risk without undermining an engagement with the potentially 'real' environmental consequences of new agricultural technologies

---

6

In recent years several key texts have now been published which apply constructionist theories to environmental issues. For example, please refer to Franklin (2002), Irwin (2001b) and Macnagthen and Urry (1998 & 1995).

will be addressed.

As a starting point towards developing an awareness of the normative value of nature in risk debates, it is helpful to make a disjunction between the simple meanings ascribed to 'nature' and its complexities of usage. In its most common form, and that critiqued by constructionism, nature refers to the real, or essential quality of the world. The Collins English Dictionary thus defines nature as "the whole system of existence, forces, and events of the physical world that are not controlled by the human being." However, as Raymond Williams (1997) points out, this type of definition reflects proper assumptions about the meaning of words and offers little in understanding the complexity of their usage. Thus, when confronted by singular generalizations pertaining to the immutable characteristics of nature, Williams reminds us to think, not in terms of proper definitions, but in terms of the variation of our experiences of nature: "[W]hen I hear that nature is a ruthless competitive struggle I remember the butterfly, and when I hear that it is a system of ultimate mutual advantage I remember the cyclone" (1997: p. 70).

Through this disjunction between a proper definition of 'nature' and the capriciousness of its usage, Williams infers that nature is imbued with an extraordinary amount of human history. As he states, the idea of nature is necessarily the idea of humanity, society and, "indeed the ideas of kinds of societies" (Williams, 1997: pp. 70-71). In this way, the construction and performance of ideas like 'nature' and 'environment' are not neutral statements. Instead, their meanings, values and expressions constitute a focal point of modern ecological and social politics. As Harvey argues, we assign value to nature in order to give meaning and value to social life (Harvey, 1996: p. 118, 157). Furthermore, to accept this premise that nature is a normative construction makes it exigent to speak about contested natures and contested values. This is opposed to envisioning 'Nature' in the singular where values are only contested in terms of a materialist and utilitarian definitions. As Macnaughten and Urry cogently argue, if nature is not natural, but socially and culturally constructed, then nature cannot compose the basis for any singular moral, or ethical definition of the "good life" (Macnaghten and Urry, 1998: pp. 29-31). The constructionist perspective of nature thus proposes two unremitting questions which give shape to a perception of

nature as the subject of cultural contestations: "Whose Nature? Whose Values?" (Proctor, 1996).

These questions are made even more prevalent in the contemporary political context of British society when considered in relation to Beck's (1992, 1994) contention that modern societies are characterized by an evolving environmental crisis. Following five decades of growing public awareness of the consequences of human development on the material world 'nature' is more and more often understood as interconnected, violable, and endangered (Tesh, 2000: p.49). Eder likewise argues that the growth of a global culture of environmentalism, and shared perceptions of an environment at risk, marks a potential turning point for the politics of modern society (Eder, 1996: pp. 163-212). It is in this sense that these authors argue that the growth of an environmental ethic has situated debates about the value of nature to the forefront of normative contestations over the shape of British society. As Eder argues, where the politics of the past were oriented around industrialization and the redistribution of resources (a utilitarian definition of value), the politics of nature can be found in contestations over how nature will translate into the common-good. Franklin similarly argues that in late modernity concerns for the natural world play an increasingly important part in the way in which society seeks to find moral meaning and ascribe normative stability in the world:

> "[I]n very complex ways the natural world is still used by humanity to hold a mirror up to itself, to tell new stories about itself and to seek to order and reorder itself. Our conclusion argues that the historically sudden and abrupt changes in late modernity plunged a hitherto complex, highly regulated modern social order and moral community into disorder, moral confusion and lack of regulation. Despite continuing environmental problems, nature operates as a refuge from this and at the same time a model of order by which we may retune and reorder ourselves. Nature seems the panacea for our seriously disharmonious world and we can find a pattern that links the historically sudden and passionate new affair with the natural world to the moral and social collapse of a modern social order." (Franklin, 2002: p.18)

Having presented this approach to the understanding of risk and environmental issues it is important to ask whether speaking of risks in relative terms, may detract from social concerns about the possibly 'real' environmental dangers posed by new agricultural technologies? This question calls attention to a virulent debate between

environmental realists and natural constructionists. The main thrust of the realist critique is the argument that by obscuring the division between the social and the natural, constructionists, if taken seriously, cripple society's ability to analyse and engage with what Searle (1995) refers to as the "brute facts" of nature. Some environmental sociologists (Dickens, 1996; Murphy, 1994; Benton, 1994) have thus argued that without the ability to claim objective knowledge of the natural world, constructionism potentially draws attention away from environmental problems. Benton (ibid.: pp. 44-50), for example, suggests that by detracting away from the 'real' environmental problems associated with resource depletion, "oversocialized" visions of nature contribute to arguments which deny the existence of environmental limits and the need to restrain growth and development. Clearly articulating these arguments, Murphy puts forward the following statement. In it he argues that constructionism's denial of the ability of science to claim objective knowledge of the natural, fails to take notice of the real consequences of human action on environmental well-being:

> "The sociological representation of science as a social construction has tended to obscure the discovery of the properties of nature and the effect such discovery has on social action, to ignore that nature itself is a crucial element in the scientific determination of what will be taken as factual knowledge, and to gloss over the manipulation of nature and attendant environmental repercussions." (Murphy, 1994b: p. 197)

These critiques need not necessarily be seen as an invalidation, or outright rejection, of social constructionist theories. Alternatively, Dickens suggests that most realists are willing to concede that as a discourse, nature is at least in part socially constructed. However, he further argues that, in the end this insight makes "a great deal of ado about rather little" (1996:p. 83), and therefore is of limited consequence for understanding environmental issues. The argument follows that accepting that our knowledge of nature is mediated by society does not preclude nature from exhibiting its own causal powers. For Dickens, the understanding of a causal nature, its impact on society and *vice versa* must remain a central occupation of both science and sociology. Some constructions, as he argues are "more equal than others":

> "[W]hat do the scare quotes around the word 'nature' actually allude to? Are there really no natural limits as such? Are we not again back to the assertion that gravity is simply a product of human consciousness and this means we need take no account of it in our actions? Again, all natures are

> indeed social constructions. But some constructions are in a sense more equal than others. Although they are always revisable, they are 'weak' social constructions referring to 'core knowledge' of the powers, capacities and tendencies of organisms and their development in dialectical relation to their environment. And nature here is not in quotation-marks. It refers to the real powers of human beings as well as non-human organisms. These are not just yet another 'nature.'" (Dickens, 1996: p. 83)

Defending the political potential of constructionism, Irwin (2001b) suggests that these critiques largely misrepresent the claims made by social constructionists (refer also to Burningham and Cooper, 1999). He argues, that the problem begins with the often crude caricatures that divide constructionist and realist perspectives. Taking the middle road, Irwin posits that rather than making ontological judgements about "how the world is," constructionism is more importantly an epistemological venture concerned with "how we know about the world" (Irwin, 2001b: pp. 167-169). Constructionism is thus not interested in denying the existence of the material world; the hole in the ozone layer for example. However, it is necessarily engaged with questions about how we know that such a hole exists, how we define the consequences of that knowledge and how this knowledge is performed in environmental controversies (ibid. pp. 167-169). Where constructionism focuses its epistemological critique and where it finds its political potential is "based less on a denial of the natural world than on analytical skepticism and the methodological imperative to maintain an agnosticism in the face of competing knowledge claims" (ibid. p. 168). Latour, citing Bloor, similarly argues that the focus of constructionism is not realism, but absolutism – the belief that there can only be one understanding of reality (Latour, 1999a). Thus, far from ignoring environmental degradation, these authors suggest that constructionism can encourage a plurality of environmental understandings. Cogently making this case, Irwin states that constructionism both participates in, and encourages, a normative debate over environmental issues in which a heterogeneity of social and natural values can be uncovered. Parallelling Wynne's argument above, the task of sociology is to address and enable these alternative, and not to attempt to offer objective accounts of environmental debates:

> "[I]t can be argued that, by avoiding inevitably contestable claims to 'know better' than one's opponents, constructivism opens up ethical and political choices at the core of environmental engagement. *Rather than presenting sociology as bringing 'truth' to environmental disputes, the constructionist responsibility is to highlight value choices, challenge epistemological assumptions and avoid recourse to unjustifiable certainties.*" (Irwin, 2001b: p.170)

In concluding this discussion of the relativity of nature and environmental issues, this approach further assists an understanding of how debates over the risks and benefits of new agricultural technology relate to normative struggles about the shape of society. Firstly, overlapping the relativist approaches offered by cultural theories of risk and constructionist theories of knowledge authors, such as Franklin (2002), expose nature as a potential political category in the debate over agricultural genetics. This research suggests that when exploring the ways in which social actors contest the risks of agricultural biotechnology, particularly those pertaining to the environment, that further attention be paid to the cultural values of nature and society these politics project. On the one hand, this means addressing the links between risk claims and the values elicited by actors in describing how society ought to relate to the material world. For example, constructionist approaches to nature suggest that it may be beneficial to address the values and perceptions which support contrasting conceptions of how agriculture impacts on the environment. However, on the other hand, this research implies that it is also important to address how the normative valuations of nature, which may be involved in the debate over biotechnology, relate to the values ordering British society more broadly. To continue with the above example, it is of further importance to address how environmental debates can help explain debates over the values currently driving agriculture and food production. Finally, taking account of realist critiques of constructionist theories of nature and the environment, it is also import to speak about relativist politics of risk without undermining actors claims about the potentially real consequences of the developments on the environment. In practice, this does not mean a relative approach needs to take a back seat to realist claims about the possible dangers of GM crops and foods. Rather, it further commits this research project to address the complex ways in which a variegated society knows, defines and performs these 'real' risks.

Conclusion

This chapter set out to address some of the ways sociology can help conceive of the politics of science, technology and risk, with an eye on the politics of new agricultural technologies in particular. More specifically, the purpose of this literature review has been to situate debates over the potential dangers of genetics in relation to a broader socio-political context.

In approaching this aim, the often overlapping theoretical fields of the social production of risk and social constructionism were assessed through a discussion of some of their potential benefits and limitations. Overall, it was argued that theories of the social production of risk allow the debates over agricultural biotechnology to be envisioned in relation to a context recognizable by the increasing complexity of modern British society. Specifically, the work of Beck and Giddens suggested that debates involving the risks of GM crops and foods could be understood in relation to contestations over changing modes of expertise, authority and governance. Further drawing on the cultural relativist perspective of risk associated with the work of Mary Douglas, it was argued that the politics of science, technology and risk could also be approached in relation to normative struggles involving competing values and social visions.

In addition to risk theories, the benefits of the constructionist perspective were envisioned in terms of the ability of social research to move beyond essentialist definitions of science and technology. As a consequence of these critiques, constructionism further posits that science and technology are better envisioned in relation to the complexity of social relations through which they are shaped, defined and performed. Constructionism thus suggests the need to investigate the variety of values and definitions which actors bring to the debate in the struggle to impose a specific image of risk, benefit, or safety on agricultural biotechnology.

Finally, this chapter has argued that within both constructionist and risk approaches, two further key issues arise in this literature which hold specific relevance for the empirical findings of this thesis. The first of which built on constructionism's critiques of an essentialist epistemology and argues that, alongside scientific knowledge,

lay expertise and public values can play an important role in understanding and managing risks. This suggests the need for this research project to question how debates over the risks of agricultural biotechnology involve contestations over the authority of knowledge. Moreover this body of research advances the need to address how these debates are implicated in the impending contestations over the governance and commercial regulation of GM crops and foods in Britain.

The second key issue to be derived from the theoretical literature, concerns the necessity of coming to terms with the importance of environmental politics involved in the GM debate. Recent research in the sociology of nature offers a potential way forward in this regard. It does so, by linking environmental concerns with the social politics involved in contesting the relationships society has with the natural world. Agricultural biotechnology and its potential risks can therefore be placed in a wider context in which the type of relations society has with the natural world are debated, along with the moral and ethical values underpinning these politics. Moreover, this does not necessarily imply that the risks faced by the environment as the consequences of human development are any less 'real.' Alternatively, constructionist theories of environmental risk potentially provide a deeper understanding of those realties.

Overall, the above discussion helps situate this research project in a socio-political framework which takes debates concerning risk, science and technology as a focus in discussing the politics of GM crops and foods. It situates these contestations in the context of an evolving British society, which is struggling to reconcile development with growing concerns about the potentially detrimental consequences this is perceived to imply. Moreover, in adopting this focus, this thesis commits to the understanding of the complexity and heterogeneity of knowledge and values involved in the debate over genetic technologies, and the shape of the society in which they are being incorporated.

With this theoretical framework in mind, this thesis will now turn to a discussion of how this project can be accomplished empirically and methodologically.

CHAPTER THREE: METHODOLOGY

Introduction:

In Chapter Two a theoretical framework was presented that briefly outlined theories of the social production of risk, and constructionist theories of knowledge, science and technology. These sociological perspectives were advanced as beneficial means of understanding the politics of new agricultural technologies within the context of contemporary British society. Moreover, for the purposes of this chapter, the content and tenor of these theoretical outlooks are furthermore suggestive of an empirical approach to the social study of the debate over the use of genetics in agriculture. This is not to suggest that these approaches prescribe any single method to the analyses of risk and techno-scientific controversies. However, they do guide the empirical approach of this thesis in at least two important ways.

Firstly, recall John Law's (1999) call for a commitment to a sociology of complexity. He argued that social researchers' conceptions of science and technology must acknowledge the heterogeneity of social relations involved in their construction and performance. Building on these arguments, authors in the public understanding of science (i.e., Irwin and Wynne, 1996) similarly made a case for recognizing the diversity and equality of knowledge claims in speaking about risks. The methodology proposed here must, in keeping to these commitments, seek and come to terms with the heterogeneity of knowledge and values involved in the debate over new agricultural technologies.

Secondly, work in the field of risk research suggested that risk controversies are linked to the broader politics of modern societies. For authors such as Beck and

Giddens, the focus was on how risks, understood in a context of social change, are challenging the efficacy and legitimacy of social institutions such as science and governance. Furthermore, the culturally relativistic position of Douglas addressed how people are able to critically engage with the cultural values shaping society in contesting risk issues. In this sense, a further aim of this methodology must be to engage with the potential ways in which debates over risk and the use of genetics in agriculture are tied to these broader social and cultural politics.

With these commitments in mind, this thesis proposes a qualitative methodology of study combining interview and documentary analysis. The following discussion details the empirical logic behind these methods, the ways in which they are applied, and how the research data will be approached analytically. To begin the chapter, a more detailed exposition of the empirical tasks of this research project will be made. Specifically, this will account for the consequences of a relativist perspective for conducting social research. Secondly, a description of the data set will be presented, including an explanation of the rationale behind the decision to combine interview and documentary data. Finally, conscious of relativist arguments about the variegated and intrinsically political character of knowledge, a brief discussion of the author's own subjective position in the debate will conclude this chapter.

Empirical Approach

For most researchers working in the social sciences, and for those working with concepts of culture in particular, there is little disagreement about the discipline's inability to speak objectively about a social reality (Silverman, 2001). In other words, after several decades of critical reflection few researchers would purport to be able to apply a purely positivist method to the study of society as was often suggested during the first half of the last century. As a consequence, contemporary debates in social research methods are less about distinguishing socio-cultural methods from positivism, and more about how to move forward from this separation (Motherway, 2001: p. 19). Yet, the extension of the debate between positivism and relativism discussed in the previous chapter to the ways in which the social world can be addressed analytically

continues to provide a useful starting point in developing an empirical approach for this thesis. The aim is not to try to carve a methodology out of a critique of positivism. However, by contrasting the two approaches a better idea of what is required of a methodology for the study of the debate over agricultural biotechnology can be advanced. Furthermore, broaching the subject in this way sheds light on some of the potential pitfalls and weaknesses of relativist empiricism.

Social Realism and a Relativist Response

At the time when the social sciences were taking shape in Western thought, the development of a social methodology was often prescribed as a way of delineating a specific field of social study. Authors, beginning with Comte (1880), argued that disciplines, such as sociology, could benefit from the use of the same sorts of empirical methods that were being successfully applied in the sciences. Simply, they advocated that where the natural sciences applied methods of observation, experimentation and comparison to the material world, social scientists could do the same with the natural world.

Radcliffe-Brown, commonly cited as one of the founders of modern anthropology, stated the case clearly in a valedictorian lecture at the University of Chicago in 1937. In his talk he called for a united social science linking disciplines, including sociology, economics and anthropology, around a proposed "natural science of society" (Radcliffe-Brown, 1957). The aspiration of social research, he argued, was to be able to perform systematic comparisons of different societies (ibid. p.3). Importantly, at the heart of this argument, is a vision of society made up of various institutions which could be considered as objective aspects of any society or culture. Specifically, morality, religion, justice, politics, economics, and their organismic relationships were to be the objects of the sociological gaze. Moreover, influenced by the French tradition of structural functionalism, Radcliffe-Brown perceived these objects as both outside and preceding human interactions. Hence, in advancing a positivist method for social scientists, he did so in a manner which delineated a specific image of society. Clearly elucidating this relationship between the positivist empirical

outlook he proposed, and his vision of the social world as a structural social system, Radcliffe-Brown makes the following deduction:

> "If we agree that natural science is concerned with natural systems, and can agree that a society is a natural system and one that can be investigated, we can have a natural system of society. A natural system consists of entities that are in relations of real (existing in phenomenal reality) interconnectedness... The relations between individuals in a social system are social relations, and these are real things, parts of phenomenal reality." (Radcliffe-Brown, 1957: p.43)

In response to Radcliffe-Brown's hypothesis, the overall relativist framework this thesis has advanced is unlikely to agree with any of these suppositions. Briefly revisiting the arguments of the last chapter, a relativist critique of social realism can be broken down as follows. Firstly, relativism casts aspersions on the ability of science to uncover knowledge about any "phenomenal reality," arguing instead that natural systems are better envisioned as the product of socio-cultural relations. Thus, the foundation of positivism and the natural sciences for social scientific research are called into question from the outset. Underlining the relational nature of all knowledge claims, relativism would likewise stand in opposition to any attempt to speak knowledgeably about an external social reality. Relativism leads sociology away from envisioning *Society* as comprising a series of objective structures and institutions, and towards an engagement with *society* as a series of contested values, knowledge and experiences. In other words, the task of a relativist methodology is to investigate the diversity of relationships and contingencies involved in the ways realities (natural and social) are constructed and struggled over (Irwin, 1995: p. 168).

Points of Caution

However, in contrasting the positivist empiricism of earlier social theorists with the relative perceptions of constructionism, a couple cautionary points should be noted. Firstly, the comprehensive critique of positivism made by the constructionist perspective creates the danger of replacing one form of absolutism with another. As Bowden argues (1995), the purpose of a relativist methodology should not be to replace positivism with constructionism as a means of understanding the social or natural

worlds. In the same sense, he further argues that no single analytical approach should be prescribed as the only way, or the best way, to understand risks, science and technology (ibid.: p. 74). To do so, only serves to duplicate the types of segregation constructionists seek to unravel, and would, therefore, be hypocritical given the critical pretensions of the relativist approach. Similar to the critiques raised by Hacking (1998) and Osborne (1998) in the previous chapter, Bowden is particularly concerned that some constructionists, distracted by their deconstructionist antics, have consequently have committed just such a scholarly offence. He states:

> "First they substitute one type of segregation for another. Where positivists held that a single, nature-based approach (the scientific method) was appropriate for understanding both nature and society, recent theorists argue that a single, socially based approach (social constructivism) explains both the natural world and the social world. This is the conceptual equivalent of the feminist argument that you counter one type of sexist perspective (male centered) by substituting a second type of sexist perspective (female centered)." (Bowden, 1995: p.77)

To avoid this type of hypocrisy, a constructionist methodology is best served by applying the same relativist principles with which it approaches ideas of risk, science and technology to its own epistemological ventures. In making this critique, Bowden is simply making the case that a methodology should reflect the overall purpose behind a research project and not be an aim in and of itself. For example, in the feminist case the overall purpose would be to produce a non-sexist paradigm. The overall purpose guiding empirical projects in science and technology studies, Bowden argues, is the "development of a perspective that truly integrates nature and society" (1995: p. 77).

A second note of caution in developing a relativist methodology relates to the roles of description and explanation in data analysis. Where in positivist research these roles intrinsically refer to each other, in relativistic research there has been a tendency to isolate one from the other (Collins and Yearley, 1992). For example, Radcliffe-Brown's positivist hypothesis operates on the assumption that scientific descriptions of society constitute a reality and, therefore, form a basis for explaining the institutions and structures of society. However, when the bond between description and reality is broken, explanations of society and social phenomena have often been left to the side. As Collins and Yearley (1992) cogently argue, the relativist commitments of

constructionism have at times led researchers towards providing exclusively descriptive accounts of the social contexts and relationships involved in techno-scientific controversies. The authors do not mean to suggest that such descriptive accounts are not of value themselves, nor are they positing a return to positivist explanations of the social world. Simply, they argue that empirical relativism sells itself short by not asking, or seeking to offer, answers to critical social questions, particularly given the democratic ethos of contingency underlying constructionist research. Explanation should, in other words, not be seen as an empirical limitation of relativist principles but as enabling a methodology which truly seeks to engage with the social world. Mulkay thus argues that the project of sociology is not to simply report, or describe the social, but to participate "actively in the world in order to create the possibilities of alternative forms of social life" (Mulkay, 1991: p. xix). Coffey and Atkinson state the argument this way:

> "We do not simply 'collect' data; we fashion them out of our transactions with other men and women. Likewise, we do not merely report what we find; we create accounts of social life, and in doing so we construct versions of the social worlds and the social actors that we observe." (Coffey and Atkinson, 1996: p.108)

Empirical Tasks

Having situated this project within a relativist framework of social research, and conscious of the above points of caution, the following empirical tasks, or commitments, can be identified. These form the basis for constructing a methodology with which to examine the questions advanced in Chapter One.

Firstly, in agreement with Bowden (1995), the empirical imperative guiding this research project is not to demonstrate that positivist perceptions of science and society have it all wrong in discussing risks, nor that social constructionists have it all right. Much more fundamentally, the emphasis is on building a methodology which is able to address the ways in which risks and debates over new agricultural technologies negotiate the boundaries between nature and society. Moreover, adopting this focus should commit this social research project to the democratic principles underlying

constructionist theory. In other words, building on the work of authors, such as Irwin and Wynne (1996), one of the tasks before this thesis is to give voice to a diversity of experiences and understandings of risk in relation to both the social and natural worlds.

Secondly this research project is mindful of Collins and Yearley's (1992) challenge to combine description with social explanation. In relation to the research questions posed in Chapter One, this thesis requires a methodology which is able to provide the basis for an explanation about the types of values people hold in making risk claims and how these values relate to normative contestations about the shape of British society. This includes offering a critical explanation of the ways in which risks, values and knowledge are performed in social life, particularly in regards to social relations of expertise and authority.

Part Three of this thesis concerns the way in which social institutions, and governments in particular, are able to contend with social conceptions of risk and knowledge, therefore, creating a final analytical challenge for this research project. Stated simply, the task is to apply a relativist sociology of the debate over new agricultural technology within an institutional setting. In this light, institutions will not be perceived as objective realities, for example as suggested by social positivism. Rather, they will be approached as a context in which the debates over new agricultural technologies are orchestrated around formal debates concerning issues of regulation and control. The empirical task is in part to describe contestations over risk, knowledge and expertise within these formalized debates. Moreover, it must also provide the basis for an analysis of the way in which Government is able to respond to these politics in making decisions concerning the future of agricultural biotechnology.

Methodology and Data Set

Taking account of the empirical tasks laid out by a relativist approach to social research does not predispose, or prescribe, any single methodology for the social study of risk, science and technology. Thus a choice has been made, based on both empirical considerations and practical necessity, to adopt a loosely discursive methodology based on a constructionist analysis of talk and text (Potter, 1996: p.105) Although discourse

analysis can include the use of any number of methodological tools, this research project employs a combined methodology consisting of both interview techniques and documentary analysis. The discussion below demonstrates the benefits of applying these methods and justifies why they were chosen in the context of this project

Interviews

Although interviews and discourse analysis are popular ways of proceeding in risk and STS (science and technology studies) research, they are not the only ways to address the subject. Ethnography, for example, has been a useful tool for social researchers to map and understand the cultural relationships involved in the construction of scientific meanings and technological objects. Latour and Woolgar's (1986) ethnographic study of scientists has been highly influential in directing research in science and technology studies, and has offered significant insights into the way facts are constructed in laboratory environments. Others, such as Bijker (1995, also Bijker and Law 1992), have applied documentary research techniques providing historical accounts of the social and material relations involved in the construction of technologies whose meanings we often take for granted (eg. the lightbulb). Focus groups are also advocated as a means of providing access to in-depth accounts of people's experiences with risk, as well as the values they hold in relation to the potential dangers they face from technological, or scientific development (Irwin et al., 1999; Walker et. al., 1998).

Although in some cases it may have been optimal to apply these alternative methods in addressing the research aims of this thesis, the context of the debate over new agricultural technologies dictated that such methods were either inappropriate, or impractical. A critical ethnography could perhaps offer an unparalleled depth of analysis of the cultural politics involved in debates over risk, science and technology. As Thomas describes, by reflecting on culture, knowledge and action, ethnography "opens to scrutiny otherwise hidden agendas, power centres, and assumptions that inhibit, repress and constrain." (Thomas, 1993: pp. 2-3) However the depth of access provided by ethnography is achieved by tying a research project to a specific locality or context through practices of participant observation; for example, the laboratory setting

advanced by Latour and Woolgar (1986; also Latour, 1987; Downey, 1998). However one of the compelling points of interest in the debate over risks and new agricultural technologies, to be discussed in detail in the following chapter, is that these struggles are taking place across a variety of social contexts. They may involve scientists in the laboratory, but they also involve farmers, environmental groups, corporations, governments and of a host of other publics. It is difficult, therefore, to imagine ethnography given its emphasis on in-depth and localized research as the best means of coping with the diffuseness of the debate.

Focus groups, or group interviews, are also often presented as a means of gaining in-depth qualitative data concerning the ways in which people's attitudes and experiences are constructed and expressed around specific topics (Kitzinger and Barbour, 1999). Whereas an interview is limited to a one-on-one interaction between the researcher and the participant, focus groups involve multiple interactions outside of the control of the researcher. As a consequence, Kitzinger states, they provide a valuable means of allowing research participants to take "the research into new and often unexpected directions and in engaging with each others in ways which are both complementary and argumentative" (Kitzinger, 1994: p.166). Given the research objectives of this thesis, focus groups would appear well suited to providing the varied and culturally provocative accounts of risk this thesis is seeking.

However, as ethnography was deemed inappropriate because of the diffuseness of the debate, focus groups are impractical for similar reasons. Although considered early on in this project as a method of analysis, by their nature focus groups require bringing people together in one location at a specific time. However, where this task is not a substantial barrier in doing research on segments of the general population, the questions posed by this thesis direct analysis towards the experiences of those actively involved in the debate over agricultural biotechnology. This would imply a use of focus groups in either one of two ways. Firstly, a series of groups could have been conducted, each generating a set of results around a particular segment of the public (ie. farmers or scientists). However, given the variation this thesis seeks, the sheer number of groups and the vast amounts of data focus groups provide, such a task would exceed the limitations in time and resources of a doctoral project. Secondly, taking account of

these difficulties, a series of groups might have been conducted bringing together the various active participants in the debate. However, even in a situation such as this, the logistics required present considerable barriers to this research project. For example, focus groups combining various elements of the debate would require bringing together people from around the country to meet in one place at one time. Even if it were possible to arrange such a meeting, it would require considerable resources on the part of either the researcher, or the participants, to bring people together. Such resources, as most readers will be aware, are seldom available in doctoral research.

For these reasons, interviews were chosen, not necessarily as the ideal means of meeting the empirical focus of this research project, but as the best possible means of doing so considering the practical requirements of the debate context. Acknowledging this should not discount the potential of interviews as a means of accessing the experiences and values of actors involved in contesting risks and agricultural genetics. However, in order to maximize the benefits of this methodology, three pressing considerations overlie the interview process conducted in this thesis.

Firstly, interviews can be an important methodological tool in that they can potentially access a wide range of research participants and their experiences in the debate over GM agriculture. Although it is likely impossible to encapsulate all the different perspectives involved in the debate, this project applies interviews in an attempt to address this diversity to as full an extent as possible[1]. The project thus comprises twenty-five separate interviews, involving research participants from a wide range of backgrounds and with varied experiences with the debate (Refer to Appendix B). For example, members of the scientific, farming, corporate, and non-governmental organization (NGO) communities all volunteered their time to be interviewed[2]. These

---

1 Although seeking to engage with as wide a variety of perspectives as possible this thesis in no way claims to be able to speak for a public in general. By having chosen participants with an active interest in the debate over new agricultural technologies, participants often shared many similar characteristics. For example, the majority of participants I spoke with had a background in higher education. For many, this background included a scientific education and a detailed familiarity with genetic technologies. Furthermore, participants often shared experiences in political engagement around a variety of issues.

2 In general, interviews lasted between forty-five minutes and an hour. Where possible interviews were conducted in person. However, because the participants involved in this thesis came from locales ranging from Cornwall to Scotland, it was necessary to conduct some interviews over the telephone. Without

participants played many different roles in either contesting, or supporting the use of genetic technologies in agriculture. These included involvement in technological design and development, governance, activism, public advocacy / lobbying, corporate promotions, risk evaluation, and the cultivation of GM crops.

It should be noted that these labels are in some ways misleading. Participants often defined their role in the debate in ways which blurred these boundaries. For example, scientists were just as likely to be corporate spokespersons, regulators, or activists, as they were to be just scientists. Likewise an environmental campaigner could be active in crop destruction activities, may be working as a lobbyist, or be involved in governance. These labels are therefore applied simply as a means of guidance in this thesis.

Secondly, the purpose of the interviews is not to impose a representative account of a participant's view of the GM debate, or of their subjective experience in it (Silverman, 2001: pp. 87-97). It is not the place of the sociologist to be a ventriloquist – to speak for participants – as Irwin notes (1995: pp. 168-169), but to give participants an avenue of speaking for themselves. I do not wish to overstate this point. Indeed, as the reader will find throughout the following chapters of this thesis, participants' comments are presented and discussed in a manner which interacts with and builds on the theoretical arguments outlined in Chapter Two. Rather, the point I wish to make here is that a more detailed textual deconstruction of the interview data is neither intended, nor desirable, for this research project. Therefore, the intention is not to propose a methodology short of sociological analysis, but to provide an analysis which sees participants act as co-researchers rather than as research subjects.

To this end a semi-structured interview technique was employed. This allowed for a consistency in the data and the ability to make links across interviews, but also permitted the interviews to reflect the diversity of contexts and approaches participants brought to the research questions. Roughly speaking, participants were asked questions along several convergent lines of inquiry. Firstly, as a way of gaining a rapport with participants and of gauging their approach to the issues surrounding agricultural

---

reservation, it can be stated that both methods proved equally beneficial in engaging participants' experiences and arguments.

biotechnology, participants were invited to offer an account of their personal background leading up to their involvement in the debate. Often this involved a detailing of why a participant had been motivated to get actively involved in either supporting or campaigning against new agricultural technologies. Moreover, participants were prompted to describe their own role in the controversy. For example, participants commonly spoke of the missions and political standpoint of the organizations they were working with. All participants were also asked to speak broadly about the technologies and the controversy from a more personal perspective. This included prompting participants to *overtly address* what they thought were some of the normative and moral issues implied in the debate.

A third consideration, closely linked to the point just made, is that in order to avoid speaking for participants, or representing their views, a constructionist perspective of the interview has been adopted (Silverman, 2001: p. 95; Potter, 1996: pp. 97-121). Although some degree of representation is endemic to any research project (Coffey and Atkinson, 1996: p.108) this approach attempts to minimize this by focussing on the ways in which participants construct the meanings of risk. This opposes, for example, research which might attempt to tie specific arguments and values to particular individuals or groups, such as implying that environmentalists or scientists share a common set of attitudes and values towards GM crops and foods. Therefore, the challenge is to provide these accounts of participants' stories without undermining the ability of participants to speak for themselves; to balance analysis with description. Outlining the goal of the constructionist in using interview data, Holstein and Gubrium state this challenge well:

> "The goal is to show how interview responses are produced in the integration between interviewer and respondent, without losing sight of the meanings produced or the circumstances that condition the meaning making process. The analytic objective is not merely to describe the situated production of talk, but to show how what is being said relates to the experiences and lives being studied." (cited in Silverman, 2001: p. 97).

In attempting to meet this challenge a rhetorical method of analysis has been applied to the interview data in subsequent chapters. As Potter (1996: pp. 106-108) notes, this sort of analysis guides the researcher towards an analysis of the resources participants use to persuade others of the validity of their own perspectives. The focus

is on the types of arguments made in either defending one's position, or challenging that of another. For example, as will be discussed in Chapter Five, several opponents of GM crops and foods applied a language of risk as a rhetorical device in critiquing the role of global corporate capitalism in agriculture, and vice versa. In this sense, a focus on rhetoric is a helpful way of guiding the research analysis towards linking claims about the risks of agricultural biotechnology, with participants' normative concerns about British society. Moreover, in doing so it allows the researcher to subjectively create some general analytical links across participant experiences, without necessarily overriding her/his own specific experiences and values.

Documentary Analysis

In addition to the use of interview data this thesis also employs a range of documentary research, particularly in relation to Part Three of this thesis concerning the governance of risk and new agricultural technologies.

Combining documentary data alongside the comments of the research participants is beneficial for a couple of reasons. Partly the research aims of this project are to address the ways in which contestations over risk are taking place in the governance of new agricultural technologies. Documentary data offers a window into these processes. This is particularly important as ideas of "risk" increasingly feature in the official discourses of British bureaucracy, including perceptions which appear to challenge traditional technocratic models of risk management. As an example, Lord Phillips' Report (2001a) on the Government's handling of mad-cow disease[3] provides an invaluable resource for documenting the changing nature of the governance of risk in which the current debate over agricultural biotechnology is taking place.

Moreover, the rapid evolution of the uptake of concepts of risk in governance involved in the case of GM agriculture requires a flexible methodology to account for this change. Where the interviews conducted over the course of this research project account for the debate up until the date of the interview, documentary data has offered

---

3 Please refer to Chapter Seven.

the possibility of following the evolution of the debate in government beyond these points. During and since the period between October 2001 and July 2002 when the majority of interviews were conducted, the political terrain in Britain has evolved considerably. In particular, the Agricultural and Environment Biotechnology Commission (AEBC) has been very active over the entire time frame of this project in seeking to get non-expert perceptions of risk acknowledged in Government. The documentation provided by the commission, beginning with its first report published in September 2001 and continuing through the documents associated with the Commission's recent (summer 2003) establishment of a public debate on GM crops and foods, thus offer considerable insight about the evolution of risk issues in governance.

In terms of analysis, documentary data is approached in the same ways as that provided by interviews. In other words, the documentary data provided should not be read as a realistic account of the world, but involved in its own constructions of reality (Atkinson and Coffey, 1997: pp. 45-62). The idea of a rhetorical discourse is not limited to the spoken interaction of the interview. As Atkinson and Coffey point out, an analysis of text can be seen to be fundamentally about how a document "persuades their readers... to get a particular point of view across to others" (ibid.: p. 61). In this sense, when possible, the analysis of documentary materials has sought to relate texts (spoken or written) to one another.

Personal Reflexivity

Through the use of these methods this project offers one interpretation of the debate over new agricultural technologies. Thus, although it seeks to give voice to a diversity of risk perspectives and cultural values, the interpretation and presentation of the data are the author's / mine alone. It is, therefore, worth briefly stating my own background and position in the debate over new agricultural technologies in Britain.

In many ways, I come at this debate as an outsider. As a Canadian, with no previous experience of living in Britain prior to this project, my conceptions of agriculture and risks, particularly those pertaining to the environment, were often at odds with those of the research participants. For example, participants constantly

reminded me that agriculture and nature hold a close and symbiotic relationship in the British context, which they might not in Canada. The argument follows that where hedgerows and agricultural landscapes are essential to understanding Britons interactions with nature (Bell, 1994), ideas of wilderness are seen to be more prevalent in North America with agriculture often taking place outside the environmental gaze (Cronon, 1996; Sandilands, 2000). This provides one example of the difficulties of coming to terms with the cultural context in which the debate over GM crops and foods is taking place. However, it is certainly not the only one. Others, might include the particularity of the growing distrust between British citizens and the Government following mad-cow disease, or the relationship between science and authority embodied by institutions such as the Royal Society. In this sense, I have attempted to be conscious of my own perceptions in describing what are aspects of a similar, but nonetheless, different cultural experience.

Furthermore, I come into the debate over the use of genetics in agriculture from a largely academic perspective. Previously I have conducted sociological research on the debate over the use of recombinantly engineered growth hormones in milk in Canada in the mid-1990s as part of a Master's dissertation (Jones, 2000). As was the case then, the adoption of biotechnology as my research focus has been primarily motivated by a scholarly curiosity in the debate and the importance it has been given in socio-political culture of Western society. As such, I have not come into the debate with a clear-cut position in the debate, and after four years of research I would still be unable to equivocally say if I was for, or against, the use of biotechnology in agriculture. This is not to say that I don't have doubts about the technology, or that I have reservations about the manner in which it has been developed to date, but that these concerns have not hardened into a clear position. In this sense, I have found it an enlightening personal process to hear arguments both for and against the technology by participants with passionate views about the future of new agricultural technologies, the environment and society. In keeping to the general tone of this thesis, I have sought to respect the views of all participants equally, even in situations where I may have disagreed with their arguments. The aim has not been to gain an objective vantage from which to impartially observe the debate, but simply to give these various perspectives

equal voice in the debate.

However, as noted above, the purpose of any research project is not only to provide a description of a particular facet of society, but to engage in the shaping of that society oneself. In this sense, I agree with Harvey (1996), who persuasively argues that social research must be unafraid to demonstrate commitments to certain social values. In Harvey's case these include responsibilities to social justice, the environment and what he terms the 'geography of difference'. Thus, although somewhat ambivalent in my position to GM crops and foods, my own version of the sociological story of the debate is motivated by similar commitments. These, include issues of social justice and environmental welfare, but further relate to democratic values of equality, inclusion and choice. Simply, this research project hopes to bring these values to the debate over GM, and hopes that the participants and readers that have given their time to this thesis would be supportive of this project.

Having introduced the research topic of this thesis and outlined its theoretical position and method of research, the following two sections will turn to an analysis of the politics of risk involved in the debate over new agricultural technologies.

PART TWO : THE POLITICS OF RISK AND SCIENCE

"Will GM ever really improve the fabric of our society? Will it be a more peaceful, more cooperative and more harmonious place, which I assume most people are wanting to work towards? We may have different visions of what all those words mean."

– A GM Activist and self-described 'Crop-decontaminator' (Participant I)

"People perceive risks through different 'frames' that reflect their values world views, and concepts of social order. These frames can influence definitions of risk, allocations of responsibility and blame, evaluations of scientific evidence, and ideas about appropriate decision-making authority. Is risk to be defined as a technical matter to be resolved by measuring the extent of harm? A bureaucratic issue of appropriate regulatory mechanisms and jurisdictions? An economic question of allocating costs and benefits? A political issue involving consumer choice and control? A moral issue involving questions of social responsibility, religious values, equity, and rights?"

- Dorothy Nelkin (2003), "The Social Meanings of Risk."

CHAPTER FOUR: THE CONTROVERSY

Introduction:

This chapter offers the reader some background to controversies regarding agricultural biotechnology in the United Kingdom. Given the pervasive and complex nature of these controversies, the intention is not to provide a comprehensive account of the debate. Rather the aim is to give the reader a brief snapshot of the technologies, the public reaction which they provoked in the UK and the context in which this debate has taken place[1]. The focus is on those aspects of the story which are of specific relevance to the analysis presented in the following two chapters. In this light, this chapter situates the politics of new agricultural technologies within the frameworks outlined by research participants in interview[2].

In building this context, three interrelated histories of the controversy over agricultural biotechnology are presented. In the first, the development of agricultural biotechnology as a public debate in the second half of the 1990s is outlined. Guided by participants comments, this history suggests some initial links between the debate over the risks of GM agriculture and the evolving social context of this time. Secondly, part of this public debate involved a history of the initial commercial growth of the biotechnology sector and the subsequent reversal of fortunes of the commercial viability

---

1 A time line of events is provided in Appendix A to assist the reader in drawing these histories together.

2 In outlining these histories this chapter will occasionally draw on extracts from the interviews conducted over the course of this research project. Participants, in many cases, had long been involved in the events leading up to the controversy over GM foods. Thus although this chapter is not intended as an analytical discussion *per se*, participant statements assist in telling the story of the debate.

of genetically modified (GM) foods, and the industries behind their development, are documented. Specific attention is paid to the commercialization of GM tomato paste – the first GM commodity to reach the shelves of British supermarkets – and to the life-industry model behind initial attempts to commercialize GM agriculture. Outlined in the final section of the chapter are some of the key scientific cases around which the public controversy has developed. This account makes the suggestion that the controversies over agricultural biotechnologies are not restricted to matters of technological risk alone, but point to science as a focal point in which the social and cultural politics of risk are played out.

The Growth of a Political Debate

This section addresses the rise of agricultural biotechnology as a public debate in the U.K. It is worth noting from the outset that the development of agricultural biotechnology has not always been accompanied by such an overt public debate as characterizes the controversy today. When compared to the overall history of the technology, the public debate over GM crops and foods is in fact a relatively recent event, beginning in the second half of the 1990s. This is not to suggest that the technology advanced uncontested from the 1970s up until this point of time (e.g. Krimsky, 1992), but rather that its rise to prominence on the political stage has occurred only recently. To recall, the overall question asked by this thesis is 'what are the politics of new agricultural technologies, and more particularly what are the politics of risk involved in the debate over GM crops and foods?' The following discussion will give some depth to this question, suggesting that it may be more pertinent to inquire into what has brought GM agriculture to the fore of public debate in Britain.

The Debate Before 1996

Although, as several research participants noted, one could be forgiven for assuming that the commercial development and marketing of agricultural biotechnology did not begin until the late 1990s, the technology has a much longer history. Although

some will claim that biotechnology dates back to the first attempts at fermentation or cheese making, the practice of genetic engineering has its origins in the 1950s with Crick and Watson's discovery of DNA. The development of molecular genetics accelerated through the 1960s, with the discipline gaining increasing prestige in the scientific community. It was not until the 1970s, when scientists were becoming skilled at manipulating the genetic structures of organisms, a period Durant (1992: p.10) refers to as the "true dawn of biotechnology," that any concern was raised. A short lived moratorium on some types of genetic manipulation was called by scientists on both sides of the Atlantic in 1974, including by Watson. Accompanying this initial moratorium public skepticism about the risks of genetic engineering technologies began to develop. However, by 1976 with commercial benefits for the taking and corporate research money on the funding table, the moratorium was dropped. Biotechnology entered a phase characterized by the search for practical applications and commercial markets (Yoxen, 1983: pp. 32-67). As Yoxen states, any apprehensions scientists held about the technology were obscured by an "economic sunrise" (ibid.: p. 64). Although concern about genetics continued to bubble throughout the next two decades, particularly concerning the regulation of human genetics, no extensive public debate was evident in the UK during this time (Marris et al., 2001: pp. 36-42). Any space for a public debate that had been opened with the signing of the moratorium, was lost in the rush for commercial prosperity and obscured by the speculated benefits the technology was going to bring society.

In the case of the development and testing of GM crops in the UK, little public debate has accompanied these practices until recently. This despite the fact that releasing GMOs into the environment as part of the scientific evaluation of the technology has been occurring for close to 15 years, beginning with a trial of herbicide tolerant rape seeds in 1987. At the time, no specific legislation existed which covered the growing of GM crops for commercial or research purposes. Government and industry operated on the basis of a voluntary agreement to carry out risk evaluations (health and environment) before any consents would be issued. Even when government began to develop early legislative frameworks around the technology at home and in Europe, little public interest was raised. Thus, the business of issuing licences for the

release of GM crops went ahead in the Advisory Committee on Genetic Modification (created in 1984) largely unquestioned for the better part of a decade. Even when the voluntary basis of the licencing practices was set out in legislation in 1993 little public interest could be generated. One senior civil servant involved in the creation of the legislation at MAFF (the then Ministry of Agriculture, Fisheries and Foods, now replaced by the Department for Environment, Food and Rural Affairs) described the situation this way:

> "If we go back to the first release... People are amazed when I say to them that the first releases of GM plants occurred in 1987. People don't believe me, but it's true. Herbicide tolerant oilseed rape has been trialed in Britain in 1987. There were trials in Cornwall, Berkshire and Scotland looking for its impact on the environment... So the civil servants were regulating the industry and nobody was taking an interest in it... We made the legislation that is currently in force and we had public consultations on bringing in the legislation and nobody in particular took any interest." (Participant X)

The absence of any public interest in the topic, the participant further explains, not only surprised those at MAFF, but given the political climate of the time was the cause for some concern. Under consecutive Conservative Governments in the 1980s agricultural planning was characterized by policies of increased industrialization in farming and industry self-regulation. It is worth noting that these are the same policies which have now been implicated in the rise of the BSE epidemic and which in this context drew little public or regulatory attention (Miller, 1999). Knowing what we now know about the consequences of BSE, the lack of concerted engagement with the changing nature of the UK agricultural industry now appears conspicuous in its absence. As the participant cited above further revealed, the only voices of caution were coming from within Government itself. Where MAFF did find pressure being exerted on them was from an industry and governing party who wanted to quickly deliver GM foods into the marketplace at pace with the United States. This contrasts starkly with the situation today. Generally perceived in favour of the technology, the Labour Government and DEFRA (Department for Environment, Food and Rural Affairs) have both been under widespread and consistent pressure to hold off on the commercialization of GM foods. The respondent states:

> "The main problem we had with introducing the legislation was that the industry thought that we were being too hard on them. The Thatcher Government was in place at the time they thought we were being too hard on the industry and we struggled at that time to make the legislation. We were under pressure at that time to make sure that any consents that were applied for were dealt within a matter of days. When we issued the Europe wide licence for the import of soya, we as civil servants were worried that nobody was taking an interest in it, because we thought of it as being extremely important; the first genetically modified food to be approved for sale in Europe. We thought that this was a pretty big step and there wasn't the slightest bit of interest in it whatsoever. I signed the consent on behalf of the European Community and nobody took any notice. We got worried that nobody was taking any notice." (Participant X)

As implied in these comments, even amongst the activist communities and non-governmental organisations (NGOs) for which agricultural biotechnology is now a foundational campaign issue, concerns over crop biotechnology were, for the most part, not even on the agenda in the 1980s and early 1990s. For example, in 1987, the same year the first crop trials were being planted, the Green Alliance, a lobbying group whose mission is to stimulate debate and incorporate issues of environmental concern into Government, attempted to start a debate by inviting Jeremy Rifkin to the UK on a speaking tour. Rifkin, an American author and activist had been influential in embedding GM issues within the US environmental lobby. Known for his 'evangelical' tone, Rifkin's invitation was intended to force the issue onto the agenda at a time when the Green Alliance was gearing up to lobby government over the writing of Part Six of the Environmental Protection Act (EPA) concerning the establishment of European regulations for the growth of GM crops. Yet, despite having some success in their lobbying activities, little ground was made in bringing the issue forward in the consciousness of the wider activist community whose attention was being focussed elsewhere. A participant from an NGO background who has long been involved in pushing for the regulation of biotechnology offers the following comment, shedding light on the attitudes of the time:

"The Green Alliance has always given itself an agenda setting role with environmental issues, rather than necessarily pursuing things in depth. By having Rifkin's tour, we felt we were setting the UK environmental policy agenda. It would be up to the NGOs to take a hold of it as they wished. At this time climate change and ozone depletion were becoming 'respectable' environmental issues. Previously they had been seen as wacko claims that no one thought were scientifically underpinned. When they became confirmed scientifically they became big campaigning issues and it was clear in the late 1980s that there wasn't room on the NGO agendas for GM." (Participant J)

From a commercial perspective, when the controversy finally broke, an industry which by now had a range of products ready for market and which had passed almost all the scientific and regulatory hurdles was left perplexed. Looking back from where we are in the controversy in 2003, it might be assumed that prior to the late 1990s industry and government had successfully colluded to keep things quiet in the hope of avoiding a public backlash. However, as a corporate representative suggested in one interview, the industry had been very vocal in promoting the benefits of genetic technologies to the investment community, supported by a series of vigorous advertising campaigns. Going about their day-to-day business within this context of success and perceiving broad range support for their early products, they were left floundering when the issue finally broke. Furthermore, the biotechnology and seed industry was unable to contend with the breadth and pace of the controversy. The following exchange comes from an interview with a research scientist whose role following the outbreak of the controversy was transformed to that of a corporate spokesperson on agricultural biotechnology:

"Why was there a shortage of public affairs experience at [your company] prior to the GM controversy?"

"The main reason is that we were not in an area that attracted any kind of broad scale public interest; not just controversy, but interest. We are a company that produces technological solutions for farms and for farmers. Our contacts were in farming, agricultural trade, and the specialist agricultural press. Nobody ever took any interest in us, until this subject came along, so we never actually had need for this kind of an area. It just wouldn't have been justified. Occasionally, if we had anything, we would use an agency to help the one or two individuals we had in the big head offices."

"Would it be fair to say that the company was taken by surprise with the public reaction?"

> "It would be entirely fair. We were taken by surprise, not only by the fact that in our point of view [agricultural biotechnology] was a development which we saw as generally very positive in terms of the environment, safety and benefit. There had always been a very small rumbling voice on the fringes through the 1980s and 1990s over here about genetic engineering, but it had never really reached any level of profile. I think we were all surprised equally by the breadth and the depth this issue has grown to. So if you take other areas of controversy where we would regard there to be much better reasons to be frightened – like diseases, organisms and chemicals in food – here we have something that with the testing that has been done there has never been any example of harm and therefore we always felt the facts would come through. It did take us by surprise that some groups were able to weave such mystical controversies out of no evidence. We wrongly judged that such an issue could become a big issue in the early days." (Participant O)

As a second research scientist, involved in the promotion biotechnology to the public since the mid-1990s straightforwardly states: "Prior to 1996 the public were not interested in plant science. I couldn't have bought my way into the newspapers or television" (Participant G).

The Debate After 1996

However, in the second half of the 1990s the controversy over GM crops and foods broke in earnest. As a report commissioned by Commission of European Communities demonstrates, by the end of the decade the debate had produced a flurry of political activity, generated high levels of media coverage and enrolled the activity of the non-organized mass public. By 1999 in Britain, the authors of the report state, "everybody has heard about the issues and has something to say about it" (Marris et al., 2001: pp. 37-38).

In describing their own experiences with the controversy, research participants in this thesis offered many different suggestions about why a public debate had developed in this relatively short period of time. In some cases participants attributed the development of the controversy to singular causes. For example, those in the civil

service pointed towards the adoption of biotechnology and agricultural regulation by the Conservative Party as a central issue in their opposition to the Labour Government. Others, particularly from industry and pro-GM science quarters, emphasised the success of the activist community in attaching an image of risk to the technology and getting this image into the British media. Likewise, participants identified certain key events which brought GM foods and crops to public attention. These included several vigorously contested and hyped scientific studies which highlighted the potential risks associated with new agricultural technologies (see below). The import of unsegregated GM products, particularly soya and maize in 1996, was also cited as a source of the controversy[3].

Research on public feelings towards GMOs in the UK conducted over this period, however, suggests a more cautious approach to explaining the rapid rise of the GM crops and food debate (Grove-White et al., 1997). The authors of this research argue that the rise in a public debate does not necessarily denote a change from a public attitude of acceptance to rejection of the technology. Rather, this research posits that a deep public ambivalence to the technology has always existed, stemming from a fatalistic belief that the commercialization of the technology is inevitable, regardless of public opinion. Furthermore, the authors argue that this attitude of resignation was connected to a wider range of concerns than the direct risks of GM crops and foods themselves. These included, as will be discussed in detail in the forthcoming chapters, concerns about the commercial nature of the product, its relationship with the environment and the trustworthiness of the institutions responsible for regulating the technology. Thus, although each of the above explanations of the rise of the public offered by participants are important, they need to be seen within this political context.

Almost unanimously, when these cases were presented, participants did so against the background provided by the re-emergence of agriculture as a hotbed of

---

3

Unsegregated GM soya, engineered by Monsanto to be herbicide tolerant, began entering the UK in 1996 from the United States where it was then mixed with non-GM soya. As a key ingredient in processed foods, this practice impacted large numbers of products being sold in supermarkets around the UK. With no labels to inform consumers which products contained GM ingredients, consumer organizations and the activist lobby reacted strongly against this practice. Please refer to Chapter Six for a more detailed discussion, or refer to Lassen et al. (2002).

political controversy in recent years. As suggested by the term 're-emergence' agriculture has been a consistent political theme in the UK and the subject of public disputation for at least the past 50 years. The effects of agricultural usage of chemical fertilizers and pesticides on the environment had exposed the industry to tremendous public scorn in the 1960s. Rachel Carson's 1963 book *Silent Spring,* for example, warned about the dramatic ecological consequences of using artificial pesticides. *Silent Spring* and DDT became icons for the burgeoning environmental movement, making agriculture front and centre in the politically active 60s. Since the 1970s concerns over the monocultural approach taken by the Green Revolution[4] and its effects on biodiversity and human welfare in the developing world have been the subject of intense controversy. Today these same battles are concentrated around the patenting of genes and the use of GM cash crops in the developing world (Gillies, 1998; Hannigan, 1995; Shand, 1997; Shiva, 1993 & 1995). Likewise, the stewardship of rural Britain and the effects of intensive farming practices on landscape and wildlife have been persistent political topics and been foundational to the platforms of well respected organizations such as English Nature and the Royal Society for the Protection of Birds (RSPB).

Furthermore, the events of the 1990s leading up to, and overlapping, the debate over GM agriculture have further established agriculture as a significant arena of public interest and political activity. Here controversies centred not on abstract notions of environmental degradation and biodiversity loss, or on the distant realities of people in the developing world, but on the immediate impacts of contemporary agricultural practices on food safety. Public concern has been raised about the transmission of deadly bacteria (principally E-coli and salmonella) from animals to humans, exacerbated by concerns about the overuse of antibiotics in treating animals with these infections. This focus furthermore brought to light the use of antibiotics as growth

---

4

Initially founded by the Rockefeller Foundation in the 1960s, the Green Revolution expanded with the support of Northern governments and was further enlarged when adopted by the Breton Woods institutions as the basis for modern agricultural development strategies. The approach taken in this regard was to replace *inferior* crop and livestock varieties, commonly associated with traditional farming practices, with *superior* high yielding varieties which correspond to large-scale intensive methods of agriculture. Critics argue that such models have been based on a belief that global hunger and world poverty are essentially technical problems which require Northern models of economic industrialization and modernization.

enhancing agents in pig and poultry feed[5]. Likewise the now well documented mishandling of BSE (Phillips, 2000a) by Government, industry and science was offered by participants more than any other explanation for the sudden and widespread public interest in agricultural controversies. In particular, participants pointed not only to the incorrect assumptions made about the safety consequences of the disease, but the willingness of Government officials and scientists to issue statements of fact and certainty in relating the potential risks of BSE when considerable uncertainty existed (Phillips, 2001; Jones, 2003). Although occurring after the initial spike in the controversy over agricultural biotechnology, the outbreak of Foot & Mouth Disease (FMD) in 2001 has further heightened the association between agriculture, risk and public controversy. The closure of the countryside and the mass cull and destruction of ovine herds across the UK, implemented in order to control the spread of the disease, bore out an image of British Agriculture as out of control and government, science and industry at a loss as to how to regain any sense of order.

When moves were made to bring agricultural biotechnology to the marketplace, it was done so within an evolving and volatile history of political contestation. On the one hand, this context has been characterized by the presence of immediate concerns over food safety and environmental risk issues. On the other hand, biotechnology within this context has served as "lightning rod," as described by one industry representative, for broader societal concerns and signified a loss of trust in science, government and in industry (both at the farm and at the corporation). A member of an advocacy organization calling for a five year moratorium on the commercialization of GM crops clearly summarizes the complexity of the issue and expresses a concern which extends far beyond technological specificity and immediate risks associated with the technologies:

5

These concerns stem from fears that the routinization of antibiotic usage in agriculture will generate new forms of antibiotic resistant bacteria, or 'super-germs' as they are sometimes popularly referred to. On one hand this would mean that bacterial infections would be increasingly difficult to treat at the farm, but furthermore implies a risk that the treatment of bacterial infections in humans could be made more difficult as many of the antibiotics used in veterinary medicine are the same as those used in human medicine.

> "Obviously there is genuine concern, but also it is like yet another thing with the food chain. Yet another area.... The thing about it is that because it is so cross cutting of so many different areas that it has really crystalized a lot people's feelings, fears, concerns about science, industrial agriculture, about the food chain, etc. It's a big thing and it is a lot more than just the issue." (Participant C)

In summary, providing an explanation of why agricultural biotechnology has developed into the political issue it has in Britain is not a straightforward task. In part it has been triggered by certain key events such as the importation of non-segregated soya product into the UK processed food industry. By the second half of the 1990s these sort of events, and the technology more generally, were immersed in a context of agricultural risk and distrust in science, industry and government. In addition, the above participant comments and public attitude research cited suggest that the politics of agricultural biotechnology has overlapped and become entwined with the various debates at the centre of political consciousness in Britain.

The principal message to be drawn from this discussion is thus that the causes behind the politics of agricultural biotechnology are broad and varied. In other words, the controversy cannot be delimited to specific cases, or the potential for risk alone. In conclusion, one observation stressing the intangibility of these politics came from a biotechnologist and advocate of the technology. In her/his statement s/he contrasts public reaction to biotechnology with some of the other key technologies in today's society. Where innovations such as mobile telecommunications technologies have raised some concerns over radiation and their impact on health (eg. from handsets and from the siting of antennae) (IEGMP, 2000), the scope and intensity of these controversies is not comparable to those surrounding agricultural biotechnology. This discrepancy can in part be attributed, in the participant's opinion, to how the risks and benefits of the technology are perceived. Where the risks of information technologies are deemed acceptable, there is no such clarity to the debate over agricultural technology. However, such rationalized explanations do not explain the source of public scepticism on its own. Moreover, the intangibility of the politics of new agricultural technology is described in terms of a public "gut reaction" against the technology:

> "It hits a nerve with people, that maybe the Internet doesn't. The Internet has risks as well. Great benefits, you know, you can get information from it very quickly, but it also opens the way into things that you don't want your children to have access to. You have to take steps to stop that from happening... It carries an element of risk, but people are happier dealing with that. It has not gone beyond that. Whereas the feeling that there is risk with GM, there is something more than that, there is a sort of gut reaction to it" (Participant G)

A Reversal of Fortunes: GM Agriculture and the Life Industry

From the above discussion of the rise of a public debate over GM agriculture in Britain, this chapter will now move to look at two key elements associated with the public debate. The first, dealt with in this section, addresses the history of the commercial development of the technology in the 1990s. The second, to be discussed below, looks at the role of science as a hub in the debate.

Consumer Reactions to GM Foods

On February 5, 1996, tins of genetically modified (GM) tomato paste, or puree, appeared on the shelves of Sainsbury's and Safeway, two of the United Kingdom's largest grocery retailers. Both retailers adopted an open information and labelling policy from the beginning, proudly proclaiming the products to be: "Produced from Genetically Modified Tomatoes." What separated these tomatoes from their ordinary cousins, was the "switching off" of the fruit's softening gene. By doing so, scientists at Zeneca (now Syngenta) had produced a firmer tomato which was able to ripen on the vine for a couple of days longer than the average tomato. These tomatoes were less susceptible to damage during transport, consequently reducing costly wastage. Their proponents argued that they offered benefits to the consumer in terms of flavour and colour. Furthermore, firmer GM tomatoes required fewer energy inputs in processing to thicken into paste with the consequence of reducing the cost of the product to a couple of pence less than its competitors.

Initially the paste was accepted by consumers and sold very well. By 1997 Safeway announced that it had sold three-quarter of a million tins of GM tomato paste, that it was outselling its conventional rivals and in control of approximately 60% of the canned tomato market. It appeared that Zeneca and the supermarkets had found an open market for GM products, and industry looked at the successes of GM tomato paste with great optimism for the future of GM food products.

However, by July 1999 the party was over, and the last stocks of GM tomato paste were cleared from the supermarket shelves. Public opinion had swung against the use of genetic technologies in food production. Facing increased pressure from the consuming public, both Safeway and Sainsbury's rapidly altered their stances on genetically modified organisms. Where in 1996 labels and supporting pamphlets proudly extolled the virtues of GM technologies, by 1999 supermarkets were starting to pronounce foods as being "GMO (genetically modified organism) free." Voices opposing GM foods gained increasing credence and the public were perceived to be sceptical of the food industry, government regulations and scientific promises of safety. Facing this opposition, the supermarkets made the decision to pull back from their support of GM foods. As of Summer 2003, Sainsbury's, Safeway, Tesco's and Iceland have all adopted policies which seek to eliminate GM ingredients – primarily GM maize and soya – from their own product brands in response to what they conceive as "overwhelming customer concern."[6]

The Life Industry

The reversal of fortune experienced by Safeway's and Sainsbury's GM tomato purees are indicative of the more general rise and fall of the agricultural biotechnology industry. In the late 1980s and early 1990s industry was highly optimistic that biotechnology would provide the scientific basis for a new generation of commercial products and economic prosperity. It proposed a life-sciences model of industry, which

---

6 Sainsbury, *Sainsbury's position on GM food.* http://www.sainsburys.co.uk/gm/main/asp

focussed corporate interests around innovations in agricultural technologies as opposed to the generation of specific markets. Labelled the "life industry" this strategy combined a variety of product areas including agriculture (e.g. seed companies), food additives, pharmaceuticals and chemical fertilizers & pesticides. Corporations either ventured out into new biotech based enterprises themselves, or sought to capture market position through commercial acquisition. For example, between 1996 and 1998 Monsanto, looking to gain control of the seed market, acquired Monsoy, Asgrow, Holden's Foundation Seeds, segments of Cargill's international seed operations and DEKLAB genetics.

The first commodities produced out of the life-sciences model were directed towards agriculture and crop protection systems. These included transgenic varieties of corn, canola, soy and cotton which were engineered to be either herbicide tolerant[7], or resistant to pests[8]. The companies argued then, as they do today, that these technologies allow farmers to control weeds and pests more efficiently with fewer external inputs. Farmers, for example, could replace the employment of several different herbicides and pesticides with single products tailored to the GM crop being planted. In many countries the incorporation of these crop technologies has been widely accepted, foremost amongst which are the United States, Argentina and Canada.

By 2000 it was clear that these successes were quickly being off-set in the UK by the British public's reluctance to accept foods containing GMOs, and a growing distrust of the companies standing behind their development (Gaskell et al., 2002). The corporations composing the life-industry were not held up as the paragons of progress as they imagined themselves to be, but were increasingly seen as brash, profit driven and forcing technologies on society without public approval. In promoting agricultural

---

7 Herbicide tolerant crops allow farmers to use broad-spectrum chemical herbicides which kill a wide range of plants with the exception of those carrying a tolerance gene. This technology has allowed companies, such as Monsanto, to link their commercial chemical and seed interests. Monsanto, for example, markets herbicide resistant crop varieties as "Roundup Ready" which are marketed in conjunction with the companies popular "Roundup" herbicides.

8 Insect resistant crops contain transgenes which enable plants to produce toxins targeted at specific insect pests.

biotechnology the corporations spoke of *feeding the world*, of providing '*Food, Health, Hope*[9]' and providing *security* in a context of self-diagnosed environmental insecurity (Levidow, 1996: pp. 57-59). However, in the media, with their attention increasingly held by organisations such as Greenpeace and Friends of the Earth (FOE), a disjunctive view of GM agriculture was becoming evident. A series of uncompromising stories developed which attached a rhetoric of pollution, contamination and monstrosity to biotechnology. Technologies which produced plants with sterile seeds in order to protect corporate property rights were seen as immoral and branded as '*terminator technologies*[10].' Food products which were found to contain GM ingredients were

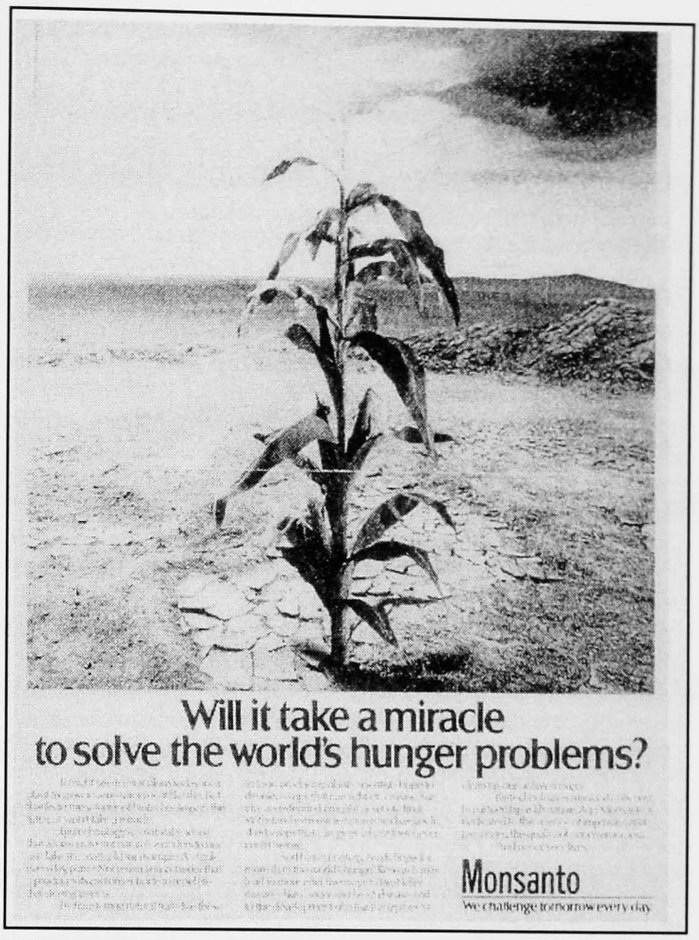

Figure 3 - A heavily criticized advertisement from Monsanto displaying a stock of corn growing in a desert. Image reproduced from Levidow, 1996.

---

9 'Food, Health, Hope' was the moto adopted by Monsanto throughout the company's attempt to promote itself as a 'life-sciences' industry. Viewed with skepticism by the public and derided by opponents of biotechnology, the motto was later dropped and replaced by the less controversial slogan of 'imagine.'

10 This label was coined in 1998 by the Rural Advancement Foundation International (RAFI), now the ETC Group (Action Group on Erosion, Technology and Concentration), a non-governmental organization working in the area of agricultural, development and indigenous rights. So-called 'Terminator' technologies use genetic engineering techniques to create plants which produce sterile seeds. The purpose of which is to force farmers to buy new seeds each year instead of storing and replanting some seeds from the previous years harvest. Corporations have been interested in these technologies as they not only provide a stable and perennial market, but also offer greater control over the licensing and patenting of the technology. Similar to 'terminator' technologies, 'traitor' technologies refer to crops which require farmers to apply an external chemical inducer to their crop to switch on or off a plant's genetic traits. Both of these technologies have received little support and created considerable scorn about the overeager profit motivations and hubris of the corporations involved in their development. For more information refer to the ETC Group website: http://www.etcgroup.org

labelled *'contaminated'* or imaginatively described *as 'Frankenfoods*[11]'

As described above, over a very short space of time agricultural biotechnology had become a topic of political contention amongst the wider British public. Where in the late 1980s and early 1990s the development of GM technologies in agriculture went forward largely unnoticed and unhindered, by the end of the 1990s the 'life-industry' was coming under intense pressure and scrutiny. The so-called 'miracles' (ref. Figure 3) offered by genetics and the possibilities afforded by modern agricultural systems were being viewed sceptically. The life-industry, at the very least, had lost the opening battles of a public relations war over the rhetoric of agricultural biotechnology.

The effects on industry were dramatic. Only a few short years after embracing the 'genetic revolution' and the life-industry model, Monsanto, the most active and vocal proponent of agricultural biotechnology found its stock prices plummeting and saw its reputation tarnished. This occurred despite the economic successes the company was experiencing through their pharmaceutical subsidiary Searle. With the pharmaceutical industry going through a period of rapid consolidation, Searle was a valuable commodity and on December 19, 2000 Monsanto announced it would merge with Pharmacia & Upjohn to form the new pharmaceutical giant "Pharmacia." Monsanto was reduced to being the parent company's agricultural subsidiary and quickly sought to retreat from the public spotlight[12]. The company subsequently dropped their slogan of "Food, Health, Hope" and further sought to reform its image through the creation of a new corporate pledge. The once brash and uncompromising multi-national corporation (Jones, 2000) devoted itself to becoming a more respectful, open and transparent company. Monsanto promised to be more attentive to public concerns, to work towards gaining public approval of new technologies instead of attempting to force products into the marketplace, and to emphasise the welfare of growers (both in developed and developing

---

11

J. Hardy, "The Prime Monster," *The Mirror*, February 16, 1999: p.1

12

In August 2002, Monsanto once again became a fully separate and independent company when Pharmacia having stripped the company of its pharmaceutical assets distributed its remaining shares of the company to their shareholders.

contexts) above corporate profits[13].

The bold promises of agricultural genetics and the life-sciences industry model had lost their lustre in only a few short years. In 1997 Robert Shapiro, CEO of Monsanto at the time, gave an interview to the *Harvard Business Review* in which he predicted that biotechnology, alongside information technologies, would revolutionize global society. He promised that the life-sciences would provide sustainable and environmentally friendly systems of agriculture, ensure the increased welfare for farmers around the world and make a gigantic step forward in solving world hunger. However, as Leiss states:

> "Less than three years after the *Harvard Business Review* interview had appeared, both Robert B. Shapiro's bold corporate vision and the corporation itself in which it was to be embodied had been shipwrecked on the shoals of a risk controversy he neither anticipated nor understood." (Leiss, 2001: p.20)

Is the Controversy Closed?

The failure to gain public support, or maintain consumer acquiescence, for GM foods along with the fading of the life-sciences model constitute substantial stumbling blocks for the future of agricultural biotechnology. However, they do not suggest a closure of controversies over new agricultural technologies. If belief in the life-sciences model and the initial promise of industry's first forays into the marketplace have faded, belief in the commercial potentials of genetic engineering in agriculture has not. Plans to market herbicide resistant crops are still going ahead with a series of farm-scale evaluations being conducted by industry and the British government to test the effects of growing these crops on biodiversity and the environment. For many, these farm-scale evaluations mark one last hurdle to be cleared before GM crops can be grown commercially in the UK[14]. Moreover, industry has begun the push to create a more

---

13 Monsanto. *The New Monsanto Pledge.* http://www.monsanto.com/monsanto/about-us/monsanto_pledge/default.html

14 The FSEs and the expectations which surround them will be covered in detail in Chapters Seven and Eight..

marketable, and what it sees as a more acceptable, 'third generation' (refer to Appendix B) of GM products. These include edible vaccines, cancer preventing vegetables, and high nutritional foods. All of which are touted as offering very real benefits to the British consumer. Furthermore, despite being largely rejected in Europe, GM crops – particularly canola and soy – are already being grown around the world with the situation likely soon to be exacerbated with the introduction of staple crops such as GM wheat and sugarcane. With no regulation keeping GM ingredients out of processed foods and no current labelling laws compelling retailers to identify these products, most Britons are likely already regular consumers of some GM food products. Likewise, the use of GM animal feeds is increasingly common outside of Europe and the subject of growing contestation. Finally, although often understated, it is important to remember that agriculture is not limited to growth of food products. Slow growing turfgrass, nicotine free tobacco, trees engineered with reduced lignin to facilitate the recovery of wood pulp, and agricultural crops designed to produce biodegradable plastic polymers are all in the biotechnology pipeline.

With the development of genetic technologies in agriculture still very much alive, the controversy over their commercialization and implementation is likely to persist, at least in the short term. Certainly the questions which have troubled those wishing to bring a GM revolution to agriculture persist. As for the life-industry, although it is clear that the progressive promises attached to this model have faded, the biotechnology sector continues to look to second and third generations of products with an eye on potential commercial successes.

Science as Political Hub

Science has been a central component in the way in which the debate over new agricultural technologies has been framed. Certainly many of the debate issues concerning risk, such as the consequences of GM foods on human health, or the environmental effects of GM cropping, would appear to be just the sort of questions which might be best addressed by scientific expertise and scientific institutions. Indeed, the development of the technology under the influence of the public controversy has

meant that the risks and benefits of applying biotechnology to agriculture have been heavily scrutinized. As several respondents suggested in interview, such inordinately close inspection has been unprecedented in the agricultural seed industry. Moreover, despite this scrutiny, no decisive scientific picture of the benefits and risks of agricultural biotechnology exists. The science of agricultural biotechnology is, in other words, as much the subject of contestation and controversy as the larger political terrain in which it is embedded.

The fact that debates over new agricultural technology have been characterized by uncertainty and scientific contestation and not immutable facts is in and of itself nothing out of the ordinary (e.g. Beck, 1992). Nor is society likely to find these routine uncertainties necessarily or particularly alarming. After all, as one senior research scientist stated during an interview "the scientific method is based on uncertainty" (Participant U). Science, s/he argued was characterized by the disputation of findings, controversy and the continual rejection and renewal of scientific findings (refer also to Nowotny et al., 2001: pp. 1-3). Early sociologists of science make just this point by challenging determinant conceptions of science and arguing that scientific knowledge is open to continuous, and as Kuhn (1962) argued, sometimes revolutionary changes in how we understand our world.

However, where scientific controversies might be fought out within the confines of the discipline on a day-to-day basis, the scientific controversies over agricultural biotechnology have been fought out in the open. An analysis of the social and cultural meanings of these scientific controversies will be discussed in length in Chapter Six. The following discussion describes some of the scientific debates involved in the GM controversy and examines the responses they provoked. In particular, the scientific and political hubs discussed below underline the importance of issues of risk and science in building support or opposition to new agricultural technologies.

Specifically, several key scientific / risk stories, or hubs as they will be referred to here, have become central elements of the context in which the politics of new agricultural technologies is taking place. These scientific cases are not of crucial importance in and of themselves as they are not likely to provide the key scientific evidence which would allow a verdict on the riskiness of biotechnology to be determined. However, using the term hub places attention on the importance of these cases in serving as focal points around which the politics of new agricultural technologies have developed. Each of these hubs has been well documented in the media, become key articles of the opposition platform against biotechnology and forced responses from the pro-GM scientific and industrial communities.

One key hub involved the controversial work and conclusions put forward by Dr. Árpád Pusztai. In 1995 Dr. Pusztai, funded by the then Scottish Office of Agriculture, Environment and Fisheries Department, began working on the development of a scientific risk assessment of the impact of GM foods on human health. With considerable expertise in the field, Dr. Pusztai designed a series of experiments to test the effect of snowdrop bulb lectin – a naturally occurring plant toxin which protects plants from insects – on the health of rats. Previous research had suggested that rats fed with the lectin showed no adverse reactions resulting from the ingestion of the toxin. However, when potatoes which had the lectin genes inserted into their genome were fed to rats he recorded what he describes as a series of "unexpected results" (Pusztai, 2002). Firstly, the potatoes were not seen to clearly exhibit the insect resistant properties, particularly against aphids, that were expected. Secondly, and more worrying for Pusztai, the research results suggested that, when the lectin gene was expressed in potatoes, the safety of the toxin was called into question. In particular, the researchers' initial results, published in *The Lancet* (Ewen & Pusztai, 1999), created concern about the potential risks of eating GM potatoes on animal metabolism, organ development and the immune system. Hazarding a guess as to why this might have been the case, Pusztai put forward the hypothesis that the results might be explained by a situation in which the transferred genes landed in different parts of the potato genome, thus altering the

expression of those genetic traits (Pusztai, 2002: p.72). Pusztai's research, thus, called into question both the precision of genetic engineering techniques and the safety of the process in food products.

Also concerned with the risks associated with GM agriculture, this time in regards to the environment, researchers at Cornell University began investigating the consequences of GM crop planting on species welfare and biodiversity. Under the direction of Dr. John Losey, the Cornell research group was interested in the effects of the widespread cultivation of insect resistant crops on non-target insect species in the wider agricultural-environment. In particular, they were interested in whether or not the cultivation of Bt maize, a widely grown commodity crop in the US, created any risk to the monarch butterfly – a species which, although not endangered, is increasingly the focus of conservation efforts in North America and is publicly popular. In their own words, they found that the "larvae of the monarch butterfly, *Danaus plexipus,* reared on milkweed leaves dusted with pollen from Bt corn, ate less, grew more slowly and suffered higher mortality than larvae reared on leaves dusted with untransformed corn pollen or on leaves without pollen." (Losey et al., 1999). Losey's research thus provides a second scientific account of the potential risks of new agricultural technologies.

More recently a series of studies in the Americas has focussed public attention on scientific debates about horizontal gene transference – the conveyance of genetic modifications in commercial GM crops to native landraces of the same species through the spread of pollen. One potential consequence of horizontal gene transfer is that native species would gain the same resistant characteristics as their commercial cousins, thus creating what have been popularly referred to as 'super-weeds.' Dr. Allison Snow at the University of Ohio has recently presented research which she suggests reveals the dangers of the flow of modified genes from pesticide resistant sunflowers to native species. This research found that transferring the Bt transgene to wild landraces, not only gave the modified plants insect resistant properties, but as a result dramatically increased seed yields as well (Snow et al., 2003). Dr. Snow's findings thus heightened growing concerns about the plant's potential proliferation as a weed.

Another source of unease in regards to the pollen transfer of modified genetic material pertains to the impact of transference on species diversity. The concern is that

the spread of modified genetic materials amongst native land races will undermine species biodiversity[15] in the agricultural environment. For example, in Mexico, home to many native maize species as well as even more primitive maize varieties such as teosinte, considerable concern has been raised about the potential for these species to horizontally acquire the genetic traits of GM corn. In November 2001, microbiologists Ignacio Chapela and David Quist of the University of California Berkley produced research which seemingly gave credence to these fears. They reported the "presence of introgressed transgenic DNA constructs in native maize landraces grown in remote mountains in Oaxaca, Mexico" (Chapela and Quist, 2001).

Biodiversity loss, envisioned loosely as an 'umbrella term' for describing nature's variety (Hannigan, 1995: p.146), is perceived as much more than an environmental risk, but one which could potentially hold severe economic and social consequences. For example, it is from this diversity that today's commercial crops have originated and are enabling modern agricultural systems to produce highly efficient and resilient crops. More worrying, many cultures around the world are dependent in crop diversity in generating their own livelihoods. As Vandana Shiva persuasively makes the case, high yielding monoculture crop systems have proven to be fully inadequate in meeting the multiple needs of the populations of the South. She reminds us that rice is not just a grain, but also provides straw for thatching, mat-making and fertilizer, fodder for livestock, bran for fish ponds and husk for fuel (Shiva, 1993: pp.48). Shiva summarizes what she identifies as the consequence of biodiversity loss in no uncertain terms:

> "Biodiversity erosion starts as a chain reaction. The disappearance of a species is related to the extinction of innumerable other species with which it is inter-related through food webs and food chains, and about which humanity is totally ignorant. The crisis of biodiversity is not just a crisis of the disappearance of species... It is, more basically, a crisis that threatens the life-support systems and livelihoods of millions of people in Third World countries" (Shiva, 1993: p.69)

15

Dharam Ghai, makes a more definitive statement in defining biodiversity "as the variability of life in all forms, levels and combinations — not the sum of ecosystems, species and genetic material, but rather the variability in and among them." (Ghai, 1996: p.i).

Although, the research involved in several of these cases originated in the United States where crops where GM crops are in commercial use, in the UK, public interest and a heated political debate flourished around these hubs. In a context in which risk is an increasingly prevalent part of the political landscape, these studies attached an element of uncertainty and the possibility of hazards – on human health, environmental well-being and socio-economic welfare – to agricultural biotechnology. Consequently in the struggle for public opinion, research findings hinting at risk were either adopted as support for opposition platforms, or vociferously attacked by proponents of the technology.

For example, the environmental lobby has frequently hyped such cases and adopted the research findings as conclusive evidence of the risks posed by GM foods and GM crops. Moreover, the potential of these cases to demonstrate risk has been used to support wider claims against the viability of intensive agricultural systems and the corporate structures behind their development. For example, on November 28, 2001, a day before Chapela and Quist had their research letter published in *Nature,* Friends of the Earth (FOE) issued a press release applying their own discourse of environmental threat to the study. Entitled "Wild Maize Contaminated with GMOs," FOE advanced the need to halt what they termed as the "reckless experiment" of growing genetically modified maize in an environment which is home to the many wild landraces from which today's commercial crops have been developed. Pete Riley, Senior Campaigner for FOE's Real Foods campaign, put it this way in the press release:

> "These findings are deeply disturbing and highlight the huge gamble the biotech industry is taking with nature. The long-term implications of allowing GM crops to contaminate wild plants are unknown and will be almost impossible to reverse. This is why Governments around the world should halt the dangerous experiment of growing GM crops outside."[16]

16

Friends of the Earth. "Press Release: Wild Maize Contaminated with GMOs." November 28, 2001.

On the other side of the debate, critical responses to each of the above cited scientific cases appeared immediately upon their release. Members of the pro-biotechnology scientific and industrial communities mocked and berated the scientific conclusions of these studies. Moreover, each case was dismissed with an eye-opening degree of vehemence and in an overtly pejorative manner. A common strategy by the pro-GM crop camp was to treat the offending studies with contempt and to deride the scientists involved.

Dr. Pusztai, for example, was ridiculed for exaggerating the findings of his research in the media, had his scientific credibility and objectivity renounced, and his data rebutted by the scientific establishment (refer to Levidow, 2002; Pusztai, 2002). Following some early comments to the media about the potential implications of his study, a tremendous amount of pressure was placed on Dr. Pusztai and the Rowett Research Institute (RRI) where he was employed. Most notably, heavy criticism came from the UK's prestigious Royal Society (RS) which had convened a special committee to investigate Pusztai's research and conclusions. The RS subsequently produced a damning report (1999) which declared Pusztai's findings 'non-significant' on the basis that the research was based on an inadequate methodology. Surprisingly, the Royal Society's investigation of the data took place before it had been subject to the standard practice of peer review[17]. The authors were thus never given the opportunity to respond to the criticism of their peers by editing their conclusions, before being made the subject of intense criticisms. Clearly concerned about the Royal Society's circumvention of ordinary scientific practice, Richard Horton editor of *The Lancet* published an editorial comment entitled "Genetically modified foods: 'absurd' concern or welcome dialogue?" alongside Pusztai and Ewen's research letter. In this comment Horton states:

> "Berating critics rather than engaging them – and criticising reports of research, as the Royal Society did with the Pusztai data, before those data were reviewed and published in the proper way – will only intensify public scepticism about science and scientists." (Horton, 1999: p. 1315)

---

17 Ewen and Pusztai's paper was scrutinized by no less than 6 referees, five of whom supported its publication after three rounds of revisions (Pusztai, 2002: p.73).

Many of Pusztai's supporters interpreted the Royal Society's possibly overzealous attacks on Pusztai as an attempt to bury the connotations of risk they affixed to GM agriculture and stem the impact of the studies on public opinion. Such concerns were seen to be given further credence when, as a result of the pressure being put on them by scientific establishment, the RRI suspended Pusztai, who shortly thereafter retired from the institute.

While the Pusztai affair has received the most public and vociferous treatment each of the other scientific hubs has been subject to similar attacks. Chapela and Quist have had their data critiqued, as well as their personal motives and qualities as scientists (Lepkowski, 2002; Metz and Fütterer, 2002; Kaplinsky et al, 2002). The same is true for Losey, who although being somewhat more cautious in presenting his results, has had the implications of his findings repeatedly downplayed by those in the agri-biotech industry. In the quotation below, Cropgen – an association of 'independent' biotechnologists funded by industry who have picked up the gauntlet of defending agricultural biotechnology in the media and with a mind towards influencing public opinion – are dismissive of Losey's findings. They infer that, although Losey offers a contribution to our scientific understanding of agricultural biotechnology and biodiversity, his study represents an extreme case – something unlikely to occur under normal circumstances – and one that doesn't paint a picture of the full context in which agricultural biotechnology is being applied:

> "The laboratory experiment with the Monarch caterpillars was designed to show what might happen in the worst imaginable situation. Such a 'worst-case' scenario is a bit like crash-testing a car: it is not intended that cars as a rule should crash but we have to know what happens if they do. Although Monarch caterpillars would not normally choose to eat maize pollen in the wild, in the experiment they were encouraged to eat high levels of pollen from GM maize containing Bt toxin. Not surprisingly, some of the caterpillars died – but remember that current agriculture uses insecticides which kill caterpillars and other insects outright regardless of whether or not they are pests."[18]

18

Cropgen. *What about Monarch Butterflies? Isn't there evidence to show that they have been adversely affected by GM crops?* Http://www.cropgen.org

Again, in the case of Snow's research into the risks of geneflow relating to the production of superweeds, the response from industry has been decisive. With her findings extensively covered in the press and adopted by the environmental lobby, Dr. Snow's research had placed considerable political pressure on Pioneer Hi-Bred the company behind the development of GM sunflowers. As a consequence the company voluntarily pulled back from attempts to seek commercial growing licenses for the plants in the US. However, as a further response Pioneer Hi-Bred revoked Dr. Snow's rights to use the transgene which they were working with. This action has elicited criticisms that industry has attempted to preempt any further findings which could prove damaging for the industry as a whole (Dalton, 2002).

It is fair to say, that out of this intense and heated controversy, there was no clear scientific picture being relayed to the public about the potential risks of GM agriculture. For example, each of the above cited cases received extensive coverage in the British media, and in the UK broadsheet press in particular. This coverage has unsurprisingly been contradictory. Where *The Guardian* firmly offers an affirmation of Pusztai's findings by proclaiming "Food Scandal Exposed"[19], *The Independent* equally decisively states "Scientists revolt at publication of 'flawed' GM study"[20]. Supporting the perception of risk posited by Losey's research *The Times* and *The Independent* ran headlines which decry "Modified maize 'killing butterflies'"[21] and "US butterflies killed by modified pollen provide key evidence of risks"[22]. Contradictorily, *The Irish Times* provocatively posits that "Reports of Monarch's Death Greatly Exaggerated"[23], a

---

19 Gillard, M.S., L. Flynn and A.Rowell. "Food scandal exposed" *The Guardian*. February 12, 1999.

20 Connor, Steve. "Scientists Revolt at Publication of 'Flawed' GM Study." *The Independent*. October 11, 1999.

21 Hawkes, N. and N. Nuttall. "Modified maize 'killing butterflies.'" *The Times*. May 20, 1999.

22 Conner, Steve. "US butterflies killed by modified pollen. Butterlies provide key evidence of risks." *The Independent*. May 20, 1999.

23 O'Sullivan, Kevin. "Reports of Monarch's Death Greatly Exagerated." *The Irish Times*. November 22. 1999.

headline which Monsanto proudly posted on the corporation's website. Likewise, in reference to Chapella's findings in Mexico *The Guardian* reported that "GM pollutes vital gene pool in Mexico"[24] while *The Times* reported that the "Attack on safety of GM crops was unfounded"[25].

It would be therefore be more accurate to see these scientific debates as cementing impressions of uncertainty than either clearly confirming or denying the risks of GM. Thus, the political activities around these scientific hubs underscore that the politics of risks are as much about the potential for risk as they are about the actual risks themselves. It is the struggles over these potentials which further suggests that techno-scientific controversies need to be understood in other ways than contestations over facts, but as struggles over public support for, or against, GM agriculture. As this section has begun to suggest, this includes struggles for support of genetic technologies, or food products, but in the institutions and actors involved in these debates (e.g. Nelkin, 1992).

Conclusion

This chapter has sought to shed some light on the social and political context which has accompanied the development and attempted commercialization of agricultural biotechnology. By addressing this context the analysis provided in this thesis is directed in several ways. Firstly, this chapter looked at the early ambivalence about the development of GM. When the issue did come to head in the second half of the 1990s, participants placed the politics of new agricultural technologies within an evolving and volatile political context of social debate, and agricultural debate specifically. Secondly, this chapter provided a general history of the commercial development of the technology, outlining the early successes and subsequent failures of

---

24

Brown, Paul. "GM maize pollutes vital gene pool in Mexico." *The Guardian.* April 19, 2002.

25

Henderson, Mark. "Attack on safety of GM crops was unfounded." *The Times.* April 5, 2002

the 'life-industry' in its attempts to create a market for GM agriculture and GM foods. This history highlighted the volatility of the topic and draws attention to the importance of the development of public skepticism in the safety of the technology, and the revolutionary promises of progress industry attempted to attach to it. In section two, the importance of several key scientific loci were identified. Cases such as Pusztai's study of GM potatoes on animal metabolism underlined the importance of science in establishing a hub around which debates over agricultural biotechnology are being fought. At these hubs the politics of GM technologies in agriculture has not been enclosed within scientific boundaries. Rather as a centre of political activity these scientific events have attracted varied and vociferous debate, merging scientific risk debates with broader notions of social and environmental risk.

In conclusion, together the three histories presented here suggest that the politics of agricultural biotechnology cannot be reduced to the inherent qualities of the technology itself – that GM crops and foods are necessarily good or bad, risky or safe. Rather, new agricultural technologies and their risks are events which, despite their scientific and technological focus, are part of a broader political arena. The issues at play in this arena are as varied as they are often intangible. The politics of risk involve contestations over the delineation of hazard, but also over expertise, appropriate forms of governance, social organization and human-natural relations. As a factor of the breadth and width of these politics, contestations over risk are cultural by nature. Such politics involve diverging conceptions of appropriate social and natural relations – the subjects of a normative politics as described in Chapter One. The following two chapters address two key areas in which these politics are revealed: first in relation to contestations involving the position of the life-industry in the debate , and secondly through a discussion of the role of science in society.

CHAPTER FIVE: THE LIFE-INDUSTRY, CONFLICTING PERCEPTIONS OF RISK, BENEFIT AND CHOICE

> "We're talking about a massive restructuring. We're talking about essentially getting rid of corporate capitalism. That's what it all comes down to at the end of the day. That's what the whole GM campaign is about." (Participant I).

> "I think there are others that have far more sinister political agendas out there. There are a number of things that came together in this controversy in terms of the history of human development. One obviously was the East vs. West system with the coming down of the Berlin Wall. [Another was] the collapse of things like the Communist Party in Britain. That kind of culture moved into different camps. I think there has definitely been a shift in the spectrum of some of the pressure groups as a result of that." (Participant O)

Introduction

In this chapter the politics of new agricultural technologies will be addressed through an analysis of the contested position of the life-industry[1] in the innovation and shaping of agricultural biotechnology. Overall, the question posed here asks *how the politics of new agricultural technology, and the politics of its potential risks, relate to normative contestations over the role of the life-industry in contemporary British society?* In response to this question the following discussion delineates a debate which, although concerned with issues of risk, is also situated within social and political debates

[1] The life-industry, to recall from Chapter Four, is an unofficial consortium of corporations who, during the 1990s, engaged in a strategy of convergence around a variety of product related markets. These market areas included agricultural and seed products, food additives, pharmaceuticals and chemical fertilizers and pesticides.

over the extension of global corporatism into the agricultural and food industries. Using data derived from a series of in-depth interviews, these debates are presented as a dialogue between those who oppose new agricultural technologies and those who support them. On the one hand, this dialogue consists of controversies over technological risk and how best to protect society from those potential hazards. On the other hand, these politics of risk are further addressed in relation to contestations over normative values which reflect opposing visions of society and social progress as expressed by participants.

In line with the interview data, three themes will be discussed. Firstly, the research data is applied to a discussion of the way in which participants debated concerns over the increasing predominance of the corporate actor in agricultural development and food production. From this more generalized discussion, the analysis is directed towards the ways in which participants performed these debates in weighing the risks of new agricultural technologies against their potential benefits. In the third section of this chapter, I explore the extent to which the politics of new agricultural technologies and the life-industry involve contestations over democratic rights of choice and consent.

Risk, Blame and Trust

The two quotations at the top of this chapter come from interviews with stakeholders at opposite ends of the debate over GM crops and foods in the United Kingdom. They serve to give some sense of the breadth of the politics involved in this dispute. The first statement is an extract from an extended harangue by a vocal opponent of agricultural biotechnology. The second statement comes from a plant ecologist and outspoken proponent of the use of genetic technologies in agriculture. It is drawn from a provocative series of comments in which the participant described the debate over GM crops and foods as an unwarranted attempt by a vocal opposition to "knock the system" and "create unrest." At the core of both of these comments are familiar struggles over the material and ideological driving forces behind an emerging global society. The activist, challenging agricultural biotechnology is presented as a task which implies the need to challenge corporate capitalism. For the corporate spokesperson advocating the

technology likewise implies the need to defend the corporate development of science and technology from the "sinister" motives of opposition "pressure groups."

The two statements above stand out in that they reflect an especially polarized and semantically evocative account of the debate over GM agriculture. However, although less abrupt in tone, similar statements were made by almost all of the interview participants. For example, a former Agriculture Minister and still active Member of Parliament underscored the primacy of the globalization debate in generating public opposition to agricultural biotechnology (Participant L)[2]. Likewise, a crop scientist and representative of a pro-GM lobby group described the opposition to GMOs as a strategic move against the multinational corporations comprising the life-industry (Participant G)[3]. Others posited that the politics of GM crops and foods is not only a reaction against globalization and the growth of the life-industry, but also reflects anti-American values and the unease of the growing influence of American corporate capitalism in Europe (Participants J & Y).

The degree to which participants related the politics of GM technologies with unrest over the emerging role of American corporate capitalism and the life-industry in British agriculture varied. For some participants this meant delineating debates over risk as secondary precipitations of the wider globalization debate. In other words, the debate over new agricultural technologies was seen as a debate only in proxy. As a consequence, to take the pro-GM position, opposition claims concerning risk and safety could be discounted, or undermined, due to their subordinate status in the debate. For example, some participants argued that the scientific attestations of hazard advanced by

---

2 The participant states: "I think my own view at the moment is that, apart from the straight scientific argument, part of the reaction to globalization has been, for example, the reaction against genetically modified crops. This is because on all the science I've ever seen the risk factors of some awful thing happening to the normal biosphere is pretty low. I won't say there is no risk, there is always a risk, but the definable risk – 'is it going to threaten mankind's food supply?' – well, from what I've seen the answer is no."

3 In response to a question asking why the environmental lobby had reacted against GM in the manner they had, the participant offered the following comment:
"If you talk to them privately they are not against GM itself... they just don't like it being used the way it is. They are really against multi-national companies, they're against capitalism and they see this as putting agriculture more into the control of large multinationals. It's really part of the globalization [debate]. Of course it has nothing to do with the science." (Participant G).

opposition activists could be discounted as a result of their links to the wider political debate. By becoming tied up with social and political debates, opposition science was derogated because it was perceived to have lots its objectivity. As discussed in the previous chapter, this was a common scientific argument raised against dissenting academics such as Pusztai (2002). Yet, for others, the politics of risk and the politics of corporate capitalism were not perceived as subordinate to one another, but inextricably linked. Activists, for example, described the potential risks of GM crops and foods as part and parcel of environmentally and socially intrusive models of agriculture they link to the life-industry.

Notwithstanding the varied ways in which this political relationship is contested, the point to be underlined here is that whether casting reprobation or support for GM agriculture, these arguments were often interwoven with a critique or defence of the preeminence of corporate models of development. Participants' accounts of the relationship between the politics of new agricultural technology and the role of the life-industry, therefore, pose an important question. If global forms of social politics are inextricably linked with the politics of new genetic technologies in agriculture, what does this mean for how we understand the politics of risk and danger also attached to the technology?

Risk, Blame and the Opposition of Moral Communities

It is helpful at this point to refer back to the cultural theory of risk advanced by Mary Douglas in Chapter Three. To recall, Douglas theorizes that struggles over risk are part-and-parcel of "normative" struggles (Douglas, 1986b; 1992, pp. 43-44) over the types of societies we wish to live in. In this sense, contestations made in relationship to globalization, capitalism and the life-industry are united with struggles over technological risk by an overarching cultural politics occurring between conflicting moral communities. Douglas (1985) further characterizes this political context by suggesting that risk is best understood as the attribution of blame. Likewise, conflicts over the risks of agricultural biotechnology are best understood as moral judgements of social responsibility. Tansey, describing the strengths of Douglas' theoretical

framework, spells out the types of questions these ideas suggest for understanding the politics of genetically modified organisms (GMOs):

> "Risk becomes politicized not simply because it is a threat to ways of life... At whom is the finger of blame being pointed? Who is being held accountable? What is being rejected and what is being defended in particular collective social action? This implies that for issues such as genetically modified organisms, research that seeks to demonstrate the safety of the technology will not dissipate political opposition since protest is in defense of a moral boundary." (Tansey, 2003)

Mindful of the types of statements which opened this chapter, responding to these questions focuses analytical attention clearly on perceptions of the culpability of the life-industry in generating novel risks to social and environmental well-being. The following discussion provides three examples of the types of arguments participants made involving issues of risk and blame in relation to agricultural biotechnology and the life-industry.

The first example comes from a self described 'GM crop decontaminator' and activist. With a history of campaign work involving whaling, nuclear development, global warming as well as a host of other issues, the participant joined the debate over agricultural biotechnology during the second half of the 1990s. This is precisely the point at which the controversy was reaching its hottest levels. As her/his following statement details, when asked what the issues were that drew her/him into the debate, the participant responded by stating that GM crops and foods may indeed produce novel risks, but that these hazards came from familiar sources. Her/his comments describe GM agricultural products as an immediate threat and an overarching symbol of the types of issues the environmental lobby has traditionally engaged with. Risk, in this sense is a term which encapsulates both the participant's immediate anxieties about the technology (e.g., it will harm biodiversity) and the normative values about the type of society s/he supports. As the participant states, risks to human health and the environment are the same risks that threaten her/his democratic values:

> "Take any issue in the world and it boils down to this. Someone at the middle who's out to make a fast buck at the expense of somebody else. Basically, these things are just symptoms of the disease. It just happens that GM is a more glaring example of the disease. It has been an amazing campaign and has included people from all sorts of political and ideological backgrounds. Whether it is people that are interested in civil rights,

> democratic rights, environmentalists, consumer rights people or whatever, it has really pulled everybody together. It is such a scary campaign. It is such a significant threat to everything: human health, the environment, democratic rights. It is such a blatant example of everything that we campaign against. There is no real difference between these corporations and any other corporations... It's the same game we're playing." (Participant I).

A second participant advanced this same convergent perspective of risk when discussing her/his individual motivations for getting involved in the controversy. Like, the activist cited above, her/his concerns about agricultural biotechnology are immediate, but also relate to issues which have long provided the foundation of the participant's politics. With a background in civil organizations extending more than 35 years, the participant's concerns come via a longstanding engagement with agricultural development projects. Although until recently reluctant to accept issues of risk and safety as part of her/his lobby, the participant clearly sees the ability to provide products which meet adequate safety standards as the responsibility of science and industry. Moreover, it is equally transparent in her/his comments that if s/he was ever to accept the use of genetic technologies in agricultural development that certain moral criteria must be met alongside standards of safety. Specifically, long-standing relations of inequality, exploitation and poverty associated with the life-industry and the peoples of the developing world must be broken. As the participant's following statement suggests, her/his support for agricultural biotechnology is likely to be contingent on how immediate issues of safety are negotiated with longer standing perceptions of justice and equality:

> *"What was your main concern about agricultural biotechnology at the time you got involved?"*
>
> "It was certainly not safety. It continues today to be much more concerned with ownership and control. Who is making decisions about technology? What kind of technologies are they going to focus on? What ones are they not going to focus on? Who is going to benefit? Who profits from it? That has always been our major focus..."

"Would you say that is the same now?"

> "It is, although in the last five or six years the shock to us has been the safety questions which we thought were marginal we now recognize are not so. Many of the groups that we were not particularly impressed by we now have to agree that they have a point. We are not against genetically modified organisms in principle... In the context of the technology, the belief is that these technologies should be used, that they should be developed and when the proper safety standards are developed to test things by and that it meets clear human needs, then it should be used in the field. But, when it meets those needs and when we know it is safe" (Participant Q).

The statements of a campaign director at a large environmental NGO provide a third example of the relationship between issues of risk and a politics of blame. In her/his statement cited below, this participant outlines a commonly evoked criticism of agricultural biotechnology and the life-industry. S/he accuses industry of failing to keep in touch with public interests, or intentionally overriding their concerns. Although individual technologies and corporations may stand out as of particular concern, her/his critiques, like the two participants cited directly above, cast blame more widely. The culture of corporate development, s/he argues, is also to blame. As the participant suggests, the motivations behind life-industry models of agricultural development are being driven by an overarching concern for profit, with scant regard paid to whether new agricultural technologies are potentially beneficial or harmful to society:

> "[W]hat has happened is that the power of the corporates has enabled them to shape the food chain and shape research to their own end. Because they are fundamentally only answerable to shareholders, and shareholders are traditionally only interested in the dividend at the end of the year, then a lot of important questions have not been addressed." (Participant T).

Although each of these three examples offers individual insights, they all make claims to risk in relation to allegations of blame. Risks, in other words, first challenge the acceptability of the technology and secondly question the institutions and more importantly the values driving the development of GM crops.

However, before turning to a more detailed analysis of the various manifestations of these debates, it is first necessary to point out that Douglas' conceptualization of risk as blame is not limited to a discussion of dissenting positions alone.

When referring to the position of those who have aligned themselves with industry in this debate it is helpful to speak not only of risk as blame, but also of its opposite – trust. In situations where blame is levelled against the life-industry, these circumstances can also be characterized as lacking of public trust or confidence in the life-industry. In this way, differentiating between blame and trust is a helpful means of analysing the political actions of participants in this debate.

Several of the pro-GM spokespersons interviewed worried that industry had lost the trust of the public in the 1990s when companies, such as Monsanto, belligerently pursued the commercialization of GM crops despite growing public concerns. As a consequence these participants see industry as having to fight an uphill battle to regain public trust in the technology and in the industry if it is to eventually succeed in commercializing GM crops and foods in Britain. Exacerbating these concerns, participants also worried that the NGO community, including large environmental organizations such as Friends of the Earth and Greenpeace, had gained the public's confidence over the same period. The task they see before them is, therefore, not only to regain the public's confidence, but in order to do so they realized that they would have to challenge the NGO's ability to speak for 'the public'.

A public relations officer for a life science company was one participant who spoke at length about the need to reestablish a relationship of trust with the public. S/he pointed to the establishment of the Agricultural Biotechnology Council (ABC) – a coalition of six of the largest biotech companies in Europe[4] – whose principal mandate is to engender public trust in biotechnology and the industry. The participant's comments outline an attempt to communicate more effectively with the public. This move reflects a trend in risk and public relations in post-BSE Britain which highlights the need for institutions to be more transparent and open in their communication with the public. In this sense, the ABC envisions communication as a means to fill what it sees as gaps in the public's understanding of the risks and benefits of GM crops and foods. Moreover, it

[4]These are Aventis, BASF, Dow AgroSciences, DuPont, Monsanto and Syngenta.

is through these gaps in public knowledge, that the ABC perceives the NGO community's ability to generate and exploit public anxieties about GMOs. The committee thus describes the overall goal of communication as promoting "a fair debate on behalf of the UK agricultural biotechnology industry" (ABC, 2002). The participant details this project in the following statement:

> "The ABC report is *mea culpa*. It's an admission that the industry hasn't communicated well in the past. The opponents of the technology have been much better communicators. They've been moving and shaking a lot better than we have... There is research suggesting that big industry is the worst possible messenger. We are the least trusted people. I can show you a slide which is all about trust [ref. Figure 2]. It has industry, government and regulators all labelled according to their levels of trust within industry being the least trusting. Then you get this 'circle of trust' which is essentially environmental groups, NGOs, the media and the public which have this circle of communication. NGOs are essentially seen as the guardians of the environment. They have no vested interests like big business in making profits and making money, although they have an interest in raising funds. The slide is a stark indication of the battle we have to actually try to wrest some of the ground away from these people." (Participant Y)

Although it is generally believed that transparency and open communication marks an improvement in the relationship between industry and the public, it is worth noting that social commentators have expressed some reservations about the sincerity and viability of such moves. For example, Grove-White et al. (1997) argue that unless assumptions which view public knowledge as deficient in risk debates are avoided, communication strategies, such as those proposed by the ABC, may in fact further undermine public trust in industry. The authors state: "picturing trust as contributing to the goal of restored control, through the instrumental

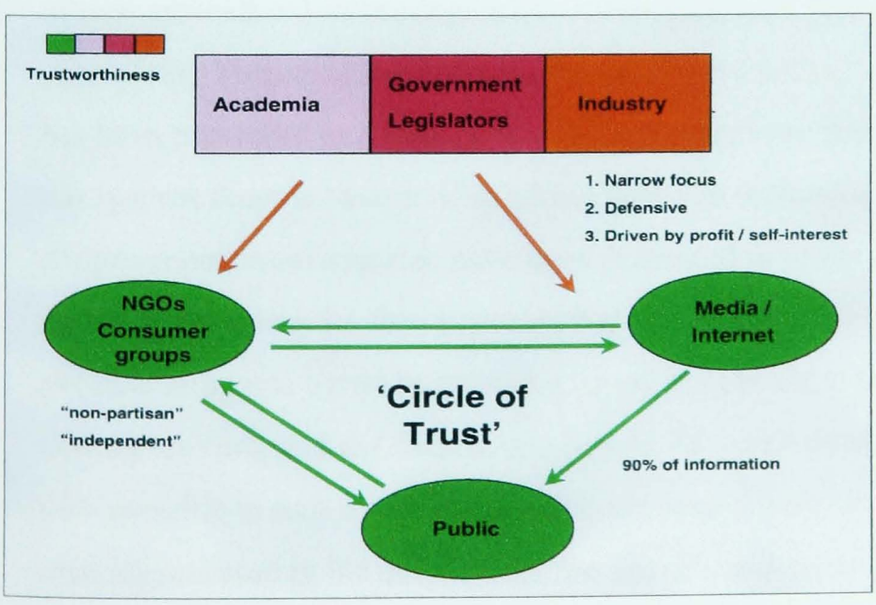

Figure 4 - 'Circle of Trust'

propagation of information, actually implies a negation of the authentic spirit of trust relations themselves (ibid.: p.34).

It is, therefore, important to note that although seeking to generate trust in agricultural biotechnology and the life-industry the ABC could potentially be exacerbating its problems. Where the comments of the GM opponents broaden notions of risk to include the moral responsibility of institutions alongside technological hazards, the model of trust presented by the above comments obscure this relationship. Adopting a deficit model of expert-citizen relations, the ABC assumes that public apprehension about GM crops and foods stem from a lack of accurate information about the technology. This position further implies that if the public is given more accurate information about the risks and benefits of GM-crops that it will be persuaded to come around and side with industry. In this way trust is used as a way of reasserting the boundary between technological and social politics. Evaluations of the technology are in this way distanced from concerns about the corporate origins of GM-crops and foods and the role of these corporations in society. All questions of moral responsibilities are turned aside. As another scientist and corporate spokesperson argued, "we don't tend to get embroiled in world politics and issues like democracy" (Participant O).

Summary

Through an analysis of stakeholder comments, this section has argued that the politics of new agricultural technologies are intertwined with global debates about corporate capitalism. Moreover, in line with the theoretical underpinnings of this thesis, this data has been presented in a fashion which neither reduces issues of risk to global politics, nor ignores them in favour of speaking solely in technological terms. Instead, controversies involving risk have been presented in terms of a cultural politics of blame and trust. In doing so, this argument has tied concerns over the hazards of GMOs to political struggles between opposing moral beliefs about the social benefits offered by GM agriculture, and the institutions behind its development. From this foundation it is now possible to turn to a more detailed account of how the politics of risk, blame and trust is contested in the debate over the use of genetic technologies in agriculture.

Contesting Risk and Benefit

In the above section data was presented that suggested that risks in the debate over new agricultural technologies are not objectively given, but identified in relation to intense moral and cultural politics involving the legitimacy of the life-industry. Otway (1992, p. 223) notes that one important way in which risk and social perceptions of a technology may be further understood is in reference to "perceptions of its benefits, [and] the social and political outcomes associated with its use." Stated differently, how a technology is selected as risky (or not) and whether those risks are acceptable (or not) is closely linked with the visions of society and progress proposed by opposing moral communities. Therefore, it follows that we should explore how participants ascribe risks to new agricultural technologies in relation to arguments about their potential benefits, as well as addressing the types of values embodied in these ascriptions.

Biotech Generations

A common point of contention in the debate over GM crops and foods is the relationship between the benefits agricultural biotechnology offers industry and its capacity to respond to public interests and contribute to wider social well-being. Participants, discussing the risks of agricultural biotechnology and whether it is worth pursuing, offered differing evaluations of the positive and negative aspects of the technology. This included benefits being proposed in relation to those crops now ready to reach commercial markets, but also the promised advantages agricultural biotechnology is proposed to offer in the future. Specifically, these discussions were raised in relation to what are commonly referred to as first, second and third generation GM technologies (Appendix B).

First generation technologies consist of crops which have been genetically modified to be herbicide resistant or to express insecticide genes. These crops are designed to be cultivated in coordination with specific chemical regimes which are then sold alongside the seed licence. Chiefly, these crop technologies have been applied in cash crops such as soy bean, maize, rape seed, cotton and more recently in wheat and

sugar cane. For example, Monsanto now produces several *Roundup Ready* ™ crops, including cotton and maize. These crops have been engineered to allow plants to survive being sprayed with Monsanto's hugely prosperous *Roundup* variety of herbicides. It is worth noting that several of these crops are nearing commercial regulation in Europe and are also grown in numerous other countries around the world.

Opponents of agricultural biotechnology unsurprisingly reject any pretensions of benefit ascribed to first generation GM crops. They argue that the benefits of these technologies are primarily directed towards the life-industry itself, its corporate shareholders and possibly to some farmers. Herbicide tolerant crops, for example, are seen to epitomize corporate values of greed and reflect the life-industry's detachment from the values and needs of the British people. In part, profits are derived from these crops through the direct sale of seeds and crop licenses to farmers. Additionally, corporations such as Monsanto have been able to use herbicide resistant crop species to encourage farmers to exclusively employ their profitable brands of chemicals. As one corporate spokesperson resentfully acknowledged, industry is seen "to be selling herbicide on the back of a GM technology" (Participant W).

Similarly, opponents of the commercialization of GM crops and foods further argue that first generation technologies offer few discernible benefits to the British public. If any benefits can be postulated, they are seen to be overly abstract. As a result, with only industry seen to benefit directly from the technology the attention of opponents has been focused on perceptions of risk. Thus in justifying their position against first generation technologies, these opponents asked why, if there are no agreed benefits of the technology for broader society, should anyone take any risk at all? These views are expressed in the following statement from a participant who is part of a campaign calling for a temporary moratorium on the commercialization of GM agricultural products. If, as s/he states, her/his membership is going to accept the technology then the benefits to society will have to be concrete and easily discernible. Furthermore, unless those benefits can then be seen to outweigh any identifiable risks, future support for GM agriculture would not be forthcoming:

> "The problem with agricultural use at the moment, particularly in the UK, is that the consumer knows that there are no conceivable benefits to consumers from the crops that are being grown at the moment. It's quite

> clear with rape, soya, and maize – the commodity crops – that the benefits are going to be with industry and possibly, although possibly not, with the farmers that take it up... People are very cautious of potential risks now, and for them to accept it as a benefit, that benefit will have to be shown to outweigh the potential risks that are being flagged-up." (Participant C)

Proponents of first generation technologies were keen to counter these critiques. They argued that although they hoped herbicide tolerant and insect resistant crops would generate commercial benefits, they also saw these crops as generating substantial industrial, social and environmental benefits. By altering the "input" traits of plants, first generation technologies were described as able to increase productive outputs, while also reducing the number of chemical inputs applied to a crop. Using decreased amounts of better targeted herbicides and pesticides, proponents of the technology argued, would save farmers money and increase farm profitability. Furthermore, these practices would serve to protect both society and the environment from the well-documented risks of chemical usage. In the following excerpt from an interview with a crop scientists and industry spokesperson, the participant advances these claims, identifying agricultural biotechnology as a means of improving the quality of life for Britons. It is worth noting that the participant further suggests that these benefits are being offered at some risk to the corporation itself through an implied reduction in chemical sales:

> "Often people are ill-advised on the potential benefits that [first generation crops] could bring... I'm not saying that putting a broad spectrum contact herbicide on genetically manipulated crops is always going to give you 100% better weed control, but effectively in that situation you can reduce the amount of herbicides and the grams active ingredients you are applying. That is an example where it has cost us business, because we were selling products in other countries that were applying more grams active herbicides than spraying a herbicide resistant crop once... Part of the challenge that the industry faces in linking crop protection and GM is asking where do they fit in terms of the objectives of a better society. In reality all these things are being driven for economic benefits for everybody. Yes commercial companies are there and commercial companies only survive to make money. But, at the end of the day if they improve the quality of life for all of us... Some people would say 'hang-on' biotech selling chemicals is a disconnect. Well our attitude is that there is a role for both, we sell both and it's according to what gives the best improvement to quality of life for all of us." (Participant W)

Looking beyond first generation GM crops, debates also encompass arguments about the potential future benefits of continuing innovation and development in agricultural biotechnology. For example, industry representatives routinely sought to outline the potential of applying genetics to agriculture by situating these innovations in a linear history of agricultural and technological development. A representative of the agrochemical and biotech industry makes this argument in the following statement. In it s/he distinguishes between benefit and need, suggesting that a technology does not have to directly address social needs to be envisioned as a positive contribution to society. Rather, benefit can be ascribed to a technology if it provides any degree of improvement in productivity, or environmental protection, when compared to its technological counterparts. In other words, s/he envisions that social needs can best be met through the gradual advancement of science and technology[5], arguing that GM crops and foods should be further evaluated on this basis:

> "It's a question of how you define need... I do think that it is the case that for a new technology to be accepted that there has to be some benefit demonstrated. Whether that equates to need is debatable. But, for example, in the chemical world with which I am most familiar, when companies are developing a new technology they will test it alongside chemicals that are on the market already to see whether it produces a similar degree of control of a particular pest and so on. They will look at standards of toxicity as well. I am not saying that every new chemical is better than what has existed in the past, but there is a general trend in that direction. Companies are going to look to improve upon what we have had in the past so there is a benefit that can be explained. A chemical might be more specific in the way that it works and not harm non-target species. Or, it might be more rapidly biodegradable in the environment... Sometimes I think that those facts are not put across particularly well. I think in the chemical arena, for example, people still quote the Rachel Carson book Silent Spring, and think that the pesticides that we used then are the same as we use now. They are not. Things have moved on. The chemistry has moved on. The regulation has moved on... But that is a question of benefit rather than need. I think there probably is a difference." (Participant B).

In less abstract terms, the benefits of agricultural biotechnology are also debated in regards to what are commonly labelled as second and third generation crops.

---

5 The benefit of science as a necessarily progressive force in social development will be discussed at length in Chapter Six.

Addressing the perceived shortcomings of early crop protection technologies, both of these subsequent generations are targeted towards offering direct benefits to the consumer. Second generation crops seek to generate these benefits by genetically modifying the output traits of plants. For example, in the following passage an agricultural geneticist describes the motivation behind her/his research as stemming from the ability to engineer a wide range of potentially positive consumer traits into bananas:

> "What makes me excited is how you actually go about making a product that somebody can use... What does the consumer actually want from a banana, because at the moment every banana is exactly identical to every other banana. Can you actually make them different colours? Can you make them taste better? Can you make them last longer on the shelf? Can you make the texture better?" (Participant U)

The development of third generation technologies likewise is targeted towards providing direct benefits to the British consumer. Instead of trying to improve on upon the characteristics of a plant, for example by making it a more attractive colour, industry is attempting to engineer novel traits into plants. Chiefly this process includes modifying food crops in order to supplement their nutritional value (nutriceuticals), or to provide other health benefits, for example preventing heart disease (functional foods).

On the basis of the potential for these technologies to provide consumers with healthy eating alternatives, at least one critic of GM technologies and the life-industry was willing to grant second and third generation crop technologies some grudging support:

> "In theory, [the life-industry] could have something to offer, for sure. Again, when you get to an area like 'generation three' where you have nutriceuticals and pharmaceuticals with an 'f', and you have the ability to develop foods that are healthier for us than that is something that they could have to offer. However, it will take time and money to develop these kinds of things. They are mainly for the yuppy market, or at least, for the northern industrialized market, but that can still be beneficial and helpful." (Participant Q).

Yet, most opponents of the technology were unimpressed by the benefits of either second, or third generation technologies being promised by industry. They perceived these benefits as too abstract, were sceptical of the motivations of the life-industry in bringing these technologies forward, and were reticent to attribute any benefits to the

technology in relation to its position in the linear advancement of agricultural science. If any future generations of GM products could be seen as beneficial, several opponents suggested, then they would need to directly address social needs. Looking back at the comments of the GM campaigner who was willing to grant limited support to second and third generation technologies, it is important to note that the participant qualifies her/his support with the words "in theory." Likewise, the opinions of a consumer advocate demonstrate a sceptical belief that the potential benefits of these products could ever reach fruition given the motivations of the corporations. In the following interview excerpt the participant scoffs at the idea that the life-industry has brought forward these technologies with the health of society as its paramount concern. Instead s/he speculates that nutriceuticals and functional foods represent a cynical attempt by the life-industry to establish a market for a new range of products in the consumer led economies of the developed world. S/he states:

> "I think you have to look at the face of global business in terms of where it is looking for new markets, and what's actually driving the development of these new [technologies]. It's shareholder imperative. If you look at the developed economies, these are people who've got money to spend... People aren't developing these products because they genuinely think this is going to make us all healthy. It's not altruism. It's shareholder returns which are driving this." (Participant D).

Benefits to the Developing World?

It would be inappropriate to discuss the risks and benefits ascribed to all three generations of agricultural biotechnology without also addressing controversies over the role of GM crops and the life-industry in the developing world. Although concerning the potential of the technology outside of the immediate experience of the British public, this has been one the most overt, contested and publicized arenas in which the benefits and risks of agricultural biotechnology have been fought over. It is also an arena in which industry has often been vocal in promoting the life-industry model and the promises of all three generations of genetically engineered crops to the British public.

Several pro-GM participants eagerly made the case for the application of agricultural biotechnology in the developing world. Voicing a commonly made

argument, a public relations officer for an agricultural biotechnology corporation claimed GM crops and foods were essential tools in the battle to prevent famine and feed the world's poor. For example, plants with increased productivity levels, or which could survive in more hostile conditions, were presented as a response to a looming Malthusian catastrophe resulting from the rapid growth of the populations of Asia and Africa (ref. Figure 3 in Chapter Four). As Levidow has commented, the promise made by industry has been to provide food security to the citizens of the developing world as well as providing security to the rest of the world from the global instability created by widespread famine (1996: pp. 57-59, also Levidow and Tait, 1995).

In adopting this assessment of the technology pro-GM supporters argue that it is not fair to discount the potential of GM agriculture by weighing its benefits against its potential health and environmental risks in the British context alone. What's more, they contend that it is equally unfair to claim that the life-industry has adopted a cynical public relations approach to development when the benefits to the developing world could be so dramatic. On this basis, a research scientist working to develop genetically modified crops accused the environmental lobby of, "deciding on behalf of the third world whether or not" they reap the rewards of GM technologies (Participant G). Likewise, the comments of a life-industry spokesperson echo these same sentiments. S/he states that GM crops and the life-industry have roles to play in the development of third world agriculture, independent of how they are viewed in Britain:

> "One of the major flaws I see with the adversarial people in this debate in the UK is that they are only looking at the UK. I think in about another 25 years time there are going to be another two billion people on the planet, but we're not going to have any more land resources on which to grow crops. I think the available arable land is diminishing. Productivity has got to come from somewhere. GM can help you produce crops on brackish saline areas that aren't available for agriculture at the moment. Hopefully we can use some of that marginal land to help feed that burgeoning population. Again we get pilloried for coming out with the developing world argument. We can't bring it up in any way. But, I think it is easy to lose sight of some of the benefits GM crops can provide in those areas... I can give you all sorts of examples of where we have donated technologies in East Africa and South East Asia. It's not just a PR exercise that we are just trying to get mileage out of it, because we are not making anything out of it. It is actually trying to help certain groups of people with their agriculture..." (Participant Y).

Although it is the promise of production benefits which has traditionally been associated with agricultural development initiatives, supporters of GM suggest that second and third generation technologies also have a vital role to play. The most publicized example is the much hyped and heroically named "Golden Rice." Engineered to contain beta-carotene (a precursor to the production of vitamin A), Golden Rice has been developed to address vitamin deficiencies which are a major cause of illness and blindness in the developing world[6]. Alongside these types of nutriceuticals, industry points to products, such as delayed ripening fruits, which would allow farmers in the developing world to market their products to the economies of the North. Described in the comments of a corporate research scientist below, the message being put across is that once again technology and industry are in a position to assist in improving the welfare and security of the world's poor. Asked how s/he valued her/his work the participant offered the following response:

> "Another problem we have had is that the products that have all come out today have benefited the big chemical companies and the farmers. Big deal, how is that going to benefit the consumer? How is that going to benefit the developing countries where these crops are going into? That's why, for me, working on the quality traits of bananas is something I feel comfortable with. I see that there could be a long term value in some of these benefits to the consumer. Not just in the Western consumers that can afford it, but I am working on some high vitamin content products and we do have routes of getting those into developing countries safely and meeting all the regulatory requirements... You will be familiar with Golden Rice. [We are also] looking at things like delayed ripening of Papaya because it is hard to ship long distances without going mushy. You can see that in some developing countries, if they can get hold of that technology it vastly opens up their markets. But, my worry is that we are coming too late with some of these products that can benefit the consumer and that we already have such a negative feel with GM that it is not going to redeem us." (Participant U).

If the above cited participant sounds defensive in advancing this argument, it is because attempts to commercially establish GM crops in the developing world have been hotly criticized by social commentators. At best, these arguments are dismissed as the

---

6 The rights to Golden Rice are currently held by Syngenta, although the corporation has released licences to scientists working to develop the potential of the technology. The company has committed to make the technology free of charge to farmers in the developing world.

cynical types of public relations exercises which Participant Y (above) has sought to defend against. At worst, they are seen to express a paternalistic desire to exert control over Southern farmers through the imposition of Northern agricultural markets and systems (Shiva, 1995; Shiva, 1993: pp. 65-88). For example, corporate patenting practices are criticized for allowing companies to gain property controls over seed use. In practice, patenting would require farmers to opt into more expensive GM crop systems and prevent them from saving seeds to replant in subsequent seasons (1995: p.199)[7]. Patents are accordingly seen to force farmers into a dependent and exploitative relationship with the life-industry (Fowler, 1995; Gillies, 1998). Overall, these sentiments were summarized well by an anti-GM campaigner who stated "that the people that consume the food and grow the food should have strong control over what goes on, rather than anonymous companies" (Participant T).

These censures on the benefit of agricultural biotechnology and the life-industry in the developing world contain criticisms of the technologies themselves. For example, with its emphasis on the cultivation of commercial monocultures, Shiva argues, that GM agriculture would devalue the crop biodiversity which the people of the developing world rely upon to meet their nutritional and material needs (Shiva, 1993). Moreover, these criticisms again point to a deep lack of faith in the motives of the life-industry. To return to the reluctant supporter of second and third generation technologies quoted above, the participant was once again hesitant to fully dismiss the benefits of the technology in relation to the developing world. However, asked whether these technologies could ever be a benefit while associated with the life-industry the participant was far more assured in her/his statements. In the following extracts s/he forthrightly expresses disbelief that the life-industry and its emphasis on patenting, profits and markets will ever be part of a just or equitable programme of agricultural development in the south:

7

Behind these critiques is a concern that GM agriculture risks replicating the disasters of post-WWII development initiatives and the agricultural reforms of the Green Revolution in particular. Levidow and Tait (1995, p.129), thus ironically point out that the success of the Green Revolution has been to "produce more food and more hunger." For a more complete discussion please refer to Escobar (1995a; 1995b).

"What really bugs you about the way in which agriculture is being developed globally?"

"[Arguments that] this will all be done for the benefit of the poor. The first time I ever heard about intellectual property rights related to agriculture was when Gene Whelan, who was [the Canadian] Minister of Agriculture in 1974, talked about how the reason to have plant breeders rights in Canada was to make a more beautiful Canada to feed the hungry. The thing I was absolutely sure of was that no one developed intellectual property law to make a country more beautiful, or to feed the poor. It never happened! It was bullshit! It still shocks me that we have some of the 'gene giants' saying that [agricultural biotechnology] is the way to feed the world's hungry. They know that's not true. You talk to them one-on-one and they know that's bullshit. They have this trickle down theory that somewhere down the road it will be indirectly beneficial, but they know it's not beneficial now."

"Is [the life-industry's] targeting of the developing world as a market for agricultural biotechnology necessarily a bad thing, or do they have something to offer?"

"Will they ever have anything for the poor? I really doubt it. There is no historical precedent to show big companies ever trying to do anything, or are ever able to do anything, for the poor. I just don't believe it, frankly."

"*What are the solutions then?"*

"The solutions to the broader questions are always ones of equality, justice and so on. They are very sweeping sorts of solutions." (Participant Q)

Summary

In summary, this section set out to look at the ways in which the politics of blame and trust involving the life-industry were mediated through debates over the risks and benefits of GM agriculture. In both the discussion of biotech generations and GM crops in the developing world, participants presented very different valuations about what they identified as beneficial about the technology. On this basis, significant differences existed between what participants identified as risky and whether the benefits of GM crops and foods could be seen to outweigh these risks. Of particular note, the ways in which participants discussed the benefit of new agricultural technologies very often

reflected the relations of risk, trust and blame identified in the opening section of this chapter. Participants who were supportive of the technology spoke about its potential to generate benefits for the citizens of both the developed and developing worlds. The life-industry was envisioned as a means of bringing these benefits forward. Those expressing hesitancy, or opposition, to GM crops expressed very different conceptions of risk and benefits. Although not dismissing the potential of the technology to offer advantages to consumers, the environment or the world's poor, these participants did not see this potential as inherent in the technologies themselves. They instead highlighted concerns about the corporate context in which agricultural biotechnology was being developed and the values and motivations of the life-industry. Identifying the ability of agricultural biotechnology to meet social needs is a process entangled with uncertainty about its relation to values of equality, fairness and justice. Here again, the life-industry is called into question for failing to meet these standards, or for exhibiting values, such as greed and control, which run counter to what is deemed by opponents to be acceptable.

Democracy, Choice and Control

Along with contestations over the benefits agricultural biotechnology, another way in which the politics of risk, blame and trust were enacted by participants was in regards to matters of democracy, choice and control. In the remainder of this chapter these disputes will be discussed in terms of participants' perceptions that the life-industry, and its attempts to bring GM crops and foods into the marketplace, has ignored the public's interests and concerns. Moreover, these concerns will be specifically discussed in relation to the labelling of GM products and consumers' rights to information and choice.

The Subversion of Choice

The rise of the controversy over GM crops and foods in the UK is strongly associated by some participants with a feeling that genetically engineered products and

agricultural regimes were being forced on Britain by the life-industry corporations. With a history of development and regulation in the UK extending twenty years, the explosion of the debate in the late 1990s created the impression that the life-industry had been attempting to sneak a potentially dangerous technology into British farms and supermarkets. Additionally, with the Government already facing a crisis in trust following the BSE scandal, an impression developed that Government had either been forced into supporting the technology or colluded to go along with industry from the beginning. These perceived failures to give the public an opportunity to raise concerns about the technology, its risks or its impacts on agricultural practices and food production systems became the focus of several interviews.

Participants described the actions of industry and government as the subversion of fundamental democratic principles of participation and consent. Below are two excerpts from interviews with critics of agricultural biotechnology, both of whom make this critical link between the arrival of GM and perceptions of a loss of democratic freedom. Both offer these conclusions in response to questions about why they had been compelled to become actively involved in the debate:

> *"What drew you into the debate? What was it that made you want to get involved?"*
>
> "The way that this was sprung on us I think. We were just so horrified that this was happening. We didn't know about it. No one had been asked. When they want to build a motorway or a house and you can oppose it, even if you don't win. But, this seemed to be snuck in. This was happening and we didn't know. We've always been told that we live in a democracy. This seemed to be something that went against everything." (Participant M)
>
> *"What motivated you to get involved in the debate? What were the issues which you believed were paramount and which really pushed you from going beyond growing an organic garden to getting involved."*
>
> "If you are campaigning for change in any way you always come up against the system and the lack of voice that the public have in whatever the issue might be. This was a clear case of the corporations and the industry behind the introduction of GM – primarily Monsanto at the time, the big baddy – were not really acting within the bounds of democracy. Their influence over government was detrimental to democracy in a way. Those elements really got me angry." (Participant C)

As was the case in contestations over risk and benefit, concerns over the loss of choice and the undermining of principles of social consent were seen to impact upon social perceptions of risk. As a senior policy officer for a consumer advocacy group argued in interview, risks are more likely to be met with anxiety if the public feel they are being denied the right to evaluate risks themselves and make decisions over what risks they want to take or reject. Her/his statements mirror research which suggests that public tolerance of risks, alongside issues of benefit, are rooted in public perceptions of choice and trust (Simmons & Walker, 1999). Research conducted by Miles and Frewer (2003: p. 280), for example, has sought to demonstrate that "under circumstances where people feel they have little personal control over their exposure to genetic modification and pesticides... the hazards may appear out of control, which results in greater perceived seriousness of the associated risks in comparison to other hazards where personal control is greater[8]." The important point to be emphasised in this research is that public perceptions of agricultural biotechnology relate both to hazard issues, and the ways in which the public's relations with these hazards are delimited. Here the point is stated eruditely by the aforementioned consumer advocate:

> "Why [do] people get more anxious about risks that if you look at the pure statistics are relatively small, or relatively remote? Some people would like to describe the people as irrational, but actually when you look at it from the perspective of the public, it is entirely rational, often the decisions that they make. If you are driving a car you think that you are in control. You think you can drive carefully. You think that if something happens out there that you are a good driver and that you can control it. People feel in control and there's evidence that people who are in control of risk, then you know they are prepared to take a higher level of risk. With something like BSE, or something like GM foods people feel completely out of control. You can't make a choice, not a real choice." (Participant D).

As this comment suggests the provision of choice is therefore identified as an essential means of addressing public concerns about the risks of new agricultural technologies, and their scepticism in the values of the life-industry. Choice, in other words, is an important factor in the way in which opponents of new agricultural

---

8 Miles and Frewer (2003) further link these public risk perceptions to situations in which the social institutions perceived to be responsible for the management of risk and the prevention of hazard indicate uncertainty about the ability to do so.

technologies weighed risk and benefit. Likewise the perceived failure of the life-industry to offer the public the ability to make these decisions between risk and benefit for themselves is an important factor in the degeneration of trust in these relationships. Recall for a moment the communications strategy advanced by the industry led ABC. It assumed that public support for GM crops and foods could be generated by educating people with the facts about the technology. However, when we consider this communication strategy in relation to the concerns expressed about deficits of public choice and control it is clear the strategy falls well short of addressing issues of risk as the opponents of GMOs see them. In the following interview passage from a senior campaigner at an environmental NGO, this position is well laid out. In her/his statement the participant derides industry's approach to public engagement and argues that public concerns about risk can never be alleviated until such fundamental democratic issues of choice and control are dealt with:

> "[Industry] have to address how they communicate with people and its whole attitude with the general public which tends to be arrogant. It tends to be aloof. It tends to treat people with contempt at times. Unless they address those issues and become much more open and honest with people about the uncertainties in the science they are doing and the risks involved and say 'we don't actually know what the long term effects of this are going to be, but these are the risks and its up to you to make your judgement and you will do that in the full face of the facts. So, if people accept things when there is openness they will start buying things... Often [new technologies] are tried to be forced through without the public having a say. We think that this is fundamental to the whole democratic process. If you can't decide what you eat then a lot of your democratic rights are being eroded." (Participant T)

Consumer Rights and Product Labelling

One of the defining moments in the development of the debate over GM foods in Britain was the importation of unsegregated genetically modified soya from the United States in 1996. By unsegregated it is meant that American soya imports made no effort to trace or separate regularly produced soya from the herbicide tolerant varieties (in this case Monsanto's Roundup Ready product) which were being grown in North America. The wide coverage of the issue in the press and its subsequent adoption as a key policy

by opponents of GM in government and in the NGO community propelled the issue onto centre stage in the early phases of the debate over GMOs. Soya became a symbol of a technology and way of agricultural production which jeopardised fundamental democratic processes in Britain[9] (Lassen et al., 2002).

The response to the soya case was a call for labelling by NGOs and consumer organizations in the UK. These calls were supported by the majority (approximately 82%) of the British public who were strongly in favour of labelling practices (European Commission cited in Lassen et al., 2002: p.295) The National Consumer Council – an independent consumer advocacy group supported by the British Government – thus began lobbying for regulations which would legislate the traceability and labelling of GM ingredients in food products. The rationale behind this regulation was that labels would allow consumers to know "what they are eating and how it is produced."[10]

As Mikael Klintman writes, labels are presented by their proponents as a means of reclaiming democratic control in response to perceptions of increasing isolation from the agriculture and food production chain (2002: pp. 76-77). In line with the consumer movement, the participant whose statements above linked risk perceptions to choice, advocated labelling as a response to the invasive actions of the life-industry. At the centre of this position is a belief that labels are key to re-establishing public control of the risks they face in their daily lives. Let the public make their own assessment of risks and benefits, the participant further argues:

9

Several participants made these claims in reference to the protection of British sovereignty. An anti-GM activist thus made the following statement: "They seemed to be saying that it had been planted in America and tested in other countries and should be Ok. But we're an island and we should have the right... They should ask us really."

10

http://www.ncc.org.uk/pubs/pdf/gm_at_a_glance.pdf.

> "We did some market research on this recently that was specifically about labelling and the introduction of use, the EU proposals on labelling. You know, people, strongly felt they had a right to know. And they felt that if they were denied that right to know then they're not happy about it. I'm making huge generalisations here because some people are far more happy about it than others, but we're all aware that actually the groundswell of public opinion is that the public hasn't seen a benefit to them in GM. Therefore, why take any risks? People are quite sophisticated at weighing out risk and benefits." (Participant D).

Such has been the public support for labelling that none of the participants interviewed were opposed to such a move. Chastened by the loss of public confidence in the life-industry, corporate representatives also put forward their support for the labelling of GM products. In several cases industry representatives, using the example of GM tomato paste, argued that labelling was not necessarily an impediment to the market as labelled products had sold well in the past (e.g. Participants U, P & W). However, the tone of others was more conciliatory, demonstrating a recognition that if industry is going to achieve commercial success in the future than some effort to address public rights to choice will have to be made. The following comments from a research scientist not only offers her/his support for labelling, but casts aspersions on the practices of the past:[11]

> "Everybody must have a choice. Certainly our company's philosophy was very positive on labelling, so people would have a choice. Part of the problem with the soya industry was that you had all these dirty great soya mills chucking out products and they did not want to offer a freedom of choice with non-GM soya... That was wrong. Our philosophy is that everything should be labelled." (Participant W)

Although the need for labels was agreed in principle by participants, the information to be contained in labels in the event of European commercialization is certain to be contested. As a representative of the Food Standards Agency put it, the challenge would be to provide consumers with information that is "meaningful" (Participant V). Thus, for example, various contestations already exist over what should

---

11

In locations, such as the US, where the debate over GM has been more muted industry has aggressively challenged the legality and necessity of labelling. Labels which identify products as "GM-free", for example, are criticized on the basis that they misrepresent risk by inferring that they are safer than those that are not GM-free (Klintman, 2002).

be included under labelling legislation. Should labelling include information which identifies products made with GM derivatives (ie. vegetable oil produced using GM rape seed), or processing aids? Should products derived from animals reared on GM products (ie. fodder corn) be labelled? What, if any, is the maximum level of GM material which can be identified in a product before it has to be labelled (.1% to 5%)? All these questions suggest that the future of labelling and the information these labels embody are likely going to be more of the subject of contestation than the interview data may at first suggest.

However, as Grove-White et al. (1997, pp. 12-13, 29-30) argue, providing information to consumers about the presence of GMOs in food products only partly encapsulates public concerns about democracy and the lack of choice. This is because, as this chapter asserts, anxieties over the hazards posed by GM are made more complex by their relationship with the politics of the life-industry. Feelings of "cynicism, fatalism and resignation" (ibid.: p.13) not only relate to subversions of consumer choice, but in the subversion of social choice in dictating the direction of development in the agro-food industry.

These sentiments were echoed by a participant from the Food Standards Agency (FSA). Identifying her/his role within the FSA as one of "putting consumer interests first," the participant was working to ensure that labelling would provide the British public meaningful, accessible and enforceable information about where their food came from and what it contained. In the following statement, the participant voices concern that these efforts may shortly be irrelevant as the techniques of genetic engineering are applied to crops, such as wheat and sugar, which are found in almost all processed foods:

> "Some of the [European] commission's proposals aren't going to be enforceable and work once there is a much broader range of products. With GM sugars or wheats you would have so many products in the market to have a traceability system on. It really would be a huge task. That is why we are looking further down the line to see the range of products that are likely to come on. It's no good just focussing on one or two products that you've currently got. Any future legislation must be anticipating a wider range of global GM crops." (Participant V)

Thus, although participants put forward labelling as a response to the actions of the life-industry with the aim of reestablishing democratic control over the risks of GM

agriculture, these actions must be seen as limited. Through the above comments the shortcomings of labelling as a means of enabling democracy and public choice are revealed.

Summary

The case of products containing GMOs and labelling places the life-industry and the debate over GM agriculture in a political context shaped by contestations over matters of choice, control and democracy. Opponents of agricultural biotechnology and the life-industry situated their political opposition in relation to feelings that the life-industry had foisted a technology, its risks and a model of agricultural development onto the public without either consultation or consent. This they argued counted as a subversion of their democratic rights. Through the advocacy of GMO tracing and labelling participants believed these rights could be returned to consumers. However, although labelling was agreed by participants from all sides of the debate to be a common goal, it was suggested that labelling could only partly address uncertainties concerning the life-industry's subversion of democracy. Thus it was suggested that struggles over choice and consent would continue in the debate over the information and meaning encompassed by labels. However, more importantly, labelling cannot encompass the complexity of concerns over democratic participation involved in the contestation of the role of the life-industry in agricultural development.

Conclusion

The question posed at the start of this essay asked how the politics of agricultural biotechnology related to normative contestations over the role of the life-industry in the debate and in wider British society. Drawing on the work of Mary Douglas and her cultural perspective on risk, this question was placed in a context of risk, blame and trust. Interview data showed that for many participants contestations over risk were made more complex through the interrelationship between hazard and a wider debate over the life-industry and global corporate capitalism.

Directed by the insights of the research participants this convergent politics of risk, blame and trust was approached in greater detail in two regards. Firstly, the contested position of the life-industry was discussed in terms of further contestations over risk and benefit. Here perceptions of benefit and the acceptability of risk varied greatly between those in support of GM crops and those who resisted their development. Risks were presented in ways which depended on how participants envisioned the role of the life-industry in providing technologies which bettered agriculture and benefited society more broadly. Furthermore, benefits related not only to the direct potential of the technology, but also to how the life-industry's application of the technology conformed with, or stood against the moral values of the community.

Secondly, in the concluding section of this chapter, the politics of risk, blame and trust involving the life-industry was discussed in regards to issues of choice, consent and democracy. As voiced by participants resistant to the use of genetic technologies in agriculture, the life-industry was accused of attempting to force GM crops and foods onto the shelves of supermarkets without the consent of the British public. How participants approached the technology and tolerated risk thus related to perceptions of a loss of control in making decisions about the acceptability of GMOs or the developmental trajectory they represent. In particular, participants drew on arguments for the tracing of GM materials in food production and the labelling of products containing GM ingredients. Here, although it was argued that the political potential of labelling was limited, participants used calls for labelling as a means of reasserting their democratic rights of choice and consent.

As this chapter has demonstrated, the contested role of the life-industry in the debate over new agricultural technologies is both pervasive and varied. This thesis will now turn its attention to an equally divisive and pervasive theme in these politics – the contested relationship between the public, science and expertise.

CHAPTER SIX: CONTESTING SCIENCE

> "Society's relationship with science is in a critical phase. Science today is exciting, and full of opportunities. Yet public confidence in scientific advice to Government has been rocked by BSE; and many people are uneasy about the rapid advance of areas such as biotechnology and IT - even though for everyday purposes they take science and technology for granted. This crisis of confidence is of great importance both to British society and to British science."
>
> – House of Lords Select Committee on Science and Technology (2000: p. 5)

Introduction

As this statement from the House of Lords Select Committee on Science and Technology suggests, the role of science in society is increasingly the subject of social and political debate in the UK. The position of the GM debate in the maelstrom created by a series of risk controversies in agriculture, of which mad-cow disease, or BSE, has been the most prominent, has made this a timely and consequential topic. As such, it is not surprising that the research data gathered in this thesis identifies science as a focus of contention in the controversy over new agricultural technologies. Concisely stated, this chapter *questions how participants debated developments in GM agriculture in relation to normative contestations over the character of science and its role in society.*

Accordingly, the following discussion is developed along three overlapping avenues of inquiry. The first avenue of investigation addresses the role of science as a force of progress in society. In particular, this discussion follows participants' debates over the development of agriculture and the sustainability of its future. Secondly, in contesting the role of science in society, this chapter addresses the way in which participants debated the certainty and trustworthiness of scientific knowledge in

contesting the development of GM crops. This includes a discussion of the degradation of public trust in science that participants associated with previous risk incidents, as well as the link between trust and a perceived lack of public input into agricultural development. Finally, the disputed correlation between scientific expertise, and governance comprises a third way in which participants contested the role of science in society. Each of these three themes is united by an analysis of a conflict over the determination of acceptable science-society relations.

Science, Progress and the Production of Sustainable Technologies

In Chapter Five the controversy over agricultural biotechnology was discussed in terms of competing visions of risk and benefit. Illustrating this point, the interview data indicated that through these valuations participants were actively contesting the role of the life-industry in modern society. Dependent on scientific and technological innovation, the life-industry and the controversy surrounding it are closely tied to debates over the role of science in society. In a similar vein to the material developed in the last chapter, the ways in which participants spoke of the risks and benefits of scientific innovations in agriculture comprise the analytical focus of this section. In opening this discussion some observations will be made concerning the way in which participants debated the progressive aspirations of science in the development of agricultural technologies. From this more general basis, a discussion of competing visions of sustainable forms of agricultural production offers a more specific example of the contested relationship between science and social progress.

Agricultural Science and Social Progress

To recall, in Chapter Two scientific determinism was identified as the object of critique for social constructionist theories of scientific knowledge. Putting aside those critiques for a moment, determinism was defined as the ability to generate knowledge which corresponded to a natural reality. Accordingly science is envisioned as the practice of uncovering facts. It therefore follows that the more you uncover the greater

your knowledge and ability to master the natural world. Harvey (1996) has argued that within this world view, social descriptions of science have swung between triumphal visions of social progress and anxious concerns of social regress. In the first instance, agricultural development has often been seen alongside other modernist institutions as part of a progressive social project (Figure 5)[1]. However, authors such as Beck (1992) have argued that recently the pendulum has started to swing away from these visions. Instead, Beck argues, science and modernity are increasingly called into question by widespread public concern about the consequences of agricultural development on the environment. Thus it is in this sense that participants contested the role of science in society in fairly abstract, or wide-ranging, fashions. In other words, the politics of new agricultural technologies were situated within a context whereby the progressive and regressive attributes of science were also being contested.

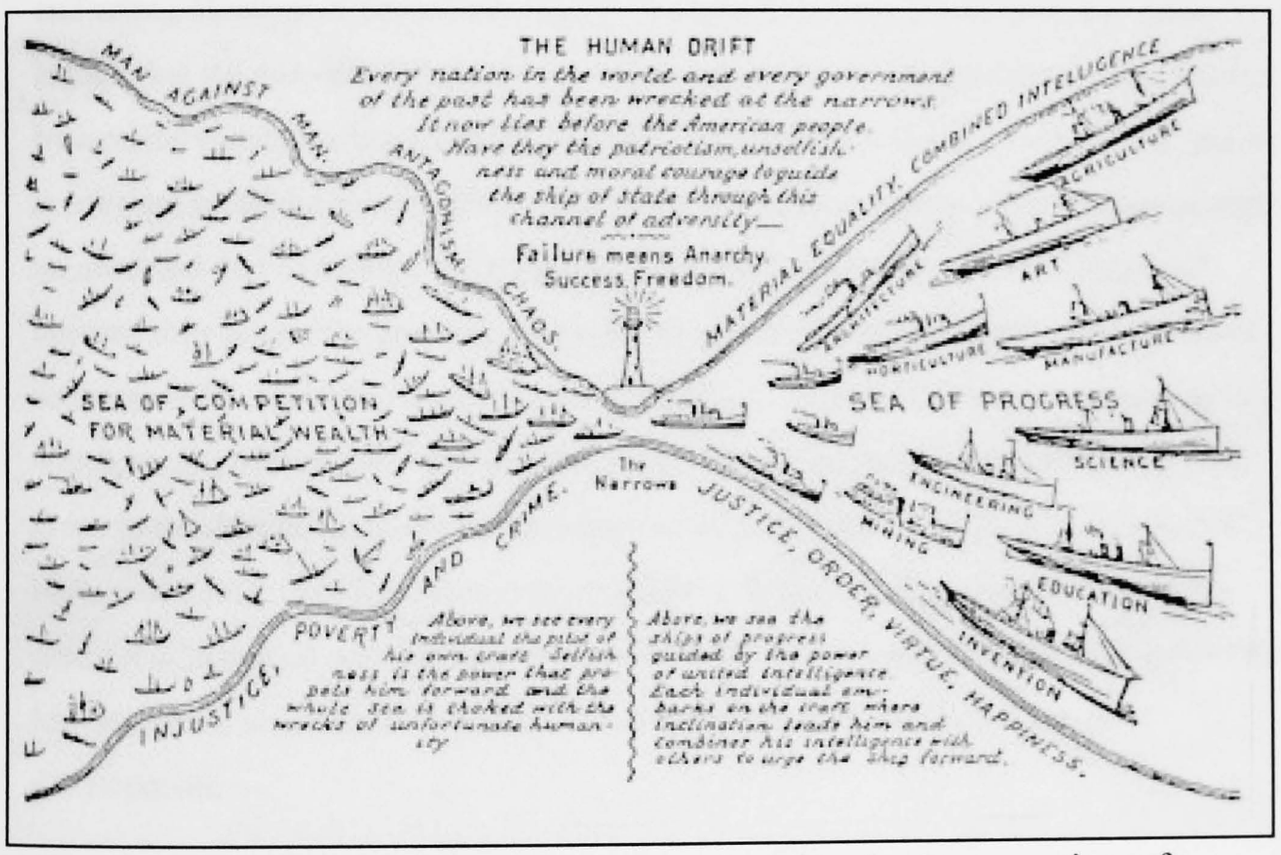

Figure 3 – "The Human Drift," a utopian conception of modernist conceptions of progress (Segal, 1985).

---

1 Refer to Bantjes, 2000 and Harper, 2001 for discussions about history of agriculture and farming as a 'modern' enterprise.

Worried by their early failures to gain approval of new agricultural technologies, some of the participants interviewed in this thesis sought to reassure the public of the progressive potential of agricultural innovation. These participants placed agricultural biotechnology within a continuous chain, or lifeline, of development and advancement. Risks, they argue, are always pertinent, but must be seen in relation to the general amelioration of social welfare afforded by techno-scientific innovation alongside any immediate benefits offered by a new technology. The role of science in society cannot be determined by weighing the risks and benefits of GM crops alone, but as these participants argue, such appraisals must also take into account the value of science as an institution of modernity. They ask that society hold onto the promises of modern development and remember the benefits this afforded society in the past.

These 'ideological' arguments were put forward by a former Agriculture Minister and acting Member of Parliament for the Conservative Party (Participant L). S/he argued that the perceptions of risk voiced by opponents of GM agriculture were tainted by a conservatism analogous to the Luddites[2] of the industrial age. Accordingly, public scepticism about the risks and benefits of GM agriculture is reduced by the participant to an irrational fear of change and progress. Such fears s/he believes to be misguided because they ignore the previous successes of science's contribution to agriculture and social welfare. In her/his statement below, the participant thus argues that the manner in which society values agricultural biotechnology must include the relationship of GM crops to the development of more productive field systems, mechanized farming and high yield seeds. Her/his comments are made in response to being questioned as to whether s/he agreed with perceptions that the relationship between the public and science had degraded, or whether the public were simply more aware of the risks of development:

---

2 It is worth noting that the reduction of the politics of the Luddites and machine breakers of the industrial age to irrational fears of progress has been convincingly challenged academically. For example, E.P. Thompson (1963) has argued that Luddism was an integral part of the development of class politics in England. In this light, it is necessary to be wary of the participant's equation of opposition to GM with a fear of development. Refer also to Grint and Woolgar (1997: pp. 39-64).

> "When you look back at British industrial history you could argue that the Luddites were a classic example of people saying 'no we don't want change,' 'we feel threatened by it,' 'we much prefer what we've got,' 'there are things that are unknown,' therefore 'we don't like it...' [S]ometimes people don't want change for political reasons. They just don't like it."
>
> "If you look at the jumps in yields in grains, you can see that the sort of 17th and 18th century change in farming started to have a big effect. I expect they probably had the same arguments we are discussing now about enclosing land, which is the outrageous thought about making a big field. Now we'd think you were sort of a bit odd if you thought you could have strip agriculture in the United Kingdom. But then the next application of technology was when they invented hybrid seed varieties, when suddenly the yield after about a hundred years of bumbling along at more or less the same level suddenly shot up in the 1970s. And that was a result of the application of science and the virtue of man intervening to breed seed varieties which had the characteristics of increasing the yield. Nobody got too upset about that. We all breathed a huge sigh of relief because larger numbers of people on this planet could be sustained as a result of that technology." (Participant L)

Moreover, the former Minister suggests that the identification of risks should not be seen as a sign of the weakness of scientific knowledge, but offers proof of its successes. The trouble with risk, as the participant states, is that the public have failed to see it in the context of a general shift forward in the standard of life in Britain:

> "So, as we become more knowledgeable with science we identify more and more potential risks to worry about without taking into account it is actually increasing the comfort zone. The one intriguing fact in all of this, is that as we have proceeded in getting more and more worried about the potential life threatening arguments that are brought forward about the use of chemicals in the context of agriculture, improved social conditions, improved public health, and improved diet have simultaneously contributed to a rapidly lengthening lifespan." (Participant L)

Participants from within the industrial scientific community made similar arguments, centring their comments on the development of chemical pesticides and herbicides (Participants B & W in particular). Chemicals, such as DDT, were introduced in the 1940s alongside attempts to modernize agriculture by increasing crop yields and herd sizes. High yield crops require increased levels of nutrients and, therefore, place heavy demands on the soil, necessitating the input of artificial fertilizers. Likewise, these crops required increased pest and weed protection as a combined result of growing

single types of a species (a monoculture) over large stretches of agricultural land (Harper, 2001). However by the 1960s, chemicals such as DDT had become widely vilified as symbols of the environmental degradation associated with the intensification and industrialization of agricultural production. Consequently, chemical inputs are today more likely to be seen as chemical poisons which pit industrial gain against environmental welfare, than as the sorts of progressive aids science hopes to offer society.

Yet, despite a general condemnation of DDT within society, several pro-GM participants argued that DDT should be seen in a positive light according to its past successes and its potential benefits in the future. Risks, they argued, do not preclude the progressive valuation of innovations in agricultural science. Instead, they argued that the risks of DDT are tempered by the benefits it has offered social welfare in terms of agricultural development[3]. Although willing to admit that the chemical's role in crop protection is at an end, the participant was reticent to avoid dismissing the future benefits of DDT altogether. Specifically, s/he alludes to the revival of debates over the potential of DDT as a means of preventing the spread of malaria (transmitted by the mosquito) in the developing world (refer to Attaran and Maharaj, 2000)[4]. The participant's comments demonstrate an unflappable belief in the progressive capacity of science and agricultural development to generate greater social well-being:

3

In addition to their comments above, the former Agriculture Minister who participated in this thesis, offers the following statement linking her/his conception of progress with the social benefits of DDT: "It is quite clear, I mean if you look at something like DDT, a highly toxic chemical, today it wouldn't be allowed and we'd all say rightly so. We go back when it first came in, in terms of dealing with pesticide risk. I f you look at crops and look at what uncontrolled pests can do, it can be the difference between large numbers of people having food and not having food. Therefore a chemical that comes along that gives mankind a better than evens chance of surviving is welcomed, but by today's understanding of the technology we are saying it's wrong." (Participant L)

4

Carter, Tom. "DDT: Malaria's answer in Africa?" *The Washington Post.* June 16, 2001.

> "The purpose [of science] is to create a better quality of life. I think that is very important. I said earlier that there is no such thing as zero risk. What I am saying is that a lot of the positives that have come out of modern day understanding / management of the environment have had negative consequences. Nobody is ever going to deny that there are some negatives. There always will be. But, it doesn't put things in perspective. The things crop protection has done for the world. Everybody slights DDT these days, but I challenge anyone to show me anybody that died from the correct use of DDT. Yes, it hangs around in the environment and it was time to move on, but look at what it did in terms of underdeveloped countries at the time. Perhaps this is an example of progress. The one priority for the world health authorities is still malaria and we still haven't got solutions there. Nobody is proud enough to point to the potential of DDT – that disaster that people make it out to be. Yes, I'll accept that it is still found in shore crabs off Cornwall, but... Those are the types of perspectives I like to bring forward." (Participant W)

Needless to say, not all participants shared this modernist perspective of agricultural science. Although no participant categorically discounted the benefit of scientific knowledge or technological innovation, one of the most direct evocations of a loss of faith in the progressive value of science came from an anti-GM activist. The participant presented a pointed challenge of what s/he described as assumptions about the linear development of science and technology. Her/his disquiet with the science of GM foods is not necessarily just about the particular risks of agricultural biotechnology. Instead, her/his concerns encompass what s/he sees as the dogmatic acceptance of scientific authority in arbitrating risks in society. In the following interview excerpt these arguments are outlined in an explication of what the activist felt the risks of agricultural biotechnology actually were. Her/his statements mock the epistemological value of science, question scientific authority and moreover belittle the model of society these values are interpreted as engendering:

> "Don't question what the technology is. Don't question the need for the technology. Don't question the long term effects of the technology. Just say, 'it's technology,' 'it's new', 'it must be all singing, all dancing and brilliant.' It's that aspect of the technology which frightens me, not the specifics of 'will it give us all cancer,' 'will it mean that there are three headed rabbits running all over Britain.' I'm not interested in that. I give you a ludicrous example and I don't genuinely believe any of that stuff. It doesn't matter. The simple fact of the matter is that we are blindly adopting an ideological stance that says 'this is science,' 'this is progress,' 'it is therefore good' and 'we will follow this model.'" (Participant I)

Although this statement was one of a few statements directed specifically against an ideology of scientific progress, it was certainly not the only criticism made. In particular, a debate over the social merits of science as progress were focussed around contestations over science and the innovation of sustainable technologies.

Technology Sustaining Agriculture

Scientific innovation, as related to sustainable agriculture, was one issue around which the role of science in society was critically discussed by participants. Sustainability in this situation does not refer to a straightforward technical concept, but a contested ideal demarcating the appropriate role for science in the pursuit of social progress. It is therefore advantageous to think of sustainability as what Olson (1995) refers to as a social vision for the future[5]. In this light, participants from all sides of the debate evoked different perceptions of good and bad science in reference to opposing definitions of sustainable agriculture. These valuations of science were determined in relation to two universally accepted goals: i) to provide a quality agricultural system, and ii) to do so in a manner which preserves the welfare of the environment.

Supporters of agricultural biotechnology from within the scientific and industry communities held up genetics as a key to providing the UK with a sustainable agricultural industry. An industry representative (Participant B) described the innovation of new agricultural technologies as enabling sustainability in two senses. Firstly, s/he argued that GM crops combined with the development of "new and better" chemicals, such as promised by first generation technologies, would lessen the impact of agriculture on the environment. Secondly, and of equal importance, the application of genetics to agriculture, was presented by the participant as a means of effecting economic

---

5

Not all authors commentating on sustainability view the concept with as much optimism as Olson. For others, sustainability is seen as a perpetuation of the domination of nature and society characterizing modernist programmes of development (eg. Banerjee, 2003; Spaargaren & Mol, 1992; Escobar, 1996). It is therefore worth noting that although not all participants spoke of science in terms of the production of sustainable technologies, no participant offered a position which overtly criticized ideas of sustainability. As has already been suggested in this thesis, several participants have been very critical of capitalist models of development, however no overt links were drawn between these criticisms and sustainability as such.

sustainability. The argument follows that if scientific innovation combined with good practice can create profits for farmers, then a healthy agricultural system can be engendered which offers benefits to both food production and the environment (Participant L).

An agricultural geneticist likewise supported the sustainable potential of agricultural biotechnology. However, not entirely satisfied with the dominant approach to genetics, the participant argued that a widening of the scientific gaze could further help to realize these promises. Specifically, the participant identified a need to move beyond a "reductionist approach" to the science of genetics. S/he described this approach as involving the detailed work concentrating on the genetic make up of individual plant species. This involves first figuring out the functions and relationships of genes in an organism, and then seeking how these traits can be applied to the development of new commercial products[6]. In contrast to this reductionist approach, the participant encourages the incorporation of adaptationist, or evolutionary, science to the development of agricultural biotechnology. Scientists, s/he argues, need to get out of the laboratory and examine the behaviour of plant species within the agricultural environment. By attempting to shift the science of genetics towards an adaptationist approach the participant expresses the need for agricultural development to take account of the consequences of GM crops on the environment. However, neither the reductionist nor the adaptationist approach is perceived by the participant as an acceptable means of providing sustainable technologies itself. S/he states:

---

[6] Yoxen refers to this as the Meccano approach to molecular biology. He states:
"I prefer to think of molecular biology as the expression of a Meccano view of nature. With a fairly simple conceptual kit and with a limited number of elements, molecular biologists have been able to represent living nature with a series of increasingly complex mechanical models. They have spent years figuring out what pieces there are in nature's Meccano set, and how they fit together... And now, finally, since the early 1970s they have figured out how to start bolting pieces together, making new models that are not even in the instruction books. To push the model to its facetious conclusion, we could say that molecular biologists are now realising what they can build and just how pleased their new patrons will be with their inventiveness." (Yoxen, 1986: p.35)

"As you are probably aware there are two types of scientists. There's the reductionist who works out how things work but doesn't really work out why. Then there is the adaptationist who works out the wonderful ecological and evolutionary ideas but hasn't got a clue what makes things work."

"Could you give me an example of both parts of that?"

"[For example], plants defend themselves when they are attacked by insects. There is more and more research going on showing that. Now a reductionist approach to that would be to work out which chemicals are involved, which genes are involved, and possibly make a transgenic plant which elevates that gene. [Then], in a laboratory still see whether it changes the behaviour of the insect. Ok?"

"Right."

"Whereas the ecological adaptationist would ask, 'are these interactions important in ecology and in nature?' So, you find examples in which plants outside the laboratory clearly defend themselves against insects. Do those plants benefit evolutionary and ecologically from doing so? Are the genes responsible for it passed on such that if you collect the offspring from these plants that they do it too? All of that can be done without a clue as to what's going on [in terms of specific gene relationships]..."

"I think we need to be able to understand how to take apart what the critical issues are in terms of what interactions are going on – why is it happening, how can it be controlled – within the context of what are the bigger questions in terms of what does this mean in terms of environment and ecology." (Participant S)

Others within the scientific community take these moderate critiques of genetics a step further, contending that genetics is not the sole means of fostering sustainable development in agriculture. Alternatively, it was proposed that sustainability could best be achieved by pursuing alternative forms of agricultural science alongside research in genetics. This argument was made by two senior research scientists working for a nonprofit collective mandated to provide sustainable futures to farmers (Participants A & F). Each participant maintained that a scientific focus on genetics in innovating agriculture could be beneficial in certain sectors and with certain crops. However, they also advanced that there were both space and need for alternative paths of innovation.

For example, Mendelian techniques of selective breeding[7] were still seen to be highly effective means of engendering positive plant traits in crops such as beans, pulses and legumes. This includes producing plants with higher yields, of higher quality and which are easier to grow and manage (i.e. weed and pest control). Likewise, both scientists supported research into mechanical weeding techniques and the use of insect traps as alternatives to chemical herbicides and pesticides.

Closely resembling the advantages of sustainability promised by the supporter of GM crops cited above, developing alternative paths of scientific innovation in agriculture was perceived to offer two primary benefits to society. Firstly, one of the two research scientists just mentioned (Participant A) argued that these alternatives were potentially less intrusive on the environment than first generation GM crops and their associated chemical regimes. Secondly, both scientists argued that these alternative techniques not only made environmental sense, but good commercial sense as well. Perceiving a context in which the future of agricultural biotechnology remains the subject of considerable public controversy, they saw alternative paths of innovation as a means of commercially exploiting consumer uncertainty about GMOs. For example, breeding high-protein crops to manufacture livestock feed supplements could offer farmers alternatives to growing or using the GM soya crops which currently dominate the feed industry[8].

Arguments about the relationship between science and sustainable development with more far reaching implications were offered by participants from the environmental lobby. Like the two research scientists cited above, these participants offered their own

---

7

Mendelian techniques involve selectively breeding desired traits, such as increased yield or hardiness, into a crop based on a detailed understanding of the inheritance mechanisms of the plant and the transmission of desirable characteristics from parent to progeny (Welsh, 1981: pp. 4-16).

8

It is necessary to note that although both scientists advanced this argument, their commitment to GM agriculture differed. One of the participants (Participant F) felt uneasy in discussing these commercial benefits. This was because s/he did not believe that organic farming was financially sustainable in the long run, and because s/he did not want to support the view that GM technologies were risky. The second participant (Participant A) was far more comfortable in asserting this position. Somewhat sympathetic to environmental politics, s/he fervently argued that it was important that science could provide marketable and "sustainable technologies" which could compete with the products of more intensive agricultural systems.

alternatives to genetics and modernist programmes of agriculture. Where the two research scientists emphasised the inherent benefits of various forms of techno-scientific development, what differentiates the environmentalists' argument is that it asserts the need for science to be founded on environmental values[9]. In other words, the environmental position shifts a vision of development based upon the ability of science to engender progress, to one which sees progressive ideologies as engendering good social practice[10].

Echoing Barry Commoners (1972) "laws of ecology," the environmentalist position emphasizes the complexity and interconnectedness of the natural world, where seemingly small changes in the environment could lead to unforseen consequences. As a result the activists interviewed firstly proposed the need for science, and the science of risk assessment in particular, to take a precautionary approach to development. Furthermore, participants put forward the need for a scientific approach built around a less environmentally intrusive model of technological development. In order to meet these needs, a senior environmental campaigner outlined a strategy of development focussed on what s/he describes as innovations in sustainable techniques. This approach is contrasted with an industry model of development based on the innovation and application of agricultural products, such as chemical inputs or genetically engineered seeds. Drawing on scientific research into sustainable farming systems[11], the participant

---

9

Although often criticized by the pro-GM camp for taking positions which are irrational or anti-scientific (refer for example to Chapter Five footnotes 2 & 3), it is worth noting that the close link between environmental claims making and science has existed since the inception of the environmental movement. Yearley, for example, argues that science enables campaigners to speak on behalf of the environment and to offer universal and definitive environmental truths in calling for action (Yearley, 1993: pp. 59-62; refer also to Yearley, 1991 & 1992). He gives the example of the ozone hole as an environmental issue which is framed by an environmental discourse centred around the chemical makeup of the atmosphere, and which can only be known through that discourse (1992: p.512). Aside from these sorts of large campaigns, grassroot movements without the scientific backing of the large environmental organizations, have been shown to rely heavily on outside scientific expertise in making environmental claims (Tesh, 2000).

10

For a more complete discussion of the relationship between sustainability and social values please refer to the work of Dave Toke (2002).

11

For example, please refer to the work of Jules Pretty (2002) at Exeter University. This research posits that non-product based alternatives to development are not anti-science, but propose the alternative types of development advocated by the GM campaigner. This position is eruditely presented in the following

argues that by focussing on techniques, farmers can better integrate production with the natural processes which input-based systems are seen to affront. Asked if s/he opposed the technology outright, the participant offered the following response. In it s/he firstly urges a cautious approach to agricultural development, but also affirms a commitment to techno-scientific innovation if it corresponds to the environmental values and model of sustainability s/he advocates:

> "[My organisation's] position is that the area of molecular genetic research is interesting and that we wouldn't want to see it stifled at the moment... There are a lot of questions that need to be answered about a) how plant genes function in the natural state, and b) what happens when you start randomly farrowing in genes from other species into a genome. From our point of view these are fundamental scientific questions about safety that have to be answered before we go into commercial production. On top of that there are some serious scientific questions about how you go about testing the environmental impacts of crops without having an irreversible impact on the environment. If we get it wrong then we could end up with something that is very difficult to eradicate if possible. All the more reason for proceeding with caution rather than proceeding at all haste like we are at the moment."

> "We think that there are much more important things that scientific brains should be applied to, rather than this particular technology. These hold up more possible solutions to global agricultural [development] than [industry] are saying GM does. The problem is that a lot of those solutions are not product based, they're knowledge based... They are techniques and ways of farming, rather than specific seeds or chemicals. Some of them may require new technologies as well, which is another area where we think research is needed." (Participant T).

For each of the participants cited above, sustainable development was a target which they could mutually agree upon. No proponent, or opponent, of agricultural biotechnology diverged from a line of argument which advanced the need for development strategies which could provide for the economic viability of the industry while also protecting the integrity of the environment. Likewise, science plays an

---

statement by Pretty and Howes:
"[Sustainable agriculture] does not constitute a return to low technology or low output farming. It is not a single system of technologies and practices. It includes a wide spectrum of farming systems involving prudent use of pesticides, antibiotics and fertilizers. Conventional practices are not rejected, but the innovative resource-conserving practices are emphasised. These usually involve the substitution of labour, knowledge and management skills for the former high use of external inputs." (Pretty and Howes, 1993, p. iii).

important role in demarcating each of the above visions of sustainability. What is contested is the model of science which is envisioned as best meeting social and environmental ideals of sustainability. For some participants new agricultural technologies were part of a sustainable solution, if as one participant argued it could be better focussed towards environmental concerns. For other members of the agricultural research industry, traditional paths of innovation, such as crop breeding, could complement genetic technologies and provide farmers with alternative types of sustainable development. And, as the environmentalist position argued, science could play an important role in sustainability, if it conformed to ecological visions of the social and natural worlds.

Summary

In this section, participants contested GM crops and foods in relation to differing and sometimes opposing beliefs about the role of science in society. For some participants the science of genetics was part of a process of linear development and the provision of social welfare. Although recognizing development as imperfect and potentially risky, the overall process of accumulated knowledge and innovation was portrayed as one of overall social progress. Other participants, either directly questioned these assumptions, or as was more often the case, debated the progressive role of science in society through ideas of sustainable agricultural development. In these instances, participants shared common desires to apply science and technology in ways which would enable a productive farming system while also protecting the welfare of the environment.

Significantly, the role of science in society was not contested between participants who were for science and those who were against science. Instead, participants proposed alternative versions of innovation which reflected differing values of development. For a few participants, GM crops, such as those currently being developed by industry, were already seen to engender sustainable development. In this sense, their position closely parallels modernist equations of science with social progress. However, the majority of participants argued that the science of genetics must

take account of environmental values if it was to be truly progressive. Contestations over sustainability in this sense involved the varying degrees to which participants identified the need for environmental values to dictate scientific practice.

Uncertainty and the Robustness of Scientific Knowledge

In this section the role of science in society is discussed in relation to issues of risk and trust in science. It addresses how participants debated the ability of science to protect society from any detrimental consequences associated with technological development. An analysis of participants' comments suggests a response to this question which is only partly based in contestations over the certainty, or uncertainty, of scientific knowledge and risk management. However, as the above discussion of science and development has demonstrated, it would be misleading to approach these debates in relation to a single monolithic vision of science. As Irwin argues, it is better to speak about sciences and the heterogeneity of knowledge and institutions that go under this label, rather than view science as a singular and authoritative account of the world (1995: pp.50-51).

Participants often linked their confidence in scientific knowledge with debates over the value of public science as opposed to industry, or corporate, science. By value, I refer to what Nowotny et al. (2001: p.25) describe as the "social robustness" of scientific knowledge. According to these authors the advantages afforded by science are not measurable in terms of reliability and validity, but in terms of its value to society. In other words, they do not expect knowledge to be certain, but more importantly demand it take account of the normative social values expressed by participants.

Agricultural Genetics in a Context of Uncertainty

Participants universally recognized that the debate over risks and new agricultural technologies was entangled within a political context shaped by questions about the certainty of scientific knowledge. Given recent failures in the evaluation of the risks associated with modern agricultural practices, a majority of participants put forward the

need to interrogate the value of scientific expertise in society. Or, at the very least, participants recognized this as inevitable in the current political context.

In making this case, participants spoke of a diversity of risk events overlapping the development of GM crop technologies. These included Foot & Mouth Disease (FMD), salmonella, E-coli, and the use of hormones and antibiotics in rearing livestock. Likewise, the handling of BSE was seen to ensure that the politics of GM agriculture was also the politics of trust in science. Although the history of BSE and the Government's response to the disease will be the subject of detailed analysis in Chapter Seven, for the moment it is sufficient to say that the controversy cast considerable doubt about the certainty and authority of scientific knowledge.

As one participant recounted, the consequences of BSE on public perceptions of risk and science were twofold. Firstly, s/he argues that BSE made risks real to the public, even if only a relatively small percentage of the population had been directly affected by the disease. Secondly, the uncertainties of science and the fallibility of science as a basis of the Government's failed strategy for contending with risk were rendered clearly visible. In a post-BSE context, the participant argues that the types of categorical assertions of safety accompanying the development of GM agriculture hold considerably less merit. Involved in the environmental lobby and a member of the Government's Agriculture, Environment and Biotechnology Commission (AEBC), the participant offers the following appraisal of public-science relations following mad-cow disease:

> "There was genuine scientific disagreement when [the risks of BSE] were considered in the UK; whether these things mattered or not. That doesn't instill confidence; whether the scientists know what they are talking about. The trouble is that you are down to such infinitesimal degrees of risk. But, then we have experienced the same things with BSE. You know there are risks and they have different degrees, but those posited risks have come to pass, although at a low rate. But nonetheless there were things that were considered at infinitesimal possibilities at one stage and have been realized. There are people who died [as a result of BSE]. It's very hard for people to get a handle on calibrating these risks, so *what becomes the focus is the uncertainty in people minds; that there is no categorical assurance available and no real quantification of risk, or comparative risk.*" (Participant J)

Participants active in the development of agricultural biotechnology also agreed that the public confidence in science had become an inescapable context in which the future of the technology will have to be evaluated. However, although resigned to developing GM crops and foods in this context, not all participants were willing to concede a lack of certainty in the evaluation of agricultural biotechnology itself. For example, a spokesperson for the life-industry grudgingly admitted that, because of BSE, industry could not ignore issues of uncertainty and public trust in science. However, s/he does not question the objectivity, or the authority, of scientific knowledge in speaking about the potential risks of agricultural biotechnology. As her/his below statement posits, the necessity of a debate over science is principally furnished by the need to contend with public scepticism about scientific claims of certainty and respond to opposition claims of risk. This debate is not, according to the participant, necessitated by any lack of certainty in industry's scientific conclusions about the safety of growing GM crops or consuming GM food products:

> "There were a whole number of things in the UK around the timing of the introduction of the technology. It became a lightning rod because there have been certain societal changes that we sense as a science driven industry over the past few years. There has been an erosion in the trust of scientists. Scientists were previously up here and highly respected, now people are more sceptical of the science. People are far more questioning about the food they eat. GMOs were introduced following a whole lot of other food scares such as BSE and dioxin. I think, if you like, Europeans were highly sensitized to the next food scare, although there hasn't been a single proven case of a safety scare or health being damaged through GM foods. I think there have been a number of bodies that have had a vested interest in actually creating alarm around it." (Participant Y)

Yet, despite the intransigence of some supporters of the technology, others from within the pro-GM camp offered a more conciliatory approach to the perceived lack of public confidence in science. Unlike the above statements which fall short of admitting to the need to challenge industry's own preconceptions of scientific certainty and risk, an agricultural geneticist offers a more humble evaluation of science's past failures. Although without specifically underlining the uncertainty of scientific knowledge involved in the BSE case, the participant does deride the Government's use of a discourse of certainty in reassuring the public of the safety of British beef at the time.

On this basis the participant proposes that scientists re-examine the way in which they communicate with the public. Importantly, in stating this belief, the participant does not reduce communication to a monologue centred on more effectively getting the facts out to the public. Instead, the participant begins to veer away from the paternalistic approach to science-public relations, described as the 'deficit model' of public-science relations. Accordingly, s/he puts forward the need for the creation of a dialogue between science and the public. Divulging some uncertainty in how far s/he is willing to take this idea, the participant nonetheless states:

> "I think the problem with BSE was that people felt that they had been hoodwinked – that they hadn't been given the information. Government ministers were saying 'it's fine,' 'it's safe,' and 'you can keep eating beef.' Yet, quite obviously, there were problems. I think the general public lost a lot of faith in scientists. I think they see us as very remote and not communicating particularly well. Maybe scientists aren't particularly good communicators. Perhaps one of the things we're not very good at, we might be quite good at talking about what we do, but not always that good at listening. Perhaps not necessarily listening, but demonstrating that we are listening to the public – being proactive." (Participant S)

This discussion of science, trust and certainty situates the debate over GM crops and GM foods in a political context created by over a decade of scientific and risk controversies in agriculture. This is a context which participants suggest has emphasised the very real consequences and risks of agricultural development on the lives of Britons. Moreover, by bearing witness to these risks, participants argue that the public has become conscious of the routine uncertainties in scientific knowledge and the fallibility of science in managing risk and protecting society from the unforseen consequences of development. Stated concisely, debates over risk and the future of new agricultural technologies are tied to contestations involving the re-negotiation of the relationship between science, expertise and the public.

Contesting Public Science

In speaking about trust in science and the need to re-negotiate science-public relations, participants focussed their attention on the perceived interdependence between science and industry. A common concern raised by participants was that science was not

meeting its responsibility to society as a consequence of agricultural genetics' close ties to the life-industry and its corporate values. Although these criticisms were implicit in much of the discussion of risk, blame and trust in the preceding chapter, participants explicitly made these types of arguments in advocating one model of science over another. Specifically several participants broached the issue in terms of the need for a public scientific approach to genetics.

These arguments were not limited to the comments of opponents of agricultural biotechnology, but were presented by participants from all sides of the debate. For example, a scientist and industry insider when questioned about decreasing public trust in science initially responded by making a firm commitment to the progressive role of science in society. However, s/he also worried that there was a lack of controls in place which could ensure that the potential benefits of agricultural genetics would address public needs and not just those of the corporations. S/he does not blame industry for developing products targeted towards securing commercial profits[12] but reprehends Government for not providing alternative paths of innovation. The root of the problem, s/he argues, is a shortage of financial support for "independent research" in the field of genetics which could meet social needs not covered by commercial interests. A senior official in an organization representing corporate interest in crop protection technologies, the participant offers the following comments:

> "I've got a scientific background so I have an inclination towards progress and scientific research coming up with new ideas. So I don't think we can, or should, stop progress. I think that humanity will always have that curiosity to not only know how things work but to push the boundaries and play around with things... There are so many things in scientific development that could be used for good or for bad. I think it is up to society to make sure that it has the proper controls in place to make sure that scientific developments are used for the good."

12

A university based geneticist and supporter of GM crops offers a more critical take on the relationship between industry and science. Although willing to lend her/his support in speaking on behalf of the safety and benefits of GM crops, the participant differentiates this from giving support to the way the corporations have proceeded with the technology. Speaking of the role of her/his advocacy group, s/he states: "We offer a service to give balanced information, but we are defending the technology and gene recombination, not the fact that Monsanto are using it for this or that... I am willing to discuss how this type of technology can be one, and I stress one, of a useful toolbox to use to solve critical issues in the world. It would be a shame to throw away that potential. But, I'm not necessarily going to defend the policies of Monsanto to produce Bt cotton in such and such an environment." (Participant S).

"You have touched a bit of a sensitivity with me in terms of university research because a lot of that is funded by industry now. It has been the Government that has pushed us in that direction. A lot of people that are working in universities spend an awful lot of their time getting research money from industry as you are aware... If society is not willing to pay for quote 'independent research' then it is going to have to come to terms that industry is going to pay for a large proportion of it and make commercial gain out of it where appropriate." (Participant B)

Others more forcefully pressed the need for publicly funded independent agricultural science and were far more critical of the relationship between agricultural genetics and industry. For example, a farmer and director of an organization representing small acreage farms in Britain advanced the need for a public science to instil an ethos of precaution in the innovation of new agricultural technologies. The participant suggests that the current domination of agricultural science by industry has resulted in a development model based on getting products to market as quickly as possible. The consequence s/he ascertains from this argument is that profits have become the motivating force behind genetic research and adequate attention is not being given to assuring product safety. As the passage below outlines, science needs to take issues of risks more seriously, firstly on the grounds of safety, but also as a step towards fostering public trust in agricultural development. The participant remains unconvinced that the benefits of the crops, as they stand, outweigh these potentially deleterious consequences. S/he states:

"Most farmers' attitude toward GM is that they don't want it right now. The public don't want it. But, don't throw the baby out with the bathwater. There might be something in it, so carry on the research. I think one of the problems that has happened in agriculture was that agricultural research is no longer funded by government in this country. [Government research] had no commercial axe to grind. It did take many years for things to come through, but the research was pretty thorough. Now the research tends to be done by commercial companies who obviously don't want to spend twenty years researching something if they can get it to market in five... I remember there was a story that Monsanto admitted to. I can't remember what crop it was, but when they transferred the gene they wanted into this crop they also discovered some time later, after it had been commercialized, that they had transferred five or six other genes they hadn't intended to at the same time.

> And it was like 'oh well, what does it matter.' To me at that time I was thinking well how do you know it doesn't matter. Where is the research?" (Participant H).

These comments reflect a commonly expressed view by participants that industry's domination of agricultural science was related to the corporate control of agriculture in general. In the previous chapter elements of industrial control were discussed. For example, participants were concerned that the benefits of agricultural biotechnology were directed solely towards the life-industry and that consumers were being given very little choice about the types of foods and agricultural systems being developed in Britain. However, participants were also worried that new agricultural technologies could be used to force farmers to adopt industrial systems of agricultural production based on intensive cropping systems and meeting the demands of global markets[13]. The farmer cited above was, in this sense, not only worried about risk and public support for agriculture, but was further concerned that farmers, particularly the small and family farmers s/he represented, were being cast aside by the life-industry. The type of agriculture represented and engendered by GM crops was described as less capable of responding to local needs or incorporating the knowledge of local members of the agricultural community. In the following statement the participant declares that industry's approach to agricultural innovation undermines the knowledge of crop welfare and plant breeding which farmers bring to the agricultural industry:

> "There is a lot of apprehension and a growing awareness of the corporate control of farming... Farmers don't express it very well, but if you narrow down the genetic field into very few lines, if those lines are susceptible to anything you can have big problems. Among smaller farmers there is a growing awareness that these companies are breeding very few varieties... When I was a student the lists of varieties of different types of barley or wheat were almost endless. Now there is twenty to twenty-five main varieties, which account for probably 90% of the cropping and many of those are related. A lot of them are susceptible to disease. But, of course that's all right, because most of the seed breeding companies are also owned by companies that will sell you sprays to treat the diseases." (Participant H)

---

13 For a more complete discussion of agricultural biotechnology and the corporate control of farming please refer to the work of Goodman and Redclift (1991: pp. 167-200).

The prioritization of local forms of agricultural development was also made by participants in reference to calls for scientific innovation to be more closely correlated with the needs of local communities. To recall, an argument was put forward by a lobbyist in the previous chapter which suggested that agricultural technologies must do a better job at reflecting human needs and respecting values of equality and justice. Continuing this line of argumentation, the participant propounds that, in order to reflect these needs and values, entrepreneurial projects should avoid altering local people's approaches to agriculture. Instead of working on a belief that Southern farmers are underdeveloped –lacking the methods, tools and experience of the developed word (Escobar, 1995b: pp.213-214) – the participant argues that science needs to work in coordination with local peoples. For example, this might include applying genetic technologies to crop breeds and cropping systems which respect the diversity of species grown by farmers in the developing world and which consequently meet the cultural and material needs of the population. Crucially, the participant argues, the pursuit of "public sector" innovations must be advanced for reasons other than commercial gain alone. Thus, even if these innovations are unlikely to generate the same types of commercial successes associated with more industrial farming systems and their ties to global markets they must be backed by science and society. S/he states:

> "The real solution today with technologies is to try to find ways in which farmers, and especially poor farmers, are able to influence the type of science being developed... To have both public sector science and a small entrepreneurial science, particularly companies that can be based in the South, work with those farmers to develop those technologies. There will certainly be significant areas of technology which have a for profit possibility and it should be used so as to be beneficial to everyone. And there are areas of plant breeding and farming systems which really can only be developed very closely with the farmer and by the public sector because it will never be profitable in the commercial sense." (Participant Q)

As each of the above cited participants have suggested, issues of trust and debates over the role of science in society closely appertain to the role of industry in the development of new agricultural technologies. More accurately, each of the extracts cited above outlines an argument for the inclusion of some form of public science, as opposed to the industrial model of innovation which is seen to dominate the development of GM agriculture to date. However, the way in which public science was

defined varied considerably, although all participants identified it as an alternative which could emphasise public needs over those of the corporation. For some, public science could be accomplished in conjunction with life-industry led research science if the Government were willing to fund it. For others, the barriers to public science were deeper rooted, involving efforts on the part of industry to advance industrialized market-based systems of agricultural production. Corporately controlled science, as these participants described, was seen to fail society by emphasising profit instead of caution, by seeking supplant the local knowledge of farmers and by ignoring the needs of local communities.

Summary

The above discussion embeds participants' political engagements with new agricultural technologies within a debate over the robustness of scientific knowledge in society. In other words, the potentially progressive role of science in society was not judged in terms of its ability to make claims to absolute knowledge, but in its capacity to reflect the social needs and normative valuations of society. Participants described their position and motivations in the debate over GM crops and foods in reference to a context in which the value of scientific knowledge had become the subject of considerable public scepticism. Following events such as BSE, this lack of confidence in the scientific epistemology was related, in particular, to the inability of science to understand and manage the risks associated with technological development. Within this context of uncertainty, the debate over new agricultural technologies is, therefore, both the product and producer of an evolving debate over the relationship between science and the public.

One manifestation of this debate related to the desire of participants for a public alternative to prevailing models of agricultural science which were perceived to be dominated by industry and under the direction of corporate interests and values. As was the situation described in the case of sustainable development, this debate did not pit science against non-science, or necessarily cast industry science against public science. Participants, both for and against GM agriculture, saw public science as a means of improving the ability of science to meet the needs of Britons in general. However,

controversies involving issues of trust in science did arise in relation to what a public science might look like. It is in these contested visions of public science where, what should by now be familiar cultural contestations over the position and values of the life-industry, once again took centre stage in the debate over new agricultural technologies.

Science and the Governance of Risk

A final way in which participants contested the role of science in society relates to the role of science in the governance of risk. In the previous section participants situated the controversy over GM crops and foods in a context of scientific uncertainty and distrust in prevailing models of industrial innovation and corporate science. Similarly this section addresses the way in which participants contested scientific authority in the identification and management of the possible risks associated with agricultural development. However, here an analysis of issues of trust and science are extended to a lack of confidence in science as applied in the governance of new agricultural technologies. This section thus seeks to address how debates over agricultural biotechnology relate to attempts by participants to renegotiate the relationship between expertise and governance.

Governance and the Public

The public and its relationship to expertise were the focus of participants' engagement with issues of trust and the scientific governance of new agricultural technologies. As such, it is necessary to re-emphasize the importance participants granted the context of uncertainty which permeates the debate over agricultural biotechnology. Participants voiced considerable apprehensions about whether the Government would be able to apply science in effectively determining the risks of GM crops and foods, or in making appropriate regulatory decisions about the future of these technologies. Moreover, perceiving this void in trust, several participants advanced the need for greater public involvement in expert decision-making processes.

As suggested, when speaking about the authority of science in general, participants linked issues of trust, science and governance to the context of uncertainty created by events such as BSE. Without labouring this point, the two following statements forthrightly articulate the attitude of several participants. Their comments reflect an uncertainty in the ability of science and Government to avoid repeating past failures in making decisions about the future of agricultural biotechnology. The first extract relates to the Government's mishandling of scientific advice and the failure to communicate uncertainty and risk effectively with the public during the BSE affair of the 1990s. The second statement mockingly criticizes the veracity of the Government's use of science as a means of public reassurance about the potential risks of GM food:

> "There are a lot of issues about democracy, participating in the decisions which are being made. As well as being kept informed. BSE and the fact that there was a lot of misinformation coming from science and the Government has made people very wary of the evidence that is being presented." (Participant C)

> "You have the Government who obviously likes to wheel out someone in the proverbial white coat and say 'look, listen to them, they're a scientist and say it's all OK.' And we're supposed to say 'phew' it's all OK and tuck back into our GM processed meal that we have in the microwave." (Participant I)

A more analytical account of the loss of trust in scientific governance was presented by a consumer advocate. The participant argues that questions about the social robustness of science have effected a fundamental change in the relationship between science, government and the public. More specifically, s/he hypothesizes that public expectation about the role of scientific knowledge in managing risk has changed in post-BSE Britain. The public not only distrust Government scientists in their white coats, but as a consequence of the diminishment of scientific authority, they are described as willing to take more control over the mediation of risks themselves:

> "I think that we have seen a change in people's attitudes, and in the Government's attitude as well. Historically people have expected government to take care of them and to take decisions on the behalf of the whole and we would anticipate and expect that they would put our safety pretty high up their agenda of things... Obviously that has changed for a number of reasons. Partly because Government doesn't necessarily see itself as playing that role any more... In many ways it's much more sort of hands-off government these days. Coupled with that people's expectations are

> quite different... [P]eople said 'we want to be more informed, we want to know what is going on, we don't want all these decisions taken on our behalf.' BSE was a classic example of where, quite rightly, our faith in those that should have been looking after our interests, was absolutely shaken. This does have broader implications... People are questioning scientists and medical people and they are no longer willing to accept reassurances of experts." (Participant D)

The participant's comments do not bemoan the loss of scientific credibility and scientific authority, nor do they perceive the solutions to risk issues as the need to do science better, or for governments to apply science better. Rather, her/his comments pose some critical questions pertaining to the governance of new agricultural technologies. These include, 'who should make decisions about the future of GM crops and foods?' 'who should be responsible for determining the acceptability of risk?' and 'what types of knowledge should form the basis of these decisions?' Her/his response to these questions is that the input of the public should be central in any attempt to regulate risk and govern the use of agricultural biotechnology. Several participants thus saw the public involvement in regulation as a means of democratizing governance and expanding notions of governance. For example, a politician with an interest in agricultural issues made the case for the inclusion of public voices in making regulatory decisions about the commercialization of GM crops and foods. Although generally supportive of agricultural biotechnology, the participant makes the case for reversing a trend which has seen the exclusion of the public from processes of governance in the past. A trend, which s/he suggests, has led to public disillusionment in governments and a distrust of politicians:

> "It is very important that you try to take into account the views of the public in ways that they can feel engaged in the decision making process and where they can see that their views have actually been listened to and responded to. There has got to be better ways to take into account public opinion and I think this is part of the reason why our political mechanism sometimes gets sidelined, because people say 'well they don't listen,' 'they don't take account of our views.' So better ways of doing that have got to be a way forward... That's why they put politicians in place, because they want them to make sensible decisions based on well informed debate, and they want to be part of it." (Participant L)

Other participants argued that public engagements with the governance of agricultural biotechnology should be extended beyond decision making processes. This

was the argument made by a campaigner calling for a moratorium on the development and commercialization of agricultural biotechnology. S/he suggests that being involved in the decision making process means going back to ask the public fundamental questions about whether they believe biotechnology is "a good development for UK agriculture, or not" (Participant C). An anti-GM campaigner from the environmental lobby likewise argues that the entire process of techno-scientific innovation must be democratically opened to the public (Participant T). S/he suggests that democratic participation is not an end in itself, but that the value of public participation is moreover evident in the perspectives and experiences the public brings to the table. Each of the two statements cited below suggests that increased public involvement can help place the debates over GMOs in a broader context than permitted by scientific risk analysis alone. The first extract, from an anti-GM lobbyist, labels the non-expert contributions of the public as a "common sense" approach to decision making. The second statement, made by a consumer advocate, argues that any decision over the future of genetics in agriculture will involve a judgement call about the risks and benefits of these technologies. It is in these areas, the participant states, that the public are well placed to be involved in that process:

> "I think there is a need for the general public... to be asked directly as to what they feel about the new technology along several key stages along the process of approval. Often, I think if there was that sort of common sense filter by the general public, a lot of things wouldn't get past the starting gate. They would be perceived to be frivolous or ethically unacceptable... Often, although they may not know all the ins and outs of the science of a new technology, the public apply some good common sense questions which means that the scientists involved actually have to think about what they are doing in a wider context." (Participant T)

> "You have to make a judgement about the introduction of any new technology or new product and judgements cannot be about science alone. Being a politician, you can't hide behind science. You have to look at all the other factors that come to bear [whether they are] ethical, moral, or economic. Science is important, but it's not the be all and end all..." (Participant D)

Many of the scientists interviewed as part of this research project were cognizant of the arguments being made around the public trust in science and the role of scientific expertise in governance. However, several of the scientists who expressed support for the commercialization of new agricultural technologies felt some of the criticisms levelled against their discipline were unjust. In making these claims they proposed an alternative vision of science in governance to that which has been the subject of criticism above. In doing so, they are seeking to reassert the autonomy and validity of scientific knowledge, its role in society and its role in governance in particular.

In Chapter Two the idea of a technocracy was put forward as a way of theorizing the link between scientific authority and government decision making. Conceptually it posited that science, through discourses of objectivity and factuality, exerts tremendous influence in governance without being held politically accountable. A common argument made by scientists in defending public trust in scientific knowledge was to deny the existence of these sorts of technocratic relationships. As a plant geneticist working in industry asserted, the scientific discipline involves fundamental processes through which scientific ideas are actively challenged and debated. In her/his day-to-day work the participant describes working in an environment in which scientific uncertainty is the norm. Risks are not discussed conclusively, but are described in terms of probabilities. If scientists have got themselves into hot water, the argument follows, it is because they have not been able to translate these probabilities to the media or Government who are seen to desire certainty in their relationship with the public:

> "Scientists are trained right from the start to never put their head on the line and say things are black and white. It's always grey... [I]f you read a scientific paper people never make very bold statements. They say, 'this potentially would indicate that...' But, then if you go to a politician they are great at avoiding the question. If they do have to give an answer, they will give quite a blank straightforward answer which can leave [scientists] in hot water. I think interpretation is really a key point. We might be writing scientific reports and there are not clear messages coming out of those because we are talking about risk and possibilities. Yet, as a politician or a journalist, you need to get the clear facts down on the paper." (Participant U).

Other participants similarly argued that it is not the responsibility of scientists to make political decisions. The role of science in governance is posited solely as providing advice to Governments. It is, therefore, seen to be up to the politicians to weigh the scientific evidence provided about new agricultural technologies in relation to any other relevant considerations. This might mean taking account of public attitudes towards GM crops including the types of common sense knowledge identified by the environmental lobbyist cited above. Or, it may involve weighing one set of scientific conclusions, such as the safety evaluations produced by industry, against those presented by environmentally focussed or publicly based scientific alternatives. As a senior scientist involved in the risk evaluation of growing GM crops on the environment argued, if ministers feel there are factors, other than scientific advice, which would change the conclusions that they come to, "then they have to make the decision to do that" (Participant R). The responsibility for the consequences of any decisions is thus placed squarely on the shoulders of the politicians. As the comment below outlines, some participants felt it was unfair to blame scientists, or the limitations of the scientific epistemology, for the mishandling of events, such as BSE. Reticent to accept any accountability for the risks to which the British public were exposed during the BSE scandal, a pro-GM plant ecologist offers the following statement:

> "I have gotten increasingly annoyed with the way that scientists have been accused and blamed for so many evils, in the wake of things like BSE, Foot and Mouth, etc. Whereas I think it's predominantly the media and politicians' fault in the sense that what science can do is offer you the information, but the actual decisions need to be made by politicians and regulators. I think it is very unfair of them to turn around to you as a scientist and say "What should you do?" What scientists can do, is offer their scientific opinion and offer the facts and figures. The actual political decision needs to be firmly in the hands of the politician, and they're basically not doing their job if they don't do so."(Participant S)

As these comments suggest, participants sought to reassert the autonomy of science, freeing it from any political entanglements with governance. In reading these statements, it is important to recall that in theorizing the relationship between science and governance, a technocracy was not delimited solely in terms of the undue influence of scientific expertise in government. In addition, the theory dictated that the influence of scientific authority on regulatory processes stemmed from an ability to project science

as an unbiased form of knowledge. In other words, it is precisely because of its ability to project its knowledge as factual and apolitical, that science gained its authority in decision making. The above comments can therefore be read as a denial of the direct role and responsibility of science in governance, but also as a reaffirmation of the basis of scientific authority. For some participants in the science community this meant that although they could accept the admission of alternative types of evaluation to governance, they still felt that an apolitical objective science should be given priority. Let the "facts come through," as one participant said (Participant O). The following excerpt from an interview with a representative of the crop protection industry underlines the move to fall back on scientific authority:

> "[W]e are very much a science-based industry. All our products are discovered and developed, using scientific techniques and processes. We are required, whether you are talking chemistry or biotechnology, to submit data packages to regulatory authorities to satisfy them and to satisfy ourselves about safety and so on. So, what the industry is saying is that it expects those scientific data to be assessed on a scientific basis... If we are developing new products and we do the scientific research, we want that scientific research to be judged according to sound science and not a political judgement. Having said that, the industry now recognizes that science is not enough. That we have to fulfill other needs and obligations beyond science if we are going to get acceptance of new technologies... I think we recognize that it is a combination of science and other factors. But, we still feel that the fundamental assessment of a new chemical or technology should be based on science." (Participant B)

Stated directly, although denying the technocratic accusations made against science and adopting a language of openness, many participants sought to reaffirm the traditional foundations of science's power in society. Willing to accept the possibility of including alternative knowledge and fielding public concerns about new agricultural technologies, science remains separated from these alternatives and outside of the political milieu. As Richardson et al. (1993: p. 16) have pointed out, the danger of this approach is that by seeking to reassert the autonomy of scientific knowledge, science enters into a potentially adversarial and hierarchical relationship with the public. Therefore, without seeing science as a social enterprise which is itself entangled in the politics of new agricultural technologies, scientists can offer little in the way of contending with public scepticism about the authority of science. In other words,

participants who agreed it was necessary to acknowledge alternative forms of expertise in decision making, but who continued to hold onto a belief in the certainty of scientific knowledge, might be accused of trying to have their cake and eat it too.

Summary

This section of the chapter has looked at the ways in which the debate over agricultural biotechnology is intertwined with debates about the role of science in governance. Participants, several of whom were opposed to the use of genetics in agriculture, expressed a deep distrust of scientists and the role of scientific knowledge in formulating government policy concerning the regulation of GM crops and foods. As a consequence of this degradation in trust, participants argued that public expectations about the way in which risks can be handled by society are changing. Instead of relying on scientific expertise, participants asserted that the public should be given greater control and responsibility in directing the future of agricultural biotechnology at all points during its development and regulation.

Responding to these criticisms, several pro-GM scientists argued that public distrust in science was unfounded. Denying the existence of technocratic practices of governance, they shifted the blame for past errors in contending with risk, along with the responsibility for making appropriate decisions about the future of agricultural biotechnology, on the shoulders of the Government. It was argued that scientists don't make decisions, but only offer advice. It follows that it is up to the politicians and legislators to apply scientific expertise as they see fit. From this basis, some of the scientists interviewed were also able to envision a potential role for other forms of expertise alongside science in the regulation of new agricultural technologies. However, in some cases this awareness was undermined by attempts to reassert the autonomy of scientific knowledge. By seeking to place science's contribution to governance outside of the socio-political milieu surrounding genetic technologies, the reassertion of scientific autonomy potentially undermines attempts to rebuild trust between science and the public.

In summary, opponents and proponents of agricultural biotechnology presented two different visions of the role of science in society. Those concerned about the risks of agricultural biotechnology, and the Government's ability to prevent and manage these potential risks, required a fundamental rethinking of the interaction between expertise and governance. Proponents of agricultural biotechnology, particularly from within the corporate-scientific community, presented a more traditional model of scientific knowledge based on its ability to produce objective knowledge about risks. In this way, despite their sometimes conciliatory tone, these participants have sought to hold on to the ability to speak authoritatively about issues of risk and safety.

Conclusion

This chapter set out to address the ways in which the political controversies pervading the development of new agricultural technologies relate to contestations over the role of science in society. Through a discussion of the arguments advanced by participants actively involved in the debate, three conclusions can be drawn from the research data.

Firstly, in contesting the role of science in society, the comments of participants reaffirmed theories of risk which argue that public trust in the progressive ideologies of science, and its ability to protect society from technological hazards, has waned considerably in recent years. However, participants did not outrightly reject the role of science and scientific authority in society. Rather, in response to concerns about the robustness of science in society, participants presented multiple versions of scientific innovation. For example, both environmentally sustainable and publically directed models of scientific practice were advanced as alternatives to the perceived dominance of corporate science. Moreover, within these categories, participants from across the debate offered multiple and contested versions of how these alternatives could be demarcated. Similarly, in discussing the relationship between science and governance, participants did not seek to displace scientific authority, but put forward the need for public forms of expertise to supplement the contributions of scientists.

Secondly, in debating the values of different types of science, participants tied contestations over the role of science in society to normative contestations over the value of certain types of social relationships. For example, in discussing alternative visions of sustainable development in agriculture, participants contested what acceptable social relationships between agricultural development and the environment should entail. Likewise, in demarcating various versions of public science participants debated the role of industry and corporate values in directing innovation and change in society. Finally, participants debated how, and to what degree, governments should democratize participation in decision making and open up the types of knowledge involved in the regulation of new agricultural technologies.

Thirdly, public engagement with science and new agricultural technologies comprised a repeated theme throughout this chapter. Debating the role of science in society, in other words, implied debating the role of society – the public – in science. Most directly, participants engaged in attempts to democratize citizen-science-government relations. Reflecting research in the public understanding of science, discussed in Chapter Two, participants argued that public values and experiences could play an important role in weighing the risks and benefits of new agricultural technologies. However, public engagement was not only sought in relation to the governance of agricultural biotechnology, but at all points in its innovation and development. For example, some participants argued that science needed to be able to take better account of public needs and knowledge if it were to play a trustworthy and beneficial role in the development of agriculture.

In conclusion, debates over the risks and benefits of new agricultural technologies need to be understood within a social context in which traditional forms of scientific authority are being openly challenged. These challenges have opened up important avenues for allowing society to reevaluate the way it conceptualizes and manages risk. Thus, instead of seeing the loss of scientific authority as decreasing society's ability to contend with risk, contestations over the role of science in society provide an opportunity to address risks in a more socially robust and democratic fashion.

Building on the discussions above, this thesis now turns attention towards a more detailed analysis of the ability, and willingness, of Governments to take up this

opportunity in regulating risks and making decisions about the future of new agricultural technologies.

PART THREE : GOVERNANCE

"From our perspective, public participation in what have been treated as exclusively expert deliberations and decision processes is about making prior framing assumptions, including technical ones, open to questions and accountable answers. Public participation is not simply about adding on 'extra-scientific' dimensions to decision making, as if all scientific issues were settled."

– The PABE Report (Marris et al, 2001: p. 93)

"There is a priority in being open to the idea that it's legitimate to hear, digest and act on the views of all the diversity of stakeholders. Government should not feel threatened by that, but to see it as a strength. They should be more open about uncertainties. You'll find that governments don't need to know everything. They don't have to get up and say, 'it's all perfectly safe.' The world will not fall apart if we're treated as adults and [government] explains to us that 'no we do not know everything, but this is what we do know, and this is what we don't know.' [Government] should feel comfortable to say, 'we would like to talk to you about this and then figure out how, as a society, we deal with it.'"

– A consumer advocate concerned about the regulation of GM crops and foods. (Participant D)

CHAPTER SEVEN: BSE, PHILLIPS AND THE UPTAKE OF RISK[1]

Introduction

Throughout the first two sections of this thesis the politics of new agricultural technologies have been described in a way which has placed technological controversies concerning risk in a social context. In particular, uncertainties pertaining to the potentially negative environmental and health consequences of GM crops and foods have been tied to participants' concerns about the role of industry and science in British society. Over the next three chapters this thesis shifts its focus to address the ways in which the Government is able to accommodate these politics in contending with the potential risks of GM crops and foods and in making a decision about the future of these technologies.

As suggested at points throughout the previous chapters, the governance of risk is not a novel issue in relation to the development of new agricultural technologies, but over the last decade has become a prevalent feature of the British political arena. The Government, at the forefront of the need to contend with risk and uncertainty in agriculture, finds itself facing a dual challenge. Firstly, in a climate of increasing industrialization and technological innovation, the Government is expected to make sound regulatory decisions within a context in which scientific advice is perceived as inconclusive and the potentials for hazard ever present. Secondly, there is an increasing awareness that governments cannot rely on science alone in making these decisions, but must furthermore come to terms with the social context in which technological

[1] Versions of this Chapter have been published in the Canadian Journal of Sociology (Jones, 2001) and in an edited collection of essays concerning the *Governance of Knowledge* (Jones, 2003).

controversies take place. Trust in government, science, and industry, changing definitions of expertise and the weighing of the potential benefits of new agricultural technologies with their potential hazards are all key elements of the context in which risk controversies are enacted. Risk, understood in relation to this dual challenge, is revealed not simply as a technical and regulatory problem, but more broadly as a challenge to governance and institutional credibility. The politics of risk, in other words, are also the politics of knowledge, consent and of contingency.

The two-decade-long history of BSE and the Government's response to the disease, therefore, provides an important case study of how British social institutions have been able to cope with risk and uncertainty. In this sense, the lessons learned from the mishandling of BSE have challenged Government to rethink the ways in which it approaches the risks and regulation of agricultural biotechnology (e.g. AEBC, 2001). In particular, Lord Phillips' report (Phillips et al., 2000a) from the BSE Inquiry, submitted to the House of Commons in October 2000, sets the tone for Government to follow. The task of the Inquiry was to review the emergence and identification of BSE and vCJD in the United Kingdom, along with the adequacy of the actions taken by the Government in response to these diseases.

This chapter presents an account of the strengths and weaknesses of the Phillips report with the intention of beginning a critical dialogue about how the Government is able to contend with ideas of risk and uncertainty. This involves re-evaluating not only how these terms are applied, but also how we treat them theoretically. By contrasting theories of the risk society with more contextual, or cultural, accounts of risk, a clear need to move beyond technical, scientific, and managerial approaches to risk is exemplified within the limitations of the Phillips report. It argues that Government must move towards an understanding of risk that can be linked to broader cultural and political processes, such as those identified in previous chapters, if it is to learn from the BSE crises in directing an approach to the governance of new agricultural technologies.

BSE: An Overview

The history of BSE, or "mad-cow" disease as it became popularly known, is simultaneously a scientific and a social story. Neither story encapsulates the history of BSE on its own. Instead, it is in the interplay between the science of BSE and the social response to BSE that we find the heart of the controversy and that which is of the greatest consequence for how we move forward in contending with risk issues in agriculture in the future. This section provides a very brief overview of the primary elements of this story.

The origins of the scientific history of BSE go back to 1985[2] when veterinarians from the then Ministry of Agriculture, Fisheries and Foods (MAFF) investigated the unusual death of a cow on a farm in Kent. Scientists later diagnosed that the cow had died as the result of contracting a type of disease known as a transmissible spongiform encephalopathy (TSE). TSEs are neuro-degenerative diseases that cause the rapid degeneration of brain cells in the victim. In cattle, animals afflicted with the disease display symptoms of extreme nervousness, hypersensitivity to touch, and loss of balance. Television news footage of cows stumbling, falling over, and being unable to get to their feet became one of the iconic images of the disease (Ford, 1996: p. 18). "Mad cows" were not seen as angry, as connoted by the North American usage of the term 'mad,' but as mentally deranged, insane, and as we will see shortly, as dangerous (Leach, 1998: pp. 126-7). BSE is a disease that progresses quickly, induces considerable suffering on the animal, and is invariably fatal (Ridley and Baker, 1998).

At the time, as remains the case today, scientific knowledge about TSEs was fragmented and contested. Uncertainty about these types of diseases was compounded by the fact that the veterinary community had not previously encountered TSEs in cattle. Veterinary science did have some experience with TSEs in agriculture as scrapie – the ovine form of the disease – has long been present in British sheep populations.

---

2 The Phillips report (2000b: xviii) now speculates that BSE probably first surfaced in the 1970s. Thus, although the official history of the disease begins in 1985, its origins are somewhat older. The implication of which is that BSE infected material would have entered the nation's food supply around this same time, although it is not possible to speculate to what extent this was the case.

However, despite this familiarity, science, industry, and Government were essentially facing a novel veterinary disease of which they had little certain scientific knowledge. Although some scientists speculated that there was a direct link between scrapie and BSE (later proven incorrect), it was unknown why the disease had suddenly developed in cattle and there existed little accurate knowledge to explain how the disease could be transmitted amongst the cattle population.

If the science of BSE was uncertain, the potential hazards the disease posed for human health were even more poorly understood. Scientists in the 1980s had no idea of whether or not BSE would be pathogenic to humans. Veterinary science's experience with scrapie appeared to suggest that the risks posed to humans would be minimal. In the 250 years society has known about scrapie there is no evidence to suggest the disease was ever transmitted to humans by means of the food chain or directly linked to a human form of TSE (Narang, 1997: p. 3). However, scientists did know that it was at least possible for TSEs to jump species barriers, possibly from sheep to cows, or from cows to humans. Scientists further postulated that even if scrapie had jumped into the cattle population, there was still no way of knowing what properties the disease would develop in cattle, or whether the disease would even exhibit attributes similar to those of scrapie (Millstone and Zwanenberg, 2001: p. 102). It is upon these shaky foundations that early appraisals of the minimal risk of BSE to humans were generated; appraisals now know to be ill-conceived. Much of the BSE story, therefore, pertains to the question of why the Government proceeded to act on these misguided assumptions for almost the entirety of the disease's history (Phillips et al., 2000c: para. 11)[3].

In the mid 1990s it became clear that BSE indeed posed a health hazard to the British consumer. A full decade after identifying the disease in cattle, the Government announced in March 1996 that scientists had diagnosed a new variant of Creutzfeldt-Jacobs Disease (CJD) in ten young people and that the disease was strongly linked to BSE. Despite the rarity of CJD, medicine had been actively treating those with

---

3 The Government's position on the human health risks of BSE come largely from the findings of the Southwood Working Party-an ad hoc expert panel created in 1988 to advise ministers on the potential ramifications of BSE. The subsequent report of the Working Party stated that it was "most unlikely that BSE would have any implications for human health" (cited in Phillips et al., 2000b: p. xx).

the disease since it was first identified in the 1920s. However, the new variant of the disease (vCJD) was markedly different from CJD. Those inflicted with vCJD are significantly younger, display psychiatric symptoms much earlier and suffer a longer duration of illness than those suffering from traditional CJD (Phillips et al., 2000d: paragraph 6.1). Pathologically, those suffering from vCJD display symptoms very similar to cattle suffering from BSE. The first signs of the disease are seen in changes in behaviour and mood (e.g., depression). Often, at the early stage of the disease, victims with these symptoms were diagnosed incorrectly and referred to psychiatric treatment (Phillips et al., 2000d: para. 6). As the disease progresses victims suffer from debilitations in movement and from loss of memory (Narang, 1997: p. 222). vCJD, like BSE, is fatal without exception.

The 1996 announcement brought public anger over BSE to a head. Media coverage, which had lulled in the early 1990s, exploded and BSE and vCJD again dominated the newspapers and TV news programming (Kitzinger and Reilly, 1997: pp. 343-4). Many in the public, with their fears over the safety of British beef now confirmed, stopped buying beef or went further and joined the swelling ranks of British vegetarians. Industry, already suffering from this sudden loss of domestic confidence in British beef, suffered a further blow on March 1997 when the Commission of the European Union banned the export of all British bovine products (European Commission, 1996). Facing an angry citizenry, the potential downfall of the British livestock industry and European sanctions, the Government came under increasing pressure to halt the disease and restore faith in British industry and in government institutions, policy and regulation.

Phillips and Risk

Almost two years after the Government's announcement linking vCJD and BSE, and within a context of public anger and mistrust, Agriculture Minister Jack Cunningham announced the establishment of the BSE Inquiry to the Parliament in December 1997. Chaired by Lord Justice Phillips, the BSE Inquiry was given the following mandate:

> "To establish and review the history of the emergence and identification of BSE and variant CJD in the United Kingdom and of the action taken in response to it up to 20 March 1996; to reach conclusions on the adequacy of that response, taking into account the state of knowledge at the time; and to report on these matters to the Minister of Agriculture, Fisheries and Food, the Secretary of State for Health and the Secretaries of State for Scotland, Wales and Northern Ireland." (Phillips et al., 2000b: p. xvii)

The Inquiry was asked for a step by step account of why it took Government and industry so long to gain control over the disease in cattle and acknowledge the potential hazards it posed to humans. However, in producing a response to this rather straightforward, although difficult, task the Inquiry ran up against some persistent and much less straightforward questions about the ability of social institutions, and governments in particular, to contend with the complexity of modern society. This included an interrogation of the ability of government and industry to react to the potential hazards proposed by complex technical and industrial systems of production that are increasingly characteristic of modern agriculture in Britain. Phillips recognizes that this matter is further complicated by the fact that we are seldom fully, if at all, aware of the dangers we face from these systems. When the mandate refers to the "state of knowledge [about BSE and vCJD] at the time," it refers not only to what scientists knew and did not know about BSE and vCJD. The mandate also might be read as the need to take account of the Government response to BSE according to what science could not be expected to know or may not even be able to know; the "unknown unknowns" as Grove-White (2001) refers to them.

In addressing this mandate and conveying the outcomes of the BSE Inquiry to the public, the Phillips report relies heavily on concepts of risk and uncertainty. In doing so, the report most closely reflects notions of risk associated with the work of Ulrich Beck (1992) and Anthony Giddens (1990). To recall from Chapter Two, risk according to these authors is a catch-all term that characterizes the rapid and profound changes society is undergoing as it is transformed from one stage of modernity to the next. Hence, the authors propose that we are now living in a "risk society." A reality that both authors suggest has been epitomized by the BSE story (Beck, 1998; Giddens, 1998). I do not wish to argue that Phillips has full-heartedly embraced ideas of the "risk society" in reporting the outcomes of the BSE Inquiry. However, terms such as 'risk' and

'uncertainty' become overarching themes throughout the report, and although Beck and Giddens in no way hold a monopoly on the use of the terms, Phillips does appear to tentatively approach several of the key tenets of their theories[4]. Specifically, he takes up a perception of the inconclusiveness and fallibility of science, the culpability of human actions in creating risks and the need for novel forms of governance in coping with risks.

The Cause and Spread of BSE in Cattle

To recall, when BSE was first identified in 1986 the veterinary sciences were faced with a novel disease in cattle and knowledge about the nature of the disease was sketchy at best. Although familiar with the family of diseases of which BSE is a part (TSEs), certainty about the cause of the disease and why it suddenly appeared in cattle continues to elude science. Early in the BSE story there were several theories that sought to explain where the disease had come from. Some suspected BSE entered the UK through the importation of cattle, others pointed the finger at the use of veterinary vaccines and pharmaceuticals, and yet others blamed some sort of BSE virus (Ford, 1996: pp. 153-73). Early on the theory that gained the greatest acceptance assumed that the source of BSE was ovine scrapie and that the disease had somehow jumped the species barrier between sheep and cattle. Yet, all these theories are now believed to be spurious and the Phillips report instead categorizes the cause of BSE as "unknown," and acknowledges that TSEs may develop sporadically (randomly and without explanation) in species in which they have not been identified previously (Phillips et al., 2000b: pp. 249-50)[5].

4

The fact that Phillips adopts many of the tenets of the sociology of risk is not particularly surprising. The relationship between New Labour's presentation of Third Way politics and Giddens' proclamations about the nature of 'late modern' British society are clearly interwoven. Whether taken as the serious attempt by a government to better understand the social and economic relations that are shaping modern Britain, or as simply a tool with which to theoretically justify government decisions, risk theory has become diffused throughout the current political culture. Refer to Wheen "Please, enough of the guff" *The Guardian* Nov. 24, 1999.

5

Despite making this acknowledgement of uncertainty, the report would appear to argue that the limitations of science are only temporary. In particular, the report cites recent developments in molecular biology as holding the key to providing the sense of scientific certainty that was so conspicuously absent

However, if the cause of BSE is recognized as uncertain, or potentially even unknowable, the report is far more certain in the ascription of a cause to the persistent and widespread transmission of the disease throughout the British beef industry. As early as 1988, this epidemic side of the BSE story was attributed to the use of high-protein animal feeds containing meat and bone meal derived from infected cattle. Intensive agriculture, it turns out, had turned cows into carnivores and cannibals. This practice, unregulated for several decades, constituted what Phillips refers to as "a recipe for disaster" (Phillips et al., 2000b: p. xvii).

So, if the pathway of infection was known early in the BSE story, why was the disease not properly contained for a further decade? For Phillips the answer is clear. The Government made mistakes in ascertaining the extent of the problem and in expressing the resolve necessary to deal with it. These mistakes are attributable to the Government's tendency to rely on putative knowledge about the transmission of the disease when 'facts,' as such, were unavailable. In other words, politicians and government regulators continued to seek to operate on the basis of certainty within a context of uncertainty. Yes, they knew the pathway through which the disease was being transmitted, but the actions taken to stop the disease were based upon several false assumptions about the pathway's operation.

In particular, Phillips is critical of the Government's over-reliance on the implementation of a ban on the use of recycled ruminant proteins in ruminant feed, put in place in 1988. The logic behind the ban seemed straightforward. If BSE was being transmitted through the use of protein feeds, and possibly even linked to feeds consisting of material from scrapie-infected sheep, then the solution lay in cutting these feeds out of the food chain. However, we now know that the original feed ban was a spectacular failure. At the heart of the problem was an assumption that a relatively large amount of

---

during the BSE story. Termed the "rogue prion" hypothesis (Ridley and Baker, 1998; see also Prusiner (1999), it is argued that TSEs result from the presence of prions (transmitted or inherited) that force benign molecules to change their shape, thus converting normal proteins into dangerous ones. This thesis challenges many of the taken-for-granted assumptions about molecular biology, including the primacy of genetic material, such as DNA and RNA, in the transmission of diseases (Prusiner, 1995: p. 531). Irrespective of this controversy, the report continues to look to the promise of factuality and the progress of science as the primary tools in contending with BSE and uncertainties of knowledge in the future (Phillips et al., 2000e).

infected material needed to be consumed by a cow in order to contract the infection. Consequently, the ban failed to address the perpetuation of BSE that was occurring in feed lots as a result of the cross-contamination. Pig and poultry feeds were not addressed in the ban and were still being produced with material derived from sheep and cattle. Small quantities of these feeds were inadvertently being mixed with cattle feed that, under the ban, were supposed to be free of all ruminant proteins. At the time of the ban, because of the belief that the disease could not be transmitted through the consumption of small amounts of infected material, cross-contamination was perceived as constituting a minuscule risk and therefore discounted. What in effect the Government was doing was employing regulatory measures on the basis of unproven beliefs about the nature of the disease without acknowledging the uncertainty of these assumptions (Phillips et al., 2000b: pp. xxi-xxii, p.18, p. 255).

It should be noted that, although Lord Phillips is decidedly uncritical in his investigation of the role of industry influence in the Government's production of regulatory measures, the decision not to extend the ruminant feed ban to pig and poultry feeds did not take place in a political vacuum. Instead, as Millstone and Zwanenberg (2001) note, significant pressure was being felt by the Government to avoid making regulatory decisions that would damage industry concerns. There was no awareness of the consequences of feeding pigs and chickens infected bovine material and, therefore, the extent of the problems being created by cross-contamination was not foreseen by science. However, when advice was put forward that did acknowledge the uncertainties presented by the disease, and that favoured precautionary action over inaction, Millstone and Zwanenberg argue that the Government ignored or suppressed this advice. When the Southwood Working Party, established to advise the Government in the early stages of the BSE story, seemed on the verge of calling for a total ban on ruminant feeds, Southwood has been accused of losing his nerve. The recommendation to extend the ban was dropped in favour of what has been cited as an attempt to preserve the rendering industry's principal market – chicken and pig feed[6]. Uncertainty not only led the

---

6

This conflict of interest between protecting consumer and industry interests was one that was structurally imbedded. MAFF, the lead agency in charge of the handling of BSE, was simultaneously the primary food safety regulator in the United Kingdom and tasked with the development of the agriculture and food

Government to fail to acknowledge the unknown risks posed by BSE, but also provided potential justifications for avoiding making decisions that would have gone against the economic interests of the animal processing industry (ibid.: p. 105; Little 2001).

When, in late September 1990, responses to cross-contamination were put in place (e.g., a ban on the use of specific bovine offal, or SBO, in all animal feeds), the transmission of BSE continued on the back of further misguided assumptions about the disease. Materials that were wrongly assumed to be noninfectious, such as eyes and lymph nodes, remained outside the ban. In the abattoirs, the supposition that a large amount of material was needed to transmit the disease persisted, resulting in a lackadaisical attitude toward the identification and separation of SBO during the slaughter of an animal. Furthermore, the Government lacked a clear mandate and structure to inspect slaughterhouses and trusted industry to self-police regulatory directives[7]. With no external enforcement of the SBO ban, industry intentionally passed contaminated material off as "clean" in several instances (Phillips et al., 2000f: para. 4b). In general, Phillips states that these problems stemmed from a prevailing lack of appreciation of the potential risks created by BSE and of the importance of the measures being prescribed. It was not until almost a decade after the source of the BSE epidemic had been identified that the Government finally introduced further measures to shore up these problems and contain the disease.

However, if the cause and spread of BSE were characterized by scientific uncertainty and the inability of government to take appropriate regulatory action within this context, what of the circumstances leading to the appearance of the disease itself? The Phillips report is very direct in answering this question, attributing the source of the disease to human innovation and industrial processes. In this light, Phillips identifies intensive farming practices and industrial models of production as the causes of the BSE

---

industries. For a good discussion of this conflict mandate please refer to Little (2001).

7

Miller (1999: pp. 1242-3) demonstrates that such failures are contextual. In particular, he reminds us that the BSE story took place during a time in which consecutive Conservative governments held power-governments that were characterized by deregulation, privatization, and a general "concerted tilt to the market in government policy." The emphasis of the government was not on safety, but on allowing industry to best determine how to increase productivity and profits. The use of ruminant feeds developed out of this context.

epidemic (Phillips et al., 2001b: p. xvii). Foremost amongst these practices was the necessity of using recycled animal proteins in livestock feed to nourish higher-producing animals, with very little consideration of the consequences of these actions. Uncertainty, in this sense, is not understood solely as a limitation of knowledge, but as the source of potential hazards, or risks, that are the yet unknown products of increased complexity and technological development that characterize modern agriculture. In making this conclusion Phillips' report appears to agree with Beck and Giddens' descriptions of the risk society and late modernity: "In a primitive society, the major hazards are those posed by nature. In a complex modern society the acts of individuals or corporate bodies may also involve serious hazards to other members of society" (Phillips et al., 2000b: p. 31).

In this statement, Phillips makes a move to tie the scientific uncertainty surrounding the disease and the uncertain actions of the Government with some broader notion of what we might consider the 'risk society.'

The Transmission of BSE to Humans

The Government's ability to contend with uncertainty and risk also dominates the Phillips report's treatment of the link between BSE and vCJD. Like the above discussion of the handling of the BSE epidemic, the Phillips report is critical of the Government's lack of a serious engagement with the human health risks posed by BSE and the tendency to rely on false certainties in guiding its response. Here the role of the Southwood Working Party and the Government's handling of expert advice comprise key themes pertaining to the human health side of the BSE story.

Jointly responsible to MAFF and the Department of Health (DH), the Southwood Working Party was established in May 1988. Chaired by Richard Southwood, professor of zoology at Oxford, the committee was composed of a collection of scientists who were both academically well-regarded and had considerable experience working in advisory capacities. The committee was given the broad task of examining the implications of BSE for both animal and human health and was expected to provide both scientific and policy advice to the Government (Millstone and Zwanenberg, 2001: p.

104). Over the course of the BSE story the committee produced a series of interim recommendations. These advisements, which were subsequently implemented by Government, included the compulsory slaughter and destruction of all cattle showing infection and a ban on the use of "specified offal" (e.g., brain and spinal cord) in human food. The committee produced a controversial final report in February 1989 that concluded that in its estimation, although the transmission of BSE to humans was possible, it was only remotely so (Phillips et al., 2000b: pp. 50-55).

The majority of the criticisms made against the Southwood Working Party, concern the Government's handling of the committee's advice, rather than the work of the committee itself. In particular, Phillips lambasts the Government's blind acceptance of Southwood's conclusion that BSE posed only a minimal risk to human health and the Government's tendency to cite this conclusion as constituting a scientific risk appraisal (ibid.). The Government forged a rigid position that argued that no further precautions were needed. As the Phillips report accounts, "the conclusions of the Southwood Working Party were not reviewed. Their recommendations were treated not as advice, but as definitive of the precautionary measures which did, and did not require to be taken" (ibid.: p. 1221). Moreover, the Government repeatedly used the Southwood findings to discredit and deride the opinions of dissident scientists, thus polarizing debates over the human health risks of BSE and further hardening the Government's position (ibid.: para. 1182; Phillips et al., 2000g: sec. 5). Furthermore, the Government outwardly held up the objective truthfulness of scientific certainty, while simultaneously exerting pressure to determine what these certainties would be. The Southwood Working Party was cast as the voice of scientific certainty, but was repeatedly advised by members of the Government and civil service to be cautious in its advice and wary of the consequences its decisions would have on the beef market. In summary, what was considered scientific and what was considered risky had become the stakes of a highly politicized engagement between the Government, industry, and the expert working party (Millstone and Zwanenberg, 2001). This approach to the committee's advice continued long after serious doubts had compromised many of the assumptions about the hazards posed by the disease (Phillips et al., 2000b: paras. 1209, 1221).

Foremost amongst these assumptions was the perceived relationship between scrapie, BSE and CJD. Simply, it was believed that because scrapie had such a long history in the UK and could not be directly linked to CJD in humans, BSE would act in a similar manner and therefore was not likely to pose any serious hazards for human health. In reply to a letter from a neuropathologist who had raised concerns about the Southwood report's handling of the human health risks posed by BSE, Sir Richard Southwood put it this way:

> "As you can imagine, in this report it was extremely difficult to steer the proper course between causing excessive alarm and undue complacency. The evidence to date seems to indicate that the BSE agent is very similar to scrapie, and of course we have lived with scrapie for two hundred years, and most of us have at some time or other eaten sheep offal-though the incidence of CJD remains low. It was this line of argument that finally convinced us not to press the point that you have made in your letter any more strongly." (Phillips et al., 2000c: p. 56)

A sense of apathy grew out of Sir Richard's speculations about the link between BSE and scrapie, and like the circumstances surrounding the spread of BSE amongst cattle, little was done to investigate the possible sources of risk to human health. Once again it was assumed that, even if the disease was theoretically able to jump species, a relatively large amount of infected material would need to be consumed to do so. Likewise, legislation banning the use of SBO in human foods was considered more than sufficient. Phillips (2000b) laments, that not enough concern was given to whether industry would effectively police the ban, or whether these materials could physically be separated without contaminating human foods in the first place. We now know that scrapie and BSE are not directly linked and that the regulations put in place to prevent contaminated material from getting into the human food chain were fully inadequate.

The consequences of these failures were dramatic. Between 1989 and 1996, the British public was exposed to a deadly disease, attributable to the Government and industry's inability to effectively contend with scientific uncertainty. To date, more than 100 Britons have died of vCJD. Furthermore, the widespread infection of the cattle population and intense public anger over mishandling of the disease had progressed to such an extent that those in office felt it necessary to take dramatic steps to cleanse 'mad-cow' disease from Britain. Between March 1996 and the end of 1999, Phillips reports

that more than 3.3 million cattle were prematurely slaughtered in the United Kingdom (Phillips et al., 2000b: p. 21). On top the human and animal suffering, the agricultural industry has also suffered as a result of the taint created by the BSE scandal. The livelihoods of farmers, the sustainability of the agricultural industry, and the welfare of the British countryside have all been tainted by a disease that was allowed to progress unchecked (Woods, 1998).

In concluding this section, Phillips is decisive in stating that the human health tragedy of BSE was not directly attributable to the uncertainty of the science of BSE and vCJD, but to the Government's mishandling of this uncertainty. By relying on a series of false assumptions it produced an unstable and dangerous platform on which it made, or failed to make, the regulatory decisions necessary to avoid disaster. Gavin Little offers us this concise summary of the situation:

> "The end result ... was a collective failure over the period 1989-1996 to give enough weight to the possibility that, given the lack of knowledge about BSE, scientific proof of its ability to 'jump species' to humans might only emerge once consumers were infected, which is too late for effective regulation. Against a backdrop of political and commercial pressures, there was ... insufficient appreciation on the part of government and scientific advisers of the complex ... nature of the risks posed by BSE, or of the 'built in ignorance of science towards its own limiting commitments and assumptions.' Regulatory action was therefore taken on the basis of a deferential, non-precautionary reliance on what was erroneously taken to be an authoritative, objective and definitive scientific risk assessment." (Little, 2001: p. 747)

Trust as a Casualty of BSE

The Government's failure to create effective regulatory decisions within a context of risk and uncertainty is also mirrored in its relationship with the British public. Trust in government, science, and industry were all severely challenged by BSE and resulted in a breakdown in relations between these institutions and the broader public. As the Phillips report put it, "trust" became another casualty of the BSE story (Phillips et al., 2000b: p. xviii).

Although not wishing to fault individuals, Lord Phillips is highly critical of what he describes as the undertaking of a "campaign of reassurance" in the communication of risk to the public (Phillips et al., 2000a: p. 261). Beef, the British public was routinely assured, was not only safe, but good for you as well. When coupled with a reliance on false scientific certainties about BSE and CJD, such assurances were made with a clear conscience and allowed government officials to cling to a belief in the validity of their decisions and the decision-making process. Such confidence led the Government to go to absurd lengths in defending its decisions to the public. One image that stands out as representative of this approach is that of former Agriculture Minister John Gummer feeding his daughter a hamburger on national television as part of a much maligned attempt to quell public "hysteria" over BSE[8]. Gummer explains the rationale behind his actions in the following terms:

> "In matters as important as these it is essential to have a personal benchmark to be applied to decisions wherever appropriate. In such circumstances I applied the test: "Would I be entirely happy for my children to eat this?" That seemed to me to be the proper question for a non-expert to ask when assessing the views of experts. At all times I saw my primary role as protecting the public." (BSE Inquiry, 1998: para.. 13)

However, Phillips goes further than critiquing the Government's tendency to over rely on false certainties when communicating risk to the public. The BSE Inquiry also found that communication between the Government and the public was guided by a pervasive fear that an anxious and potentially hysterical public would respond irrationally to the risks posed by BSE. Politicians and government officials feared that speaking about potential risks – the unknown unknowns – would lead the public to blow these risks out of proportion and cease to purchase British meat products. The report does not propose that there was an attempt to cover up the hazards posed by BSE in order to protect the beef industry, as might be suggested by more cynical observers of the BSE story. Instead, Lord Phillips documents that scientists, government officials, and industry representatives, when faced with uncertainty about the disease and intense public pressure, routinely resorted to more familiar statements of certainty and

---

8 For a further discussion of BSE and the language of hysteria that characterized the Government's relationship with the public please refer to the work of Bob Hodge and Robert Woog (1999).

reassurance (Phillips et al., 2000b: pp. 232-5). As one witness testified to the Inquiry:

> "Given the strength of public debate on the matter at the time one was aware of slightly leaning into the wind. You could not just stand upright and give a totally impartial view of what was the situation. There was a strong danger of being misinterpreted one way or the other, and we tended to make more reassuring sounding statements than might ideally have been said." (Phillips et al., 2000b: p. 265)

In summary, several themes have emerged from Phillips' critique of the Government's handling of the spread of BSE amongst cattle, its link to vCJD and human health risks, and the communication of risk and uncertainty to the public. These are themes I have suggested that closely reflect several of the tenets set out by the sociology of the 'risk society.' Phillips has told the BSE story as a tale of uncertain knowledge and risks. Risks, the report identifies, although somewhat circumspectly, as the consequences of the complexities of modern agriculture and intensive agricultural systems. Above all, Phillips argues that BSE is the failure of government to work within a context of risk and uncertainty to protect society from the diverse hazards posed by the disease.

"Lessons Learned" – Risk Management and Communicating Uncertainty

The overarching priority, or 'lesson learned,' that comes out of the Phillips report, is the necessity for social institutions to be better prepared to contend with risk and uncertainty. Two points stand out as particularly relevant to this discussion of BSE and permeate the majority of the report's findings. The first makes the identification and management of risk the priority in contending with future uncertainties. The second pertains to the need for governments to be able to openly and effectively communicate uncertainty to the public.

Managing Risk

At the base of the first of these priorities, what I refer to as the management of risk, is the basic insight that "uncertainty can justify action" (Phillips et al., 2000b: p.

254). The report is emphatic that social institutions can no longer remain complacent about the potential risks associated with the application of modern science and technology, even though these risks may often appear remote. Instead, science, government, and industry must each ensure that all necessary precautions are taken to both identify and contend with hazards regardless of their assumed probabilities.

Thus, although lauding the individuals who first identified BSE and linked the disease to human health risks, the report strongly asserts that organizational improvements are still needed to better identify future sources of risk to British society. On one hand, this means increasing cooperation between government and industry in order to improve the nation's animal disease surveillance systems (ibid.: pp. 251-2). On the other hand, it also means redressing deficiencies in the standards and availability of the scientific expertise needed to expeditiously recognize and track potentially dangerous veterinary diseases (ibid.: p. 225).

The Phillips report, furthermore, suggests that contending with uncertainty also means ameliorating the way in which government, science, and industry work together to address risks once they have been identified. Specifically, the report asserts that communication and cooperation between these institutions must be improved if effective and timely actions are to be taken in the future. This includes a reevaluation of relations within government, between government and science, and between government and industry.

Within government specifically, the Phillips Report foregrounds the need to promote greater intergovernmental communication and cooperation. This necessity is highlighted by the failure of MAFF and the DH to work together to recognize that BSE was not exclusively a veterinary disease, but a threat to human health as well (Phillips et al., 2000b: pp. 235-6). Likewise, the report urges the Government to re-evaluate its use of scientific expertise. Risk management, in this context, means better management of science and is to be accomplished by better coordinating and funding scientific research, and ensuring that the Government is able to access appropriate and skilled sources of scientific expertise. Particular attention is paid to the Government's misuse and over reliance on expert committees, such as the Southwood Working Party. The report argues that if it is necessary to resort to the advice of external experts, then care must be taken

to ensure that not only their conclusions are clearly articulated to government, but their limitations in knowledge and assessments of risk as well. Furthermore, efforts must be made to avoid the temptation to consider the conclusions of expert committees as determinative of policy (ibid.: pp. 238-41). Finally, in response to growing concerns about the relationship between government and industry, Phillips asserts that governments must provide and enforce clear industrial regulations aimed at the prevention and treatment of risk. These regulations must not only address those risks considered to be "reasonably probable," but also address those that are considered only "mere possibilities" (ibid.: pp. 266-72).

Communicating Uncertainty

In response to the conspicuous misrepresentation of risk that characterized the BSE story, the Phillips report makes it clear that providing security from risk also entails improving communication between social institutions and the public. Governments, scientific experts, and industry representatives are all urged to clearly communicate uncertainty and potential risks to the public. This includes the clear conveyance of the incomplete nature of knowledge upon which decisions about the probability of risk are being made, as well as the constraints these gaps imply for the ability of social institutions to secure society against these hazards. As a prerequisite to building this foundation of openness, Phillips asserts that it is necessary to first appreciate that the public will react rationally when provided with an honest appraisal of risk and uncertainty. In effect, the report is impelling government to make their practices more transparent and to ensure that in future the importance of precautionary measures will not be played down on the grounds that the risks they address are unproven. The goal of this openness is to regenerate public confidence in the institutions tasked with providing security and well-being to society.

Limitations of Phillips and the 'Risk Society'

In his report from the BSE Inquiry, Lord Phillips has clearly articulated the need for the Government to take issues of risk and uncertainty very seriously in contending with agricultural controversies. The impact of his findings on shifting the culture of governance in regards to knowledge and expertise should not be denied. Nonetheless, these successes are limited by a failure to fully acknowledge the broader implications of risk which have been discussed throughout this thesis. In other words, the Phillips report socially decontextualizes risk and uncertainty. In doing so the report potentially upholds the status quo instead of addressing the social conditions at the heart of the BSE story, and which pervade the debate over GM crops and foods. Perhaps this is not particularly surprising given the nature of the inquiry process. Regardless, lacking an awareness of the social contexts in which risk claims are made, Phillips is compelled to treat BSE as a technical problem requiring better technical management. He offers little in the way of alternatives to the institutionalized authority of science or the industry processes that the report itself so heavily implicates in the BSE story, and which participants have challenged in relation to this project.

Risk, Context and Contingency

To recall once more, Beck and Giddens argue that risks are the outcome of increased social and technological complexity, stressing their uncertainty, their social origins and the problems they create for the institutions charged with protecting society from these risks. Phillips has drawn on related ideas to both describe the BSE story and to reach some conclusions from which government can hope to learn. However, Phillips does little to engage with the social backdrop that lies behind the ideas of the "risk society"; in this case, the state of modern agriculture and the status of science in Britain.

One might be tempted to accept these limitations in social scope under the pretense that the BSE Inquiry was not the appropriate forum to address such broad social concerns. It could be the case that Phillips may have chosen not to delve further into these broader social cases in order to avoid detracting from his conclusions: the need to

push governments to look for new ways to operate within contexts of uncertainty and to force them to do so in a more open and transparent manner.

However, the failure to engage with the social context behind the creation of BSE can also be related to Phillips apparent uptake of ideas of risk and uncertainty in line with theories of the "risk society." Particularly, identified as a limitation of "risk theory" in Chapter Two, the Phillips report potentially limits its political engagement with risk. Mindful of Miller's (1999: p.1239) critique that 'risk society' theory treats risks as the, "inevitable concomitants of technological and cultural developments," Phillips' conclusions emphasise the need to contend with risks but do not directly challenge the context behind their creation. The ramification of this is that Phillips hazards bounding concerns about risk to questions of how science, technology and risk are applied within society. Consequently, more contingent perspectives of risk are overlooked and the potential for alternatives in how we organize agriculture and society are ignored.

BSE, Consent, and the Intensification of Agriculture

The biggest challenge facing the BSE Inquiry was coming to terms with the technologies, processes, and organizations that shape modern agriculture in Britain. As Phillips clearly states, it is intensive and industrialized agricultural systems that are to blame for giving rise to BSE: "BSE developed into an epidemic as a consequence of an intensive farming practice – the recycling of animal protein in ruminant feed" (Phillips et al., 2000b: p. xvii). Yet, despite making such a strong statement, the report does little to challenge these practices themselves. Instead, Lord Phillips is content to focus on how these practices are employed, regulated, and managed.

Phillips' limitation in the scope of his engagement with modern agriculture can in part be related to the BSE Inquiry's uptake of the notions of risk and uncertainty. By taking modernity for granted and accepting risks as inevitable, Phillips is directed toward prioritizing the management of the consequences of uncertainty. As a result, he displays little regard to the potential for reducing the a priori social production of risk. The conclusions that the BSE Inquiry has produced almost always are reduced to the need to develop better management and regulatory strategies around technological uncertainties

and the potential hazards they pose.

Certainly risk management is an essential part of the governance of new agricultural technologies and practices, however, it also limits the critical potential offered to governments by conceptions of risk and uncertainty. To begin with, by placing risk within a management framework, Phillips has enclosed risk within traditional models of governance. What sets these models apart is their historical tendency to stress scientific and technical appraisals when regulating agricultural practices and determining risks. This accentuation of the techno-scientific almost always is at the cost of developing a serious engagement with the social practices that underscore innovations in agriculture.

As a result, instead of addressing agriculture as a social practice, Phillips concentrates the minute technological, scientific, and industrial processes behind the risks associated with BSE. One is hard-pressed to find a discussion of agriculture itself, and is instead presented with page after page outlining the particularities involved in the slaughter, rendering and distributive use of an animal. BSE, according to Phillips, is a story that pertains to feed cross-contamination, the failure to classify and separate infected from non-infected materials and the ability to create and enforce regulations to solve these problems. At its most mundane moments, the attention of the Inquiry is reduced to discussions of the different methods of splitting a carcass, dying and removing offal, or deboning a skull (Phillips et al., 2000h).

Phillips should be lauded in arguing that governments need to recognize the routine uncertainty associated with scientific risk assessments and technical processes. However, science and technique are almost exclusively presented as the means by which Government is best able to protect society from any future risks. Contending with risk and uncertainty in agriculture is confined to doing better science and better regulating industrial and technical processes.

I do not wish to suggest that the conceptions of risk and uncertainty Phillips adopts are deterministic of these sorts of techno-scientific conclusions. Rather, by taking modernity for granted and treating risks as inevitable, Phillips is easily able to fit notions of risk into the management frameworks that prioritize scientific knowledge and expert systems of decision making.

As discussed in detail in Chapter Two, a helpful alternative to this conception of risk which can address the risks of BSE beyond this narrow focus can be found in the work of Douglas and Wildavsky. To recall, these authors define risk, as partly a problem of the certainty or uncertainty of knowledge (Douglas and Wildavsky, 1982: p. 5), but more importantly link risks to issues of consent over what they describe as the "most desired prospects" for the future. Risks, in other words, do not simply reflect the complexities of modern society, but are cultural concepts around which the future of society is being shaped. What we choose to see as risks and what risks we ignore are moral and political choices. Risks are not socio-technical inevitabilities. Where uncertainties of knowledge suggest the need for technical solutions and further scientific research, there are no clear solutions for contending with uncertainties of consent. Instead, issues of consent create spaces of overt political contestations, which connect debates over science and technology to a broader cultural and normative context.

With this perspective BSE can be understood as representing a broader debate over what we consider acceptable forms of agriculture and food production in contemporary Britain. Cultural conceptions of risk would suggest that the cross-contamination occurring in feed lots should not be understood solely in terms of the practical processes by which potentially infected material was being identified and removed from the carcass and the food chain, or in terms of the regulation of these practices. Rather, the contamination issue is representative of a broader concern for the risks posed by the practice of feeding animals to one another in the first place. Stepping back from techno-scientific risks allows us to see the BSE story as part of a contestation over the industrialization of agriculture. Public responses to BSE and vCJD on the one hand pertain to fears over the safety of the food supply and the Government's ability to protect society from these risks. On the other hand, the anger that erupted in response to BSE furthermore marks out a battle of consent over the increasing intensification of farming. This is precisely the point where the BSE Inquiry pulls up short in its investigation. Simply stated, if the BSE epidemic was caused by industrialized agriculture and intensive livestock farming, as suggested by the Phillips report, should attention not be granted to the values behind the employment of these practices and not just the processes by which they operate? These were certainly the expectations that

many in the United Kingdom voiced going into the BSE Inquiry and which participants have voiced repeatedly in describing the risks of new agricultural technologies. Emily Green, writing in the New Statesman, voices the expectation that with the establishment of the BSE Inquiry, the future of agriculture was hanging in the balance. In hindsight, such expectations were obviously misplaced[9].

However, if the BSE Inquiry has not been able to interrogate the broader connotations of risk attached to BSE, the British public has been much more capable of doing so. Whilst the Phillips report tells the story of BSE within a bounded vision of risk, members of the general public may have been less inclined to narrate the story in this way and perhaps better able to extend an awareness of BSE far beyond the implications and dangers of the disease itself. As several participants in this thesis have already commented, the risks of BSE related to exoteric reflections and overt contestations over the condition of contemporary British Society. For example, concerns raised over the condition of the national food supply were not limited to the contamination of beef by "rogue prions," but also included debates over developments in genetic engineering and the commercialization of genetically modified foods. Likewise, media vocalizations of a growing distrust in science pertained to much more than a discussion of the scientific handling of the disease itself, but more broadly evoked concerns about the increasing encroachment of industry into science and government[10]. Similarly, vegetarianism, the ethical treatment of animals, organic farming, and the plight of rural Britain were all issues that the public linked to BSE but do not take up any significant space in the thousands of pages that comprise the Phillips report.

9

Green, Emily. "In this Inquiry's Hands: The Future of Agriculture" *New Statesman.* January 9, 1998.

10

An article by Hywel Williams in *The Guardian* titled "Fallibility in a White coat" (Jan. 23, 2001) makes the provocative statement that "government grants and private sector research alike tie in the scientist to specific aims. Scientists are less free spirits than intellectual castrati singing for their table d'hote supper." Crace similarly reports that scientific voices had allowed themselves to be muted by government and industry interests ("Silent Witness" *The Guardian.* Oct. 31, 2000). In the same tone, writing in the *Observer* Odone reports on "Science in the dock: The white coats are looking grubbier after one too many scandals" (Feb. 17, 2002). All three articles suggest that in Britain scientific authority is now the subject of routine media and public scrutiny.

The limitations created by Phillips' managerial and technocratic focus on risk are also reflected in the report's approach to the communication of risk and uncertainty to the public. Although the report takes a positive step in promoting an open and transparent model of communication, it is limited by the adoption of conservative assumptions about the nature of knowledge and expertise. In particular, Phillips' failings can be traced to the separation of these terms from a clear understanding of the social application of power that characterizes relations between government, science and the public. In doing so, the report not only fails to critically challenge the way governments understand citizen-science relations, but risks upholding the same values that gave rise to the failures of communications endemic to the BSE crisis-the maintenance of science as the lone authoritative voice in the regulation of agriculture.

At the centre of the Phillips report's approach to the communication of risk and uncertainty is an assumption that trust can be generated by simply improving communicative processes and developing an awareness of the rationality of the public at large. However, the Phillips report continues to cast science as the exclusive procurer of knowledge, while at the same time upholding a perception of the public as passive receivers. As a consequence of this asymmetrical, or monological, approach to communication, the public's failure to understand science and the true nature of risk become the predominant concern in the relationship between scientific experts and the public. Thus, although the report recognizes that the public should not be assumed to be irrational, they are not recognized as significant sources of knowledge themselves. Instead, the public are derogated as tabula rasa-blank slates (Irwin et al., 1996: p. 48; Michael, 1996: p. 109).

Consequently, these unidirectional assumptions about the relationship between experts and the public potentially isolate the majority of British citizens from participating in social responses to risk and uncertainty. Although the report does state that "a lay member can play a valuable role on an expert committee" (Phillips et al., 2000b: p. 262), the contextual experience and knowledge that the public might bring to the table are for the most part ignored. For example, the initial failure of the

Government's ban on the inclusion of certain specified offal in animal food products is representative of the wider failure to consider the importance of contextual knowledge. Scientists and government officials knew that, in order to stop the infection of other animals, it was necessary to remove those parts of the animal considered most likely to contain the infected material. Within the laboratory and in bureaucratic offices the ban would seem to be a relatively straightforward matter. However, to place the ban in context requires that we consider it relation to the messy and chaotic character of the abattoirs in which the ban was to be effected (Irwin 1995: 116; Phillips et al. 2000h). No consultations were held with either workers in the abattoirs or with other members of the public who were actively involved in the meat and livestock industry. Surely, these voices could have made an important contribution to generating effective policies that took account of the context in which any ban would be implemented? By failing to reflexively consider the limitations of their expert knowledge and acknowledge the potential contributions of contextual forms of knowledge, the Government allowed the transmission of the disease to continue unimpeded.

The general disinterest the Phillips report displays in promoting the importance of non-expert knowledge causes the report to make a further mistake. Lord Phillips assumes that a greater understanding of government-sponsored scientific research will lead to the greater public acceptance of the uncertain processes through which risk is derived and managed. The potential for fostering trust through the promotion of public participation in the regulatory processes and the democratization of expertise more generally is largely ignored. If, as a society, we wish to be better able to contend with uncertainty and the potential for risk, then we need to begin to foster public inclusiveness, both in how we define and how we structure relations of knowledge and expertise (Irwin, 1995; Wynne, 1996a). Colin Tudge, writing in the *New Statesman,* (Jan. 29, 2001) cogently states the problem that Phillips has chosen to ignore:

> "Lord Phillips might also have asked why we still tie ourselves so complacently to the establishment. The committee that met under Sir Richard Southwood in 1988 to assess the unfolding of BSE was learned, eminent and well-intentioned. Yet it left stones unturned. Thousands of ordinary, intelligent people, who were neither learned nor eminent, would have done a much better job.... They would have asked awkward questions such as 'how do you know?' and 'why not?'"

Conclusion

The Phillips report makes an excellent case for the need to incorporate sociological notions of risk into our understanding of the hazards and complexities involved in the BSE story and agricultural controversies. Clearly, governments need to move beyond expectations of scientific certainty in governing hazards, and the obfuscated practices that characterized the BSE story. The uptake of conceptions of risk and uncertainty have aided Phillips greatly in making this case. However, by enclosing notions of risk and uncertainty within a framework that takes modernity for granted and emphasizes notions of the inevitability of risk, the Phillips report is unable to produce a more radical social commentary on the BSE story. The report finds solutions to the BSE story in better science, practice and government. It ignores the issues of consent and the normative politics surrounding the use of intensive farming practices that not only provided the context in which the disease developed, but that are also at the heart of public reactions to BSE. In doing so, Phillips misses the opportunity to envision how the democratic inclusion of alternative forms of knowledge can respond to risk.

In conclusion, within the context of this thesis, the BSE case and Lord Phillips' report offer essential starting points for examining the ongoing debates over the governance of new agricultural technologies. The report will hopefully compel Government to take issues of risk and uncertainty seriously when decisions are made concerning the commercial growing of GM crops and the marketing of GM food products. Moreover, it challenges the Government to engage in a more open relationship with the public in debating these risks and the benefits of the technology for society.

However, the shortcomings of the Phillips Report's engagement with risk also present several more difficult challenges for Government. Overall, in order to understand and address the political concerns voiced by active members of the debate, the Government would be well-served by showing an awareness of risk and technological controversies in context. In one instance, this implies addressing the normative concerns presented by participants in Section Two, such as those which surround life-industry models of agricultural development, and those pertaining to issues of scientific authority and credibility. In other words, the BSE story challenges the

Government to address risk in relation to the broader social and cultural questions involved in debates over agricultural industrialization, sustainability, and human relations with the agricultural environment and the natural world. Furthermore, failing to hold an open and acknowledged debate on these issues risks further alienating the public from processes of governance and decision making. As Phillips suggests, communication is an essential element of creating a more open relationship with the public. However, as discussed in Chapter Five, Government must be careful not to talk at the public, but to listen to and incorporate public perceptions, experiences and knowledges into social networks of decision making. The challenge is, therefore, also to bring questions of democracy and citizen-science relations to the fore of debates over the governance of new agricultural technologies.

With these comments in mind, this thesis will turn to a discussion of current initiatives in government which have, in part, sought to come to terms with these challenges. The next two chapters will look at the strengths and some of the weaknesses of these approaches. In Chapter Eight, the Agriculture, Environment and Biotechnology Commission's (AEBC's) attempt to expand the Government's engagement with risk be examined. In Chapter Nine, the Commission's ongoing endeavour to increase public engagement through a national debate on GM crops and foods will be briefly examined.

CHAPTER EIGHT: THE AEBC & FSEs, WIDENING PERCEPTIONS OF RISK IN GOVERNANCE

Introduction

The Agriculture and Environment Biotechnology Commission (AEBC) is often presented by the Government as an important experiment in public consultation and decision making. The AEBC has specifically been tasked with addressing the controversy surrounding the commercial regulation of agricultural biotechnology, but as a test case its impact may well be much wider. Observers of the AEBC will, in part, rate its success in terms of its ability to shed new light on the democratic processes involved in the governance of risk, science and technology. Such success potentially stems from two core aspects of the Commission. Firstly, the AEBC has taken up the challenge of increasing public engagement in debates over the commercialization of agricultural biotechnology. Engagement, as the AEBC defines it, involves creating spaces where the public is able to bring its concerns to the table, as well as redefining how publics are perceived by the Government, particularly in regard to issues of expertise. Secondly, the work of the AEBC may have implications for how traditional technocratic boundaries which delineate social processes of decision making in government are perceived, and potentially even redrawn. In particular, this chapter addresses the value of the AEBC's engagement with the meanings and consequences of the ongoing Farm Scale Evaluations (FSEs) as a way of opening governance to the social conceptions of risk discussed in previous chapters. In other words, whether the AEBC will be regarded as a successful experiment, relates to its ability to open the governance of new agricultural technologies to the transparent contestation of social ethics and cultural values.

In addressing these themes in greater detail, the chapter is divided into three primary sections. To begin this discussion, a brief overview of the AEBC and its relationship to the FSEs is provided in order to set the scene for an analysis of the potential contribution of the AEBC to how GM crops and foods are to be governed in the UK. From this foundation, the AEBC's engagement with the FSEs will be addressed in detail, focussing specifically on issues of risk and regulation. This includes a discussion of the way in which the expected results of the FSEs are being challenged by the Commission in terms of the meaning of the trials in determining the commercial future of agricultural biotechnology. Finally, an examination of the responses prompted by the Commission's conclusions will close the Chapter, pointing to some of the potential shortcomings of the AEBC exercise.

Introduction to the AEBC and the FSEs

This section will provide an introduction to the Commission and the farm scale trials, with particular attention paid to their relationship to the political controversies surrounding the governance of new agricultural technologies. To start, a brief description of the AEBC and its mandate is provided. From this point, the way in which the AEBC has approached its mandate will be addressed in relation to the publication of the Commission's first key report to government entitled *Crops on Trial.* Finally, the social and political context leading up to the establishment of the FSEs are discussed, highlighting the important position of the trial in relation to the governance of new agricultural technologies.

The AEBC – Background and Mandate

The Agriculture and Environment Biotechnology Commission (AEBC) was established in June 2000, as part of the Government's strategic framework on biotechnology. This framework was prompted by the political fallout of BSE, advances

in controversial cloning technologies (i.e. Dolly the sheep)[1], and the development of a vigorous and sustained public debate over GM crops and foods in the latter 1990s. Given the mandate to advise the Government on "biotechnology issues which impact on agriculture and the environment," (AEBC, 2000a) the AEBC makes up only one segment of a three-pronged attempt by Government to look at the implications of biotechnology in the UK, including how it might be regulated[2]. Alongside the AEBC, the Human Genetics Commission (HGC) was established to look into the human implications of genetics, and the Food Standards Agency (FSA) created with the mandate of examining the safety implications of GM foods and GM animal feed. Although it is readily apparent that the work of these three bodies overlaps in several areas, a point recognized by the coordinating roles each is assigned, this chapter will deal specifically with the work of the AEBC.

In establishing the AEBC and assigning its agricultural and environmental remit, the Government is seeking information and advice in several key areas. Firstly, it has asked for a review of current practices, as well as information on any prospective future innovations, in the scientific and commercial development of agricultural biotechnology. Secondly, of foremost significance for this chapter, the AEBC has been charged with looking at the social and ethical implications of new agricultural technologies. In other words, as the AEBC's terms of reference describe, the Commission has been asked to look beyond the science of genetics to take a broader approach to some of the "strategic issues" involving agricultural biotechnology (AEBC, 2000a). The AEBC is not envisioned as an alternative, or addition, to scientific advice. Rather, it has been asked to address its broader social mandate while keeping the science of new agricultural technologies firmly in mind. Accordingly, the composition of the Commission's membership is such that it combines expertise from across a variety of different areas, including representatives from the biosciences, the social

---

1 For further information please refer to Einsiedel et al. (2002).

2 The AEBC reports jointly to the Secretary of State for Environment, Food and Rural Affairs and the Secretary of State for Trade and Industry, as well as to ministers in the devolved administrations in Scotland, Wales and Northern Ireland.

sciences, non-governmental organizations, industry and the farming community (AEBC, 2000b)[3]. Thirdly, and the topic of Chapter Nine, the Commission has been asked to engage public opinion and public knowledge about agricultural biotechnology.

Of enormous consequence for the success or failure of the AEBC is the manner in which the Commission's advice will affect the shape and actions of Government in determining the future of the use of genetics in agriculture. Accordingly, this constitutes a repeating point of discussion in the remainder of this Chapter. As a preface to this discussion it is worth saying a few words about the nature and limitations of the AEBC's mandate in this regard. Overall, the AEBC has been asked to carry out its mandate while committing to an awareness of the evolving regulatory frameworks these technologies are now entering. This includes looking for gaps in the Government's current regulatory and advisory framework in respect to the governance of new agricultural technologies. The AEBC has also been tasked to investigate the coordination of information between expert advisory bodies and to report on any changes needed in the way in which the Government draws on expertise. This is a point of particular relevance following the problems with expert advice which surfaced during the BSE case. Furthermore, the Government has asked the Commission to advise and instruct the Government on any changes needed to the guidelines for regulatory bodies.

3

One of the outcomes of this varied membership is that the politics of risk, knowledge and expertise are being carried out within the commission itself as well as within the wider socio-political arena. The following exchange with one member of the Commission provides some insight on the struggles which took place to produce *Crops on Trial* and which point to the struggle of the Commission in coming together to find this consensus.

> "Part of the process of engaging with the FSEs and coming to some kind of joint piece of work on it you had to at least test, examine, or even explain, or trying to understand where others were coming from."
>
> "*Were there any key markers of what those positions were? I can think of some. Specifically, I am thinking of scientific versus non-scientific opinions.*"
>
> "That was of course a very important part. Whether the public was just stupid and whether NGOs were just scaremongering (sic) outrageous people which just wanted to have organizations to pay themselves salaries with no intellectual substance to their argument. Versus the scientific elite of the country who always know what's best. I've rather caricatured that there, but believe me, there was some intense tension... Some of the people said that they enjoyed the process. Well I didn't enjoy it at all. It was a nightmare. It was very tough stuff." (Participant J)

Absent from this regulatory mandate is any clear relationship between the AEBC, its remit and the Government's imminent need to make a decision about the commercial future of GM crops in the United Kingdom. Politically it may be the case that the Government may not be able to ignore the Commission's conclusions. For example, this may be the case if the AEBC is able to clearly bring public concerns to the Government. However, outside the Commission's broad consultative and advisory mandates the Government is in no way beholden to the AEBC's advice. This point is particularly relevant as government decisions are tied to current European regulatory legislation and practices of scientific risk evaluation and environmental impact assessment (DEFRA, 2001b; AEBC, 2001: Annex A). How the Government will apply the advice of the AEBC in regards to these other commitments is unclear. Simply, the relationship between the AEBC and the commercial regulation of agricultural biotechnology is ambiguous at best.

Crops on Trial

The first attempt by the AEBC to fulfill its mandate was made in its influential and aptly entitled publication *Crops on Trial,* submitted to Government in September 2001. The report makes the ongoing Farm Scale Evaluations (FSEs) the focus of the report, and highlights the trials as a centre of the debate over new agricultural technologies in Britain.

Initiated in the spring of 2000, the FSEs make up a highly ambitious scientific project. A research scientist participating in the trials labels them as "the biggest ecological experiment ever carried out in Britain, providing an enormous resource for ecological modellers for many years to come" (Participant R). The trials are seeking to address the risks GM crops pose to the environment and involve the *in situ* study of several different herbicide resistant crops and their associated management regimes on a variety of biodiversity indicators. They are being undertaken across a wide spectrum of agricultural geographies and climates in the UK, and involve approximately 250-300 separate field trials, each between four and thirty hectares in size.

By underlining the importance of the FSEs, the AEBC is seeking to provide neither an overall appraisal of the trials, nor a critique of the scientific rationale behind their development. Instead the Commission deems them to be worth considered attention because they have become a focal point in the public debate over GM crops and foods. The trials have been widely covered in the media, are the focus of anti-GM campaigning and have generated local controversies in the communities in which they have been grown. Concerns have been raised about the environmental consequences of the trials themselves, as well as the perceived lack of information offered to the public regarding the testing (eg. selecting trial sites). Moreover, the publication of the data over the next couple of years (2003-2004) is expected to revive national interest in the debate. As such, the AEBC argues that the research trials are important in that they have coalesced public concerns about the technology and the welfare of the agricultural environment. The FSEs, the Commission states, have made agricultural biotechnology tangible to the British public:

> "[T]he FSEs have made the prospect of GM crops real to many people in the UK for the first time, and the specific local issues to which the FSEs have given rise (like concerns over groundwater and gene flow) have served to bring out more fundamental worries. The majority of the public may or may not be opposed to GM technology *per se* – but it is reasonable to assume that they do wish to be sure of the integrity and the comprehensive nature of the decision-making processes governing how these crops may be used." (AEBC, 2000: p.12)

Moreover, the FSEs are often perceived to stand at the cusp of the commercialization of GM crops, and on this basis the AEBC recognizes the influence of the trials on the regulation of new agricultural technologies. In part, this involves an acknowledgement of the impact of the trials on the commercial regulation of the first generation crops being trialed – herbicide tolerant and pest resistant maize, rape seed and beetroot. However, the AEBC also clearly sees the FSEs as holding a great deal of influence in directing the future regulation of second and third generation technologies, as well as the Government's overall approach to the governance of risk and biotechnology. In other words, as the above citation suggests, the trials are not only important because they have attracted public interest. They are also singled out by the AEBC because they are perceived as a potential point of access through which a public

engagement with the governance of risk and new agricultural technologies might be engendered.

What makes the AEBC's publication of *Crops on Trial* contentious, and of importance to debates over new agricultural technologies, is that it vigorously seeks to redefine the implications of the FSEs in decision making. The AEBC, in other words, takes to task perceptions that the farm scale trials provide a final scientific hurdle to be overcome before proceeding with the commercialization of GM crops and foods. As the AEBC describes below, the Government's approach to regulation, including its reliance on scientific models of expertise and decision making, is "immature." Or more precisely, it is immature in so far as the FSEs, if understood in purely scientific terms, are unable to contend "legitimately" with the social issues raised by the public in relation to the technology. As the Commission states:

> "[The use of GM technologies in agriculture has] given rise to intense discussion in many countries as well as our own as to the terms and conditions on which they might now be developed in *useful and socially acceptable ways*. This highlights a second clear fact – that the political arrangements needed to deal *legitimately* with these issues in countries like the UK are *immature*, and in immediate need of further development. This report makes some proposals for how these may start to be improved." (AEBC, 2000: p. 6; emphasis added).

I will return to these arguments in the second section of this chapter. Before proceeding in this direction, it is necessary to provide a more detailed introduction to the FSEs, the motivations which gave rise to the trials, and the importance of the trials in the politics surrounding the regulation of GM crops.

The Farm-Scale Evaluations (FSEs) - Meeting a Scientific and a Political End

To look at the history of the FSEs, the trials have been both a scientific and a political construction since their conception.

As previously discussed in Chapter Four, small-scale crop trials have been taking place in the UK since the late 1980s. These early trials tested any direct impacts genetically modified herbicide tolerant (GMHT) crops might have on the environment. Industry has presented these trials as the basis of their application for the commercial

regulation of several key GMHT crops. The corporations argue that along with tests confirming the lack of human safety risks associated with agricultural biotechnology, GM crops pose little threat to the environment. The strength of the scientific conclusions and the regulatory applications which industry presented to the Government meant that by the time the FSEs were conceived the crops in question – oilseed rape, maize, sugar beet and fodder beet – were already nearing commercial approval. Or, in the case of Aventis' T25 maize, the company has already received EU-wide approval to commercially grow the product.

However, these early successes were eventually impeded in the late 1990s as a consequence of the considerable pressures placed on Government and industry by opposition groups and an unsupportive public. Repeated calls were made for a precautionary approach to the evaluation of the potential environmental risks of growing GMHTs. In particular English Nature, one of the Government's statutory nature conservation agencies, argued that regulators needed to make a more detailed scientific analysis of the consequences of the widespread cultivation of GMHTs. This position was supported by ACRE (Advisory Committee on Releases to the Environment) – the Government's own expert committee tasked with looking at the environmental implications of GM crops – in its report on GMHT crops issued two years earlier.

GMHT crops are not simply novel crop types, but they involve the creation of novel cropping systems, including the use of the broad ranged pesticides. How these cropping systems would affect the agricultural environments on the farm and in the countryside were the questions which had been left unasked as of 1998. In particular, "biodiversity," as one senior bureaucrat at DEFRA (Department of Environment, Food and Rural Affairs) remarked, "was the only unanswered question" (Participant X). The FSEs were consequently established to measure the effect of GMHT cropping systems on plant diversity and biomass as wells as on gastropod (i.e. slugs & snails), arthropod (i.e. caterpillars & beetles), bee and butterfly populations. Moreover, the FSEs have been designed to take account of biodiversity levels beyond the boundaries of the crop sites themselves, including studies of neighbouring fields, and birds and small mammal populations which feed on many of the species mentioned above (DEFRA, 2001a).

The establishment of the FSEs is, in part, an acknowledgment of the shortcomings of the scientific questions which were being asked as part of the commercial regulation of GMHTs. In other words, the trials are intended to fill in gaps in the scientific knowledge pertaining to the risks of agricultural biotechnology. However, the establishment of the FSEs also met a political need. As inferred above, the FSEs were the outcome of direct political pressure by organizations, such as English Nature, which held a strong and persuasive relationship with Government.

Moreover, one of the most important aspects of the FSEs does not pertain directly to crop science and safety evaluations at all. Accepting that scientific gaps did exist in the regulatory framework, the Government and SCIMAC (Supply Chain Initiative on Modified Agricultural Crops)[4] not only agreed to put the FSEs into practice, but also agreed to a voluntary moratorium on the general unrestricted cultivation of GM crops in the UK for the duration of the research trials[5]. This moratorium closely reflects what was being asked of the Government in 1998 by groups who were making vocal calls for a broader moratorium. Foremost amongst these was the 'Five Year Freeze', a campaign coalition representing more than 120 organizations. The 'Freeze' was lobbying for a five-year ban on the growth of GM crops for commercial processes, the import of GM foods and animal feed, and the patenting of genetic resources for food and farm crops[6]. Society, according these campaigners, is not ready to make a decision about the future of the technology. They argue that the science remains uncertain and that broader public concerns about the technology have been unacknowledged. Although the voluntary agreement between the Government and SCIMAC does not address the second and third of the Freeze's demands, it is clear that the FSEs provide the first. As one influential source at DEFRA unequivocally suggests, the timescale of

---

4

SCIMAC is the organization which represents British industry interests throughout the primary supply chain.

5

The initial agreement between the Government and SCIMAC provided for only a one year moratorium on the commercial growing of GM crops. This was extended in 1999 in order to take account of the time and scale of the FSEs.

[6]http://www.fiveyearfreeze.org

the FSEs, combined with the voluntary moratorium, provided just what critics were demanding:

> "Well of course they were my idea. I thought of them. We thought of them here. They were our idea. We delivered exactly what people were asking us to deliver. They said they wanted a five-year freeze. There was a call for a Five Year Freeze in the summer of 1998, Mr Meacher made the announcement of the FSEs on the 21 of October 1998 and the results are going to be made available in the summer of 2003. They've got their five year freeze. I fixed it for them." (Participant X)

Moreover, the FSEs answered more than the calls for a moratorium from an organized opposition. Because of the relatively late development of GM agriculture as a topic of political controversy, the technology appeared novel and inadequately considered to a public who were growing sceptical in science, industry and Government. In this sense, the FSEs are a rejoinder to public perceptions that the Government needed to respond to technological advances which seemed to have suddenly appeared on the horizon, and which consumers had begun to react against. Thus, although the FSEs are concerned expressly with biodiversity on the farm and in the countryside, from the outset they were also intended to contend with more general public concerns over risk and scientific uncertainty. In describing the political rationality behind the establishment of the FSEs the participant cited above went on to state:

> "Part of the difficulty was that because nobody had engaged with the issue before, nobody realized that all these assessments had been going on. So the first anybody knew about GM, it was probably going to be one of our FSEs in their village. They didn't know that it had already been tested for 15 years. They thought that this was the first ever test of this crop and there was going to be half a field of this stuff being grown. And they would say 'we want this to be tested in greenhouses first.' And we would say yes it was tested in greenhouses and tested very comprehensively. And the only test we are doing now is in some obscure corner about farm and wildlife, because as far as we are concerned all the other tests had already been done. But, people wanted us to do it now and do it again." (Participant X)

EU member governments were also facing similar pressures to those faced by the UK Government. Commercial regulation of GM crops is directed by European legislation, where practice dictates that different member states take the lead on approving different crops. Many states became hesitant to finalize the regulation of those crops already nearing the end of the release process and which are now the focus

of the FSEs. European Union legislation was in effect being used to hold up commercialization, and in essence had already created a virtual freeze on regulation.

Industry was aware that given this developing context any imminent regulation and commercial release of GM crops in Europe was very unlikely, at least in the short-term. Nor was industry able to project the immediate growth of a commercial market for their products. After the much publicized failures of Monsanto to push the technology onto the market by extolling its virtues, while failing to engage in a dialogue over the potential risks of the technology, industry saw a need to pull its head down behind the parapets. A moratorium against commercial regulation offered industry a chance to let the controversy subside and to rethink its approach to public engagement.

The moratorium agreed between SCIMAC and Government is voluntary in that no legislation is forcing industry to abide by it. However, the volatile political and social climate which developed around GM crops and foods gave them little choice but to do so. Neither industry nor government, in other words, had much to lose by volunteering to hold back on commercialization. The AEBC cogently describes the situation in the following terms:

> "An assessment within the industry of the acceptability of GM technology in the UK was reported in 1998 to have concluded that the climate was inhospitable: the British public was sceptical about scientific progress, the collapse of public support for biotechnology and GM foods was parallelled by the hostility of the press, and there was disenchantment among retailers who supported a moratorium on GM food to give them time to clarify their positions. Following a vigorous anti-GM media campaign, demand for GM products had fallen; indeed by mid 1999 the majority of British supermarkets and food producers had removed ingredients from their products. And the industry had little to lose from agreeing to a voluntary moratorium, since there was little chance of gaining early approval for further GM crops through the EU system (which was paralysed by the impending revision of the Deliberate Release Directive and the stance taken by certain Member States to delay progress in the execution of the existing Directive)." (AEBC, 2001: p.47)

Summary

The context in which the AEBC has engaged with the FSEs is one which is inherently political from the outset. Both the Commission and the trials can be understood as the consequences of the public controversy and concerted opposition which developed around new agricultural technologies in Britain. Furthermore, the AEBC, by taking on the FSEs as the object of its remit, is itself engaging and contributing to this political context. Together the AEBC and the FSEs comprise a central location in which the Government is having to come to terms with public attitudes pertaining to new agricultural technologies, specifically as relate to the governance and regulation of GM crops.

Putting the FSEs in Context

One of the arguments running throughout this thesis is that, in order to understand the politics of GM crops, these technologies, along with their potential risks, must be viewed in their socio-political context. Moreover, it was suggested in the preceding chapter that governments would be well-served by also adopting this approach and taking social and cultural concerns into account when regulating and managing risk. The following discussion addresses the way in which the AEBC's engagement with the FSEs can be understood as an attempt to place the science of the trials and their implication for the governance of new agricultural technologies within a social context.

It is in this regard that the establishment of the AEBC can be seen as a potentially innovative and important exercise which contributes to the Government's approach to the regulation of new agricultural technologies. This prospect is a consequence of the Commission's willingness to engage in a political struggle which seeks to do more than contest the application of science in regulating GM crops; for example contesting the validity or objectivity of the FSE results. Moreover, the Commission uses *Crops on Trial* as a means of actively politicizing the knowledge and authority of the FSEs. It contests the meaning of the trials and the authority of scientific safety evaluations in decision making, by advocating the need for governments to adopt a more socially in

tune understanding of ideas of risk and uncertainty[7]. The AEBC, in other words, engages the FSEs in a way which may begin to address many of the issues of concern voiced by participants in previous chapters.

The AEBC's Advice to Government

Crops on Trial presents Government with ten far-reaching proposals with which the AEBC challenges the role and meanings of the FSEs for the governance of new agricultural technologies (AEBC, 2001). Without defining each of these in detail, the following discussion outlines three overarching themes which frame the advice the Commission offers. Overall, the report advances the need to place science and expert knowledge alongside broader social concerns in regulating new agricultural technologies. Importantly, the AEBC does not solely present these broader concerns as additions to scientific expertise, but also as crucial factors in giving meaning to that knowledge and appraising its value.

7

It should be noted that the AEBC's use of ideas of risk and uncertainty reflects the growing influence of risk theory in governance and UK agricultural controversies. Asked from where ideas of risk were surfacing from in the debate, the response of one committee member demonstrates the growing synonymity between social theories of risk and "real life" experiences:

> "*Where did you first come into contact with ideas of risk and public participation?*"
>
> "I suppose they came from the precautionary principle, which was very EU driven. Risk, as a social construct. There is a lot of academic work that we are very close to... Also, in dealing with the corporate side of things and how subjects like [risk] and the social reception of GM effects their business. They see it as risk, in a particular corporate sense; risk to their business. But they also see it as people talk to them about risk and how the public interprets risk. There seems to be a lot of Ulrich Beck running through all this, who seems academically to be tremendously influential. A lot of people are talking about the risk society and those sorts of terms. And I suppose, big governmental events such as BSE, and the government / science / policy interface and public perception of all that. The BSE risk argument have loomed very large. All the way through the handling of BSE from the start, trust fell apart very early. How the government thinks about risk is heavily conditioned by all those issues about how the Government uses scientific advice. Couldn't pin down one thing. In the UK there has been a gradual coming together of the academic theories of risk with the real life examples." (Participant J)

Firstly, the AEBC is very clear that it does not wish to undermine the FSEs. The Commission strongly declares the need to continue with the trials and underlines the importance of the scientific knowledge the trials will hopefully yield. However, in its report, the Commission is adamant that in moving ahead with the FSEs that the Government should rectify derelictions in the process to date. Of primary concern to the AEBC are a series of failures in communicating with the public. This includes neglect in clearly outlining the objectives and limitations of the trials, in adequately consulting with local communities about the selection of test sites, and in committing to a clear framework through which the outcomes of the trials will be released.

Secondly, the AEBC asks government to clarify policies dictating the manner in which the results of the FSEs will be used in decisions over the future of agricultural biotechnology and the potential commercialization of the GM crops being investigated. Essentially, the AEBC is challenging the Government to commit to an open and expanded process of decision making. As the Commission states in *Crops on Trial*, the impetus for Government is to make any decisions pertaining to "whether the GM crops being grown in the FSEs should be commercialised, within a framework which extends to broader questions" (AEBC, 2001: p.19). By "broader questions" the AEBC is referring to two things. Firstly, the AEBC is anxious for Government to outline how it will use the FSE results in conjunction with other scientific studies (ibid.: p. 18). More importantly for this thesis, the Commission would like the Government to clarify the way in which the results of the farm-scale trials will be applied in relation to the wider moral and ethical concerns being voiced by the public. In particular, the AEBC is interested in research conducted in the social sciences which has provided in-depth accounts of public attitudes towards GM crops and foods (Maris et al., 2001; Grove-White et al., 2000; Grove-White et al., 1997).

Finally, *Crops on Trial* seeks to further expand the Government's approach to the FSEs by linking the evaluation of GM crop technologies to British agricultural policy. Here the commission appears eager to establish a relationship with the Policy

Commission on the Future of Farming and Food (PCFFF)[8]. For example, the AEBC argues that the Government needs to consider, in detail, the possible impact of commercially growing GM crops on the rapidly evolving organic food industry. Specifically, the Commission is calling attention to the potential problems associated with horizontal gene transference[9] and the lack of clear guidelines defining adequate separation distances between GM and organic crops. In part, the Commission is concerned that the ability of farmers to declare their products as 'organic' could be compromised by release of GM crops into the nearby agricultural environment. Additionally, the ability of consumers to choose organic products over GM foods is also perceived as under threat. In this sense, the AEBC is arguing that the regulation of agricultural biotechnology must account for the types of agricultural system desired by British farmers and consumers.

Uniting each of these themes is an argument about the relationship between science and alternative forms of knowledge in directing official decision making processes. The AEBC is adamant that regulatory decisions cannot be taken on the basis of science alone. The following two citations vigorously state this case. The first quotation is drawn from *Crops on Trial*. The second quotation is an excerpt from a member of the Commission:

> "It will not be possible to base socially robust judgements about the significance of impact [of GM crops on the environment] on the scientific data alone; decisions will ultimately have to rest on a combination of scientific and social values." (AEBC, 2001: par. 42)

> "The FSEs are the tip of the iceberg in terms of the way people are looking at them. The regulatory system saw them as the last piece of the jigsaw, where as most people have experienced them as the first contact with something which opens up much wider issues. Just that data isn't going to answer the questions. That seems fairly clear." (Participant J)

---

8 For more information on the PCFFF please refer to the Commissions publication, entitled "Farming & Food, a sustainable future," released following the FMD outbreak in 2002.

9 To recall, horizontal gene transference is defined as the conveyance of genetic modifications in commercial GM crops to native landraces of the same species through the spread of pollen.

In offering this advice to Government, the AEBC is involved in an overarching attempt to widen the Government's perception and application of ideas of risk and uncertainty. In effect, the AEBC is exhorting the Government to address the results of the farm scale evaluations with an awareness of the previous mistakes it has made in contending with risk and uncertainty. To this end, the AEBC underlines the important contributions provided by Lord Phillips' Report from the BSE inquiry (Phillips et al., 2000a). To recall, Phillips emphasized the need for governments to approach risk with an awareness of the routine uncertainty of knowledge, including that provided by experts, along with the need to communicate potential hazards openly with the public.

As noted in Chapter Seven, although Phillips' contributions certainly hold considerable value for ameliorating the governance of risk, the report's conclusions fell short of linking technological ideas of risk with the types normative concerns highlighted in this thesis. It is precisely at this point where *Crops on Trial* is most innovative in its approach to the FSEs and is able to offer a wider understanding of risk in governance. In effect, the Commission can be understood to be involved in a process of social shaping in which it is actively trying to construct the meanings and values of the FSEs. Consequently, the AEBC seldom engages with the scientific practices conducted in the trials, but attempts to influence perceptions about what the results of the FSEs may tell government about risk. It is not the number of nematodes which the AEBC is interested in, but the meaning ascribed to those numbers and in what circumstances those numbers should, or should not, be deemed important.

In adopting the FSEs and issues of commercial regulation as the subject of its remit, the Commission is challenging the conventional processes of risk assessment which have dominated bureaucratic thinking within the Government of the United Kingdom. Such risk assessment models set requirements for giving approval to a technology based on whether it meets certain scientific criteria and codes of practice. For example, in order to gain consent to release GMHT fodder beet into the environment as part of the FSEs, Monsanto was required to demonstrate that the crop met predetermined standards of safety and efficacy. This included providing scientific data

showing that the crops posed no substantial risk to humans, animals or the environment, outside of the risks already associated with the cultivation of equivalent non-GM varieties[10]. A brief glance at Monsanto's application sees risk discussed in purely technical terms. The document details acceptable human exposure levels to beet proteins, appropriate separation distance between GM and non-GM crops, and outlines techniques designed to ensure that genetic materials remain isolated to the test site. So long as these criteria are met, which they were in this instance, then regulators are required to offer a consent (DETR and MAFF, 2000).

Examining this model, the AEBC is uneasy about the perceptions of conclusiveness scientific expertise affixes to risk issues. As McNally puts it, a risk assessment can often be a "'rite of passage' for achieving closure on debate about 'technological risk'" (Prior et al., 2000: p. 113). The Commission is concerned that a purely scientific evaluation of the FSEs may be taken up by Government as the exclusive means of regulating GM crops, regardless of public opposition. Traditional approaches to risk evaluation, the AEBC argues, must give way to ideas of risk which link uncertainty to wider public uncertainties about agricultural and social development. Attention is directed away from scientific expertise as the exclusive factor in identifying and contending with risk, and as the final adjudicator in political controversies over the technology. Instead the perception of risk the AEBC associates with agricultural biotechnology consciously opens up a space in which the need to address more normative strategies of contending with risk are brought to the fore. Referring explicitly to normative concerns about the relationship GM crops imply between society and nature, the Commission states the argument as follows:

> "The FSEs address narrow issues of risk, not broader issues about the public acceptability of potentially irreversible changes. Many people are concerned that the decision-making framework, based on a risk assessment approach, does the same... The risk assessment approach does not address many people's wider philosophical or ethical concerns about what they perceive as a major manipulation of nature... We identify a particular need to explore the different kinds of uncertainty involved in the applications of biotechnology and how they might be explicitly handled in the policy process." (AEBC, 2001: pp. 20-21)

---

10 This protocol for evaluating risk is often termed 'substantial equivalence.'

However, if *Crops on Trial* clearly makes the case for the Government to adopt a wider approach to risk and the regulation of new agricultural technologies, the report remains vague in determining precisely how this can be achieved. For example, the committee suggests that the delineation of what they indistinctly describe as the "wider philosophical or ethical concerns," may be understood in relation to public anxieties over what are just as loosely described as a perception of biotechnology as a "major human manipulation of nature" (AEBC, 2001: p.20). What constitutes an 'ethical concern' and how they can be incorporated into the FSEs and governance, is a question which the AEBC fails to directly address in *Crops on Trial.*

For these reasons *Crops on Trial* is better seen as a challenge, and not as a prescription, for how government can incorporate risk into the regulatory decisions concerning GM crops. In introducing the AEBC and its engagement with the FSEs, it was suggested that the Commission had been motivated by a desire to engender a legitimate approach to the commercial regulation of agricultural biotechnology. It is this impetus which continues to run through the Commission's perspective of risk and the challenge it puts to Government. A broadened perspective of risk may contribute to the better understanding and management of the potentially detrimental consequences of GM crops, but just as importantly for the AEBC, it offers the chance of encouraging political accountability in decision making. The following passages from the AEBC clearly elucidate the role of a broadened notion of risk in regenerating accountability and public trust in the governance of GM crops and foods:

> "We identify a particular need to explore the different kinds of uncertainty involved in the applications of biotechnology and how they might be explicitly handled in the policy process... *The processes of defining and understanding uncertainty are central to the science itself, but they need to be properly communicated and understood in a regulatory process that is politically accountable.*" (AEBC, 2001: p.21). (my emphasis)

> "It seems to us that even criticisms appearing to be narrowly addressed to the FSEs themselves, or apparently couched in imprecise scientific terms, often reflect deeper concerns. References in the evidence we received to the impact of the trials on bee-keeping, earthworms or gene flow, or to the possible effects of GM technology on people's children and grandchildren, were sincere in themselves, but we suggest that they may also sometimes been ways of expressing wider, analytically more elusive ethical concerns. Such concerns are fundamental in determining how people react and

respond to a new technology, which is not fully understood and which they may not be inclined to accept. *They make it crucial – as well as hard – to build trust in how the technology is being promoted and supervised.*" (AEBC, 2001: p.29) (my emphasis).

These arguments were further underlined in interviews with two members of the AEBC (Participants J & N). Each not only argued that it was necessary to engage alternative forms of expertise and ethical considerations in governing risk, but that it was necessary precisely because it gave "official" recognition to public concerns in the regulatory process. Asked what her/his expectations were going into the AEBC, one of these participants suggested that whether s/he would be able to see the Commission as a successful exercise hinged precisely on these matters. S/he states:

> "*What were your feelings going into the AEBC? Were they generally positive, or did you have any apprehensions?*"
>
> "A mixture of both really. First of all, one doesn't do these things unless you think they are potentially worthwhile. You have to have some degree or optimism. It was an obvious body which was going to potentially give those broader areas of risk which we had always argued were relevant, legitimate and important... It was actually going to give them space and voice, if you like, to allow them to become official..."
>
> "You would hope, and of course you can never be certain that you are going to get everything right, that you get a landscape of risk assessment that would be more broadly agreed upon. You would bring in a broader range of knowledges. You may then, as a consequence, hopefully get a decision that commands better respect and confidence. It would be more robust and not so flaky." (Participant N)

Summary

In its focus on the Farm Scale Evaluations and the commercial regulation of GM crops, the AEBC has involved itself in a political struggle over ideas of risk and processes of governance. This is a constructive form of politics in so far as it seeks to redefine how technological risks are interpreted and applied in evaluating the safety of GM crops and in deciding on whether to grant commercial approval to these crops, or not. Crops on Trial critiques a model of risk based on assessment practices which infer closure to debates over risk and uncertainty through a discourse of scientific expertise.

This model is contrasted with a more normatively attuned definition of risk in order to address limitations in scientific knowledge and the routinization of uncertainty. The Commission, alternatively, proposes an understanding of risk which seeks to tie together scientific and ethical evaluations of the hazards of GM crops. The challenge being made to Government is to address the FSEs, the commercialization of GM crops and public perceptions of risk in a manner which engenders more politically accountable forms of decision making.

Responses to the AEBC - Enduring Contestations over Science in Society

Whether, or not, the AEBC will be successful in its project is anything but a foregone conclusion. Looking at some of the responses *Crops on Trial* has provoked from within and outside of government is beneficial in identifying the struggles the AEBC faces in achieving its aims as outlined above. This will be the subject of the third and final section of this chapter. Firstly, although the AEBC's conclusions were seen as a positive contribution to the debate by most research participants, *Crops on Trial* also elicited derision from those who were either involved in the FSEs, or supportive of the commercial growing of GM crops. Secondly, the Government's official response to the report, although supportive in tone, presents some serious stumbling blocks for the AEBC. In both cases, the responses made to the report can be seen as defending the authority of scientific knowledge and its position in governance.

A View from Science and Industry

Crops on Trial has been widely read in debate circles and is increasingly cited in policy documents and academic articles pertaining the controversy over new agricultural technologies. It has likewise been subject to many different interpretations. Released in the weeks prior to conducting interviews for this thesis, the Commission's report was a hot topic point for some participants who had already read it and formed an opinion of its conclusions. In particular, participants who were generally supportive of agricultural biotechnology, from government, industry and science, expressed concern about the

AEBC's expanded approach to the FSEs. These participants, although expressing support for some form of public engagement, were unhappy that the trials had been targeted by the AEBC, arguing that their scientific merit was potentially being compromised. In reacting to the AEBC's attempt to reconstruct ideas of risk in governance, participants made arguments which sought to re-establish the FSEs as a purely scientific enterprise.

In Chapter Six several participants from the scientific community were shown to be attempting to reconstruct the boundary between science / nature and politics / society. This boundary, as risk theorists have posited, was perceived to have eroded as a consequence of an increasing social preoccupation with hazards and the negative impacts of techno-scientific development. Attempts to reconstitute the autonomy and authority of science were also expressed in response to the AEBC, and in contesting the role of the FSEs in producing expert advice to government. The following statement comes from a scientist who is a frequent member of expert advisory panels and currently involved in carrying out the farm scale trials. Responding to a question pertaining to whether alternative forms of expertise could play a contributing role in presenting the findings of the FSEs to government, the participant offered the following response. S/he identifies expert advice as the province of science and suggests that political and social concerns are better left to the politicians. S/he states her/his opinion in no uncertain terms:

> "I can say to ministers that as a result of the farm scale trials we conclude X. A Minister can then say, 'despite that, because of Y I am going to do this.' If it turns out afterwards that he was wrong it's his problem, not mine. I think there are quite considerable dangers about expecting scientists to be not only expert witnesses in key areas, but also to then put a social spin on this. One of my current concerns is that the criteria for the way in which expert committees advise government are slowly and inexorably being modulated to take account of these other factors. The words, 'over my dead body,' spring to mind." (Participant R)

In making this argument, the participant is further anxious to distance the FSEs from the debate over genetically modified crops and foods as a whole. In outlining the purpose of the trials s/he seeks to limit the nature of the questions being addressed by the FSEs in a manner which is diametrically opposed to the perspective advanced by the

AEBC. The FSEs are solely a scientific task involving the empirical observation of the effects of different cropping systems on environmental biodiversity. The separation the participant seeks to place between the FSEs and the political controversy is perhaps best seen in her/his repeated inference that the field trials have actually little to do with agricultural biotechnology at all. The trials are perceived in scientific terms as a struggle over fixed carbon resources between agriculture and the natural environment. Furthermore, if the FSEs have become entangled with the politics of the controversy, and other broader issues of risk attached to the trial, s/he hints that this is a result of the questionable motivations of those parties interested in derailing the commercial regulation of GM crops. S/he states:

> *"People point to the FSEs as some sort of point-of-passage in the debate. People are anxiously waiting for the outcomes..."*
>
> "Except that none of that has ever come from the scientific steering committee. That set of views has been promulgated by a range of different people with a range of different aims and objectives in this debate... The question which was asked, to which there was no really good answer, was whether we knew what effect changing cropping systems are going to have on agriculture. It's not so much GM itself, but the cropping system in which it is used. The answer is no. We don't have any idea..."
>
> "I think you can make a compelling case for agriculture, ever since its inception, being a battle between the natural environment and the agricultural environment for which gets the bigger share of the carbon that is fixed. It's been a fairly open battle until recently. Since the war the farmers are winning to the detriment to wildlife. I, therefore, think it is quite a legitimate question to say, 'Ok is this new technology going to make matters worse or better, or have no effect at all. This is what the experiments are set up for. The experiments actually have nothing to do with GM at all. You don't see that written down very often because it suits various other people not to write it that way." (Participant R)

This argument was repeated by a research scientist and industry representative who is involved in the attempt to commercialize some of the GM cropping systems being trialed. Again, it is stated that it was legitimate for opposition groups to demand answers about how the widespread commercial growing of GM crops could affect rural wildlife and biodiversity. However, the participant clearly sees the move by the AEBC to understand this relationship in wider terms as unacceptable. With subtlety, the

participant argues that AEBC is guilty of confusing the issue and misrepresenting the issue to the public. Confident in the safety of the crops, the overarching message s/he advances is that the FSEs must be allowed to speak authoritatively about the risks of growing GM crops and to not confuse these issues with any outside political concerns:

> *"In terms of regulation, such as addressed by the FSEs, it seems that the questions surrounding them won't be solved by the science alone."*

> "The FSEs themselves do not involve a whole lot of other things. The decision of whether to approve crops for commercial cultivation in the UK does involve a lot of other things. I was disappointed that the AEBC chose to do a re-haul over the process of establishing the trials, because the trials themselves were established in such a method where we had the greatest ever internal debate between the middle ground environmental groups like English Nature and the Royal Society for the Protection of Birds, government and industry than we have ever had about a new technological development. The trials were specifically tied to one particular question. Does biodiversity get influenced when something that has been tested to exhaustion at a small scale is scaled up? Now the fact that this was one area in the regulatory framework that did not seem to have been addressed by the existing regulations meant that industry and the Government and the environmental groups were able to agree that would be something useful to work on... This whole question of a broader debate, which is not actually about the outcomes of the FSEs, is about other issues of people's feelings of various views of ethics and all sorts of peripheral issues, and is not about the safety of the crops or their cultivation themselves. They have been rolled in and confused in the minds of the public and the media as to what the FSEs are actually about." (Participant O)

The Response of Government

In early 2002, the Government responded to *Crops on Trial*, offering the AEBC a general statement of interest and acceptance[11]. In this response, the Commission is congratulated on the publication of its report and in taking account of the "broader"

11

Of the three devolved UK Governments, only the Welsh National Assembly chose not to sign onto the general statement, offering its own letter of response to *Crops on Trial.* In it, the Welsh Government reasserts its call for a moratorium on all GM crop trials and the imposition of the strongest restrictions against future GM developments. This position stands in opposition to the primary conclusion of the AEBC which was that the the FSEs should continue. This stance is put forward in line with "the principled concerns of the National Assembly for Wales as a whole about the impact of GM planting on organic and conventional farming" (National Assembly for Wales, 2002).

issues related to the FSEs. In particular, the Government sees the work of the Commission as an important contribution to the understanding of public concerns about agricultural biotechnology. Advancing its general response to the *Crops on Trial report*, the Government states:

> "We welcome the Commission's detailed analysis of the context in which the FSE programme is being conducted as well as the thorough consideration of the broader issues raised by the intense interest in the evaluations. The report is a positive contribution to the debate surrounding GM crops. We agree with the Commission's view that the report can help illuminate public discussion of the issues surrounding GM crops." (DEFRA, 2002a: par. 7)

However, despite voicing its overall approval of the report, the Government's tone is much less embracing and a great deal more cautious in its detailed response to the report's recommendations. Specifically, the Government is anxious to distance itself from the Commission's advice concerning the commercial regulation of agricultural biotechnology. In this regard, the Government's response can be seen as an attempt to reassert its control and authority over these matters. For example, although the Government is happy to recommit to a voluntary moratorium on the commercialization of GM crops until the FSEs are complete, it is wary of committing to how it will apply the results of FSEs in regulating these technologies. Of notable significance is the Government's hesitation to make any commitments which would tie regulation to any expanded criteria, or broadened conception and engagement with risk and expertise. Instead, the Government's response emphasizes commitments to scientific risk evaluations which comprise the cornerstones of decision making as interpreted in European legislation. Take, for example, the following statement:

> "Decisions must be taken with reference to the science-based criteria set down in the European legislation, but will be based on more than an analysis of the FSE results. Although general ethical and socio-economic implications of the marketing of GMOs may be taken into account in reviewing the operation of this legislation, the criterion for taking decisions on individual applications is the avoidance of adverse effects on human health and the environment." (DEFRA, 2002a: par. 13)

While directing the AEBC away from issues of governance, the Government also attempts to refocus the Commission's attention on establishing an engagement with the public. In fact, the general tone of the Government's response exhibits a degree of

impatience with the AEBC for not already having made significant strides towards accomplishing this in the time preceding the publication of *Crops on Trial.* Belying the congenial tone of the Government response, a participant who is involved in the establishment of the AEBC expressed frustration that the Commission had not already given serious attention to these tasks. Interviewed shortly after the Government published its response, the participant offered the following caustic comment in response to a question about how it is possible to involve the public in governance:

"How then, do public voices get into the debate?"

> "That's what the AEBC is going to tell us. That is why we set them up to do. We are waiting for their advice with interest." (Participant X)

In direct terms, the Government response can be read as asking the AEBC to get on with this aspect of its mandate. Specifically, the Government is anxious for the AEBC to advise on how to establish a public debate on the commercialization of agricultural biotechnology, how to apply the results of this debate, and if possible to establish the conditions of public acceptability for growing GM crops (DEFRA, 2002a: par. 29-35).

The Government's response to *Crops on Trial* may, therefore, be seen to contain a fundamental contradiction. On the one hand, the Government is critical of the AEBC for not getting on with its mandate to engage the public and reasserts the need for the Commission to dedicate itself to this task. Yet, the Government's response portrays an unwillingness to commit to how these consultative measures will contribute to the governance of the technology. Instead, alongside its calls for a public engagement is a reassertion of the importance of regulatory science in directing matters of commercial regulation. Stated differently, the Government appears to wish to tap into public opinion, but avoids linking the future of the technology to public attitudes or alternative evaluations of the risks of the technology.

Both members of the Commission, who have already been cited above, also expressed these reservations. Because the Government was in no way beholden to the advice of the AEBC, or even to take account of the conclusions of *Crops on Trial* report, they were suspicious that the AEBC might fall subject to the whims of the British political system. Although this topic will be picked up again in next chapter's

discussion of the AEBC's attempt to hold a national debate on the commercialization of GM crops, the following comments are helpful in setting the context of governance in which the debate will be held. The first statement expresses concern that the Government will simply ignore the AEBC and *Crops on Trial*. In the second statement, another participant is worried that the Commission might not only be ignored, but could be applied by Government in a way which runs counter to the conclusions it has put forward. These comments follow on from an earlier citation in which the participant tied the success of the AEBC to its ability to bring a broader perspective of risk into governance. Conversely, the potentially negative side of the experience was that the AEBC could be used as a means of stifling public debate and criticism. In other words, s/he worries that the Government will attempt to impose closure around the debate by arguing that social and cultural concerns about risk and the technology have been dealt with by the Commission:

> "You can't judge the success of the AEBC until: a) you have seen the quality of the advice, and b) whether the Government does anything with it. At the end of the day we are a creature of government in the sense that we don't have independent powers. I would hope that it would be silly of any government to set up anything this visible, which may be successful in engaging the public and cost a lot of money, and then ignore it. But, who knows. The week's a long time in politics as Howard Wilson said. Whether the advice is taken will depend on the political imperatives of the time. They can often have nothing to do with the particular issue at stake." (Participant N)

> "The negative things... I know as well as anybody that one thing that the British Political system is good at doing is creating slightly new institutional forms, be it departments, commissions or inquiries to stifle debate, to capture critique and to capture the terms of the debate. Having a talking shop and not having to do anything. Pointing to the AEBC as your, 'well we've got the AEBC...'"

> *"'...and we've dealt with risk...'"*

> "Exactly, 'we're looking at ethics...' It's not statutory that they have to take any notice." (Participant J)

The responses to the AEBC of key figures involved in the FSEs, along with the official reply published by the Government, have suggested that the debate over the role of science in society will be an enduring source of controversy in British society. In other words, the debate is likely to continue beyond *Crops on Trial* and likely even the commercial regulation of GM crops. As one member of the AEBC observed, by seeking to influence government to take a wider approach to issues of risk in regulating GM crops, the AEBC is a "tool" in a larger political debate about the democratization of decision making (Participant N). Simply, the AEBC is unlikely to settle the debate on its own.

Of more immediate significance for the success of the AEBC is the way which the Government chooses to take its advice in relation to the commercial regulation of GM crops. The challenge of confronting enduring scientific conceptions of knowledge and expertise is equally evident in this regard. In other words, the high degree to which technocratic discourses are integrated in regulatory processes presents a serious stumbling block for the AEBC and its attempt to democratize expertise and governance. How the AEBC is able to resolve the contradiction between being asked to engage public concerns about agricultural biotechnology on the behalf of the Government, and not having any clear mandate detailing what a public debate will contribute to regulatory procedure, remains an important site of conflict.

Conclusions

As an experiment in public consultation and decision making the AEBC has been shown to potentially have an important role to play in debates over risk, science and governance. By adopting the FSEs as its focus, the Commission has strongly asked the Government to address the ways in which it will apply expertise in relation to public values in regulating the commercial future of GM crops. Moreover, the AEBC, if successful, may potentially have an even wider impact on issues of democratization and public accountability in the governance of risk and technological development.

It has been argued above, that the Commission's successes are closely tied to its ability to bring widened perceptions of risk and participation into official government procedure, specifically in relation to the application of the FSE results. Where past efforts to contend with risk and uncertainty have sometimes resulted in considerable failures, such as recorded in the case of mad-cow disease, the AEBC seeks to help government learn from these errors. Significantly, the Commission's potential, in this regard, surpasses the input put forward by Lord Phillips in his report from the BSE Inquiry discussed in Chapter Seven. The AEBC does so by challenging the Government to look beyond scientific knowledge in regulating the commercial future of agricultural biotechnology, and to address public attitudes towards a broader range of social concerns. The AEBC, by focussing on the FSEs, not only advises the Government that a wider range of social and normative issues need to be taken into consideration alongside scientific advice, but further challenges the meaning and authority of the trial results themselves.

Although the Commission does not explicitly, or in detail, describe what these 'broader concerns' might entail, it does offer some indication of what they might include. For example, the Commission repeatedly refers to the public's apprehensions about the potentially deleterious relationship created between society and the natural environment as a consequence of the application of genetics in agricultural development. Likewise, in the above discussion, the AEBC has been shown to be keen to talk about issues of consumer choice, trust in industry and public accountability in science and governance. These have all been identified in previous chapters as common topics eschewed by participants, and have been seen to reflect, not only their uncertainties about new agricultural technologies, but also about the nature of British society. In this sense, the AEBC has attempted to open a space in which what this thesis identifies as the politics of new agricultural technologies can be accommodated in official practice and discourse.

However, it has also been argued in this chapter that if such a democratic space is to be developed in Government that the Commission faces an enduring and uphill struggle to do so. As theorized in Chapter Two, the relationship between scientific knowledge, objectivity and governance is deeply integrated in Western societies.

Consequently, there remain very serious doubts about whether the AEBC will have an impact on the regulation of GM crops, and whether it will be able to engender the political accountability and legitimacy it is seeking.

Whether the Commission is going be able to overcome these hurdles, depends very much on whether the Government will, or will not, feel obliged to acquiesce to the AEBC's advice. Moreover, this is itself tightly correlated with the ability of the AEBC to tap into public opinions concerning agricultural technology and its capacity to forcefully bring them to bear on Government. This will be the topic of the next chapter which addresses the AEBC's ongoing role in creating a national debate over GM crops and foods.

CHAPTER NINE: A PUBLIC DEBATE ON GM CROPS AND FOODS

> "It will be crucial for the public to be involved in the important decisions which need to be taken. We have to find a way to foster informed public discussion of the development and application of new technologies: whatever decisions are ultimately reached, they will be more palatable if they have not been taken behind closed doors. At present, there seem to be no avenues for a genuine, open, influential debate with inclusive procedures, which does not marginalise the reasonable scepticism and wide body of intelligent opinion outside specialist circles. We need to harness new deliberative mechanisms, to develop participatory methods of public engagement, together with new capabilities within Government and industry for digesting and responding to the implications." (AEBC, 2001: p. 24)

Introduction

In the previous chapter the Government's Agriculture, Environment and Biotechnology Commission (AEBC) was presented as making a strong argument for democratizing the governance of new agricultural technologies. In particular, the Commission called on the Government to adopt a broader conception of risk. It argued that regulators needed to take social and ethical concerns about biotechnology into account when evaluating the GM crops currently under commercial review in the UK. The citation above, drawn from the Commission's influential *Crops on Trial* report, indicates that a central aspect of this project was to ask the Government to conduct a public debate on GM crops and foods. Underlining the relationship between the Commission's presentation of risk and the desire to have a public debate, a member of the AEBC interviewed states that where "there is risk on the one hand, an upshot of looking at risk has been looking at public participation in decision making" (Participant J).

To a large degree, whether or not the AEBC will be able to engender public participation, and what the Commission perceives as more publicly accountable forms of governance, may depend on the success of this debate. This success, as the above statement indicates, will be measured in terms of whether the debate can be seen to have provided a "genuine, open" and "influential" debate. The AEBC, in other words, proposes a debate which encourages the provision of a forum in which citizens are able to discuss the full range of concerns they have about the risks of agricultural biotechnology with the Government. Moreover, the AEBC will also rate the success of the debate in terms of the impact public attitudes will be allowed to have on how the Government reaches a decision on the commercial future of GM crops in the UK.

At the time this chapter (June 2003) is being written the AEBC's public debate is only just getting under way. Likewise, the scientific results of the FSEs are only starting to be compiled and the Government is still some time away from having to make a decision about the regulation of GMHT crops. This chapter, therefore, does not seek to provide an in-depth analysis of the debate and its immediate impact on governance. Instead, the following discussion is intended as an introduction to the debate and poses some speculative questions about what factors might be involved in impacting the potential success, or failure, of this debate as the AEBC envisions it. These questions are drawn from an analysis of the ways in which the proposal for a public engagement has already been contested in the lead-up to the actual debate events, due to take place during the summer of 2003. The focus will be on the relationship between the science, governance and wider perceptions of risk.

The structure of the chapter will be as follows. A brief introduction and backgrounding of the proposed debate is provided in the first section of this chapter. Secondly, from this basis, questions concerning the definition and role of the 'public' in this debate will be addressed. The third, and final section of this chapter, will speculatively identify some of the key barriers the AEBC is likely to face in creating a public debate in line with its democratic aims. Stated differently, this section will address those factors which may stand against the provision of a "genuine, open" and "influential" engagement with the Government over the commercialisation of GM crops.

Background to the Public Debate

In its response to the *Crops on Trial* report[1], the Government agreed to the AEBC's request[2] for the need to hold a public debate, and tasked the Commission with providing additional advice on how the debate could be developed and conducted. The AEBC duly responded to this request and provided the Secretary of State with a working plan, broadly outlining the potential role and shape of a nationwide debate on agricultural biotechnology. Following in the footsteps of *Crops on Trial,* the AEBC focuses this debate on the "possible commercialization of GM crops," and not just on the technology itself (AEBC, 2002a). The purpose of this debate, the AEBC argues, is not to seek to produce either a 'yes' or 'no' response to the commercialization of GM crops. In other words, the debate should not be seen as referendum on the future of agricultural biotechnology in Britain. Rather, the debate is envisioned as an important means of enabling a multifaceted public to communicate its various views about the risks of commercialising GM crops to the Government. The Commission states the purpose of the debate in the following terms:

> "The principal objective of stimulating a public debate is to assess the nature and spectrum of the public's views on the possible commercialization of GM crops in the United Kingdom and any conditions under which commercialization might or might not acceptably proceed so that the public's views can inform decision making." (AEBC, 2002a: par. 6)

The Government, represented by the Environment Secretary Margaret Becket, accepted the advice of the AEBC and granted the Commission permission to develop a public debate on the behalf of the UK and its devolved administrations (DEFRA, 2002c).

---

[1]Please refer to Chapter Eight.

[2] Alongside the advice being offered by the AEBC, the Government has been encouraged to hold a public debate as a consequence of its commitments to European legislation governing the deliberate release of GM crops into the environment. Under the EU's "deliberate release directive" (directive 90/220/EEC) it is mandatory for member states to hold public consultations before any crop can be given approval to be grown. As one member of DEFRA stated in an interview, a public debate was seen as a way of clearly addressing this criterion (Participant X).

A budget of £250,000 was initially allocated for this project[3], and following the AEBC's advice, it was agreed that the debate should be managed and run by an independent 'public debate steering board' (PDSB), operating at arm's length from the Government. Like the AEBC, the PDSB is composed of members representing a diversity of expertise and interests from all sides of the debate over agricultural biotechnology[4]. The PDSB is planning to host the debate during the summer of 2003 and the Government is looking for the steering board to produce its report for the Government in September of the same year.

The public debate, later labelled by the PDSB as 'GM Nation?,' is only one part of a three tiered government consultation on agricultural biotechnology and the commercialisation of GM crops. Along with the development of a public debate the Government has also established an economic and a scientific review, each of which has its own budget and management structure. The economic strand is being carried out by the Prime Minister's Strategy Unit and has been tasked with providing a cost-benefit analysis of the impact of GM crops on the British agricultural industry. The science strand is responsible for providing the Government with a review of the scientific issues surrounding GM crops, including those which have been voiced in opposition to the technology. The science review is being directed by Professor Sir David King, the Government's chief scientific advisor. Although independent of one another, each strand has been directed to interact and work closely with each other (DEFRA, 2002b & 2002d).

Guiding the practical development of the debate has been an effort to afford the wider British public with the deliberative mechanisms with which to stimulate interest and allow citizens to become active participants in the debate. In developing these mechanisms a variety of methods have been considered by the PDSB. These included the use of focus groups, consensus conferences, media debates and the production of a

---

3 At the request of the steering board directing the construction of the debate this budget was later increased to £500,000.

4 The PDSB is chaired by Professor Malcolm Grant who also chairs the AEBC itself. Several other members of the AEBC also sit on the PDSB.

film intended to generate national interest in the issue. Going into the debate, a combination of these methods has been decided upon by the steering board. The proposed debate is set to consist of a series of locally / community organized debates which will be held across the country. These debates will be framed by six larger, conference-style, events. Furthermore, as will be discussed below, a series of focus groups have already been held with the intention of allowing the public to set the tone for the debate itself.

A 'Public' Debate?

As an experiment in public engagement the PDSB faces the obvious task of determining what constitutes a public debate in the first place. The idea of public engagement is sometimes presented by the AEBC as a straightforward means of generating legitimacy and public accountability in the governance of agricultural biotechnology. In practice, the issue is considerably more complex. As a participant and member of the AEBC states, determining what actually comprises an "adequate" public debate has been a difficult task. S/he states:

> "One of the main difficulties is the ability to promote public debate and get Government to take notice of its outcomes. How do you know when you have done that adequately? What does a public debate actually amount to? You can only get a certain number of people in a room. You can have a media ding dong about things. It's a very misused term. Would you know a public debate if it ran you over?" (Participant J)

Alongside practical considerations about how the debate should be run, the AEBC and PDSB have had to address some more fundamental questions in coming to terms with the ambiguity of their task. Firstly, they have had to give considerable attention to what constitutes a 'public' in the first place. Furthermore, they have had to determine what the role of the public will be in the debate.

What Public?

Throughout the accounts of the controversy surrounding new agricultural technologies presented in this thesis, the public has repeatedly surfaced as a central

factor in these conflicts. The 'public,' and 'public opinion' have often been utilized as resources on which participants, from both sides of the debate, have drawn in order to give credence to their positions. This 'public' is often used by stakeholders as a means of drawing strength to their political position by arguing that the attitudes of the democratic majority are in line with one's own arguments. For example, to return to the case of GM tomato puree, opponents of the technology often cite the supermarket's decision to pull the product from shelves as the result of overwhelming 'public' opposition to the technology. Likewise, proponents of the technology claim that sales of the paste infer 'public' acceptance of the technology.

Part of the challenge of defining a public debate involves moving beyond these types of politically charged situations where stakeholders speak for the public. There has been some concern raised by the Government that the controversy, to date, has been dominated by those with a direct and vested interest in the outcome, and who have further been accused of adopting overly rigid and polarized stances to the issue. This includes stakeholders from industry and science, as well as those representing the NGO and activist communities. Expressing dissatisfaction with the AEBC for failing to address the public outside of these interests in the past, a senior bureaucrat in the Department of Environment, Food and Rural Affairs (DEFRA) makes the following chiding statement:

> "*Are there attempts in government to bring the public further into the debate?*"
>
> "Yes, the AEBC is a government project... But, they have singularly failed to address the public. That has been a complete and total failure. They know that too. They have been travelling around the country saying that they were engaging with the public. But, at their meeting in Birmingham, the audience consisted of twenty members of the public, and they were the same members that came to the London meeting and who had been to the Norwich meeting... The AEBC say that they are going to engage the public, but the only people they engage are a handful of activists and a few academics. But, there is nothing in it for ordinary members of the public. What ordinary member of the public is going to give up an evening to come to a meeting in Birmingham?" (Participant X)

Both the AEBC and the Government are consequently anxious to free the public debate from these restrictions and to rectify past failures to engage the wider British

Public. The AEBC, therefore, envisions 'GM Nation?' as a means of accessing and giving voice to as diverse a range of public views as possible. The AEBC is firm in its opinion that this should not mean excluding the voices of the stakeholders which have dominated the debate so far. Simply, the Commission argues that in order to provide an open and genuine engagement with the public, a wider variety of experiences and knowledge must be given the space to participate in the debate alongside those of key stakeholders (AEBC, 2001: par. 69). This diversity is sought inclusively across all regions and social backgrounds throughout the United Kingdom; what the AEBC refers to as the "grass roots" of the British public. This is how the AEBC presents the task to Government:

> "We want to involve as many people as practicable, from a wide range of backgrounds, in ways that capture their attention. We want especially to draw people at grass roots level into the debate. The debate should also seek to gain a deep understanding of the variety and subtlety of public views about the issues around the possible commercialisation of GM crops." (AEBC, 2002a: par. 14)

The Public-Framing of the Debate

In seeking to encourage the participation of 'grass-root' public views, the AEBC argues that it is further necessary to allow this public to frame the debate itself. To this end, the Commission has recently completed a series of public focus groups which have been intended to encourage public participation in the actual design of the debate from the outset and before any debate events are actually held. These, in effect, have been designed to give citizens "a blank piece of paper" to identify the issues which they identify as having the greatest significance in the controversy over the commercialisation of GM crops (AEBC, 2002a: par. 19).

Alongside the ability to access the knowledge and experiences of a grass-roots public, the Commission identifies two additional benefits it hopes will be engendered by this process. Firstly, allowing citizens to frame the issues themselves is seen as a means of demonstrating to the public that the debate is not being controlled, or restricted, by the Government, or any other stakeholders in the debate. Public-framing is, in other words, envisioned as a means of engendering public trust in the overall debate process.

Secondly, in setting the tone for the actual debate itself, the AEBC is anxious to investigate those issues which are likely to be recognized by other members of the public in order to encourage participation in the 'GM Nation?' debate events (ibid.: par. 8).

Comments

In attempting to generate a public debate on the commercial future of GM crops the AEBC and PDSB have produced a framework of public engagement which would appear to respond to sociological criticisms concerning the lack of public engagement in science and governance. This includes some of those criticisms made in this thesis. Firstly, by seeking to address a 'grass-roots' public in terms of the heterogeneity of perspectives and experiences it can bring to the debate, the 'GM Nation?' debate could potentially address concerns pertaining to the domination of decision making processes by scientific expertise. Such a public debate, therefore, potentially creates a space where the normative and ethical concerns of participants raised in Part One of this thesis, could be heard, and openly deliberated in an official context. Secondly, by allowing the public to frame the issues themselves, 'GM Nation?' may provide a response to critiques of the asymmetrical communicative relationships and didactic practices which have traditionally characterized science-based governance. Simply stated, the AEBC and PDSB have outlined a debate which operates on the basis that alternative perspectives of risk offer a knowledgeable contribution to the Government in making a decision about the commercial future of GM crops.

In summary, whether the PDSB will be successful in engendering an open and inclusive public engagement with the commercialization of GM crops is likely to depend on the steering board's ability to translate its definition of the public, and its role in the debate, into practice. The remaining section of this chapter will look at some of the hurdles the PDSB may face in accomplishing this aim.

Key Issues Pertaining to the Success of 'GM Nation?'

The AEBC and PDSB will likely need to come to term with some key issues, or barriers, in making the 'GM-Nation?' debate a successful experiment in public engagement. To restate the point made in the introduction to this chapter, success is envisioned in terms of ideas of genuineness, openness and influence. Three points have stood out as being of particular significance in the run-up to the debate. Firstly, the ability of the debate to operate in way which can overcome what are termed fact / value distinctions is presented as an essential challenge facing the PDSB if the debate is to be successful in permitting the public to frame the debate issues themselves. Secondly, it is suggested that whether the debate will be able to engage with wider risk perceptions is partially contingent upon its ability to provide citizens with the opportunity to reflexively critique the facts and institutions involved in the production of scientific risk evaluations. Finally, the success of the debate in regenerating public trust in the governance of agricultural biotechnology will likely be tied to whether, or in what way, the Government permits the debate to influence its decisions about the commercial regulation of GM crops.

Distinguishing Between Fact & Value

One of the first things the PDSB did when it was first established was to invite a panel of social scientists with interests in the areas of risk and public engagement to sit in on the board's meetings and to offer the board advice. During the build-up to the establishment of the debate the panel offered an important critique of the process as the social scientists saw it. They were concerned that, even though the AEBC and PDSB had sought to generate a broadly focussed public engagement, the Government remained short-sighted in its approach to the debate. Overall, the panel members argued that the Government had not properly grasped the potential contribution of the public to the understanding of the risks of GM crops, particularly as related to issues of governance. This, as they saw it, was a consequence of the Government's persistent failure to overcome artificial distinctions between facts and values in its approach to the

controversy. They worried, in other words, that scientists were still being seen to speak about realities, where the public was seen to contribute additional perspectives about ethics and values. Thus, the panel argued further that the Government remained unable to comprehend the political dimensions attached to the pretensions of objectivity and truth operating behind the scientific epistemology and world-view (AEBC, 2002b: par.6). Recall, Richardson et al.'s argument cited in Chapter Six (1993: p. 16). These authors argued that the danger of distinguishing between factual and public knowledge, is that in doing so, governments have tended to place science in a hierarchical relationship with the public. Alternative risk perceptions are, therefore, potentially seen to be of lesser value than appraisals provided by science.

Irwin (2001b) makes a similar point in his assessment of an earlier attempt by government to engage with the public about biotechnology. Held between 1997 and 1999, the "Public Consultation on Developments in the Biosciences" sought to encourage a public debate about scientific issues, which might then be fed into policy processes. However, as Irwin argues in his critique of the process, these aims were undermined by the failure of the debate to allow the public to critically engage with the positions put forward under the banner of hard science and which operated under the pretenses of neutrality and conclusiveness. In this case, institutional assumptions about facts and public knowledge were built into the briefing materials given to participants to stimulate debate. Irwin describes the situation this way:

> "What seems especially noteworthy about the information provided is that, despite the advisory group's very apparent concern to maintain scientific accuracy, such statements inevitably combine social and scientific assumptions... [A] different approach to neutrality seems to have applied according to whether statements were construed as either factual (handouts) or non-factual (showcards). The apparent assumption within the exercise was that the 'hard facts' could be separated from matters of judgement and opinion. However, the selection of what counts as hard fact represents an inevitable judgement on the part of the exercise's promoters. Furthermore, and seen from an outside perspective, this fact/value distinction can be viewed as an attempt to limit rather than enhance discussion of the core issues. Within the exercise, there was very little scope for such hard facts to be exposed to critical scrutiny or contestation by more critical social groups outside the immediate group of advisors." (Irwin, 2001a: p.14)

The PDSB faces similar problems in developing the 'GM-Nation?' debate. Although the board has been operating on the basis that the public should be allowed to frame the debate themselves, this does not necessarily infer that fact/value distinctions are no longer relevant.

In this regards, it is worth noting that the Government's public debate is set to take place almost a half decade on from the point at which the controversy over the commercialisation of GM crops reached its heights. As a participant from the Food Standards Agency (FSA) described on the basis of her/his experience, although some significant public interest in the topic has been constant, since 1999 this has become more sporadic and disparate[5] (Participant V). Consequently, alongside its mandate to hold a public debate, the PDSB has also been asked to stimulate this debate in the first instance. As the AEBC puts the case to the Government, in order to establish a public debate, it is first necessary to: "raise public awareness of the science and the wider issues around GM crops, helping people gain access to the evidence and information they want and need to debate the issues" (AEBC, 2002a: par. 7).

The PDSB thus finds itself performing a balancing act between allowing the public to frame the debate itself and supplying the public with material to stimulate and in some degree to 'inform' the debate. It is around this idea of an 'informed debate,' where some members of the PDSB have expressed concerns, similar to those of the social scientific advisory panel, about the Government's perspective of the debate. For example, Environment Secretary Margaret Beckett, drew some criticism as a result of the language she used in announcing the creation of the debate to the public. She stated: "I believe it is crucial to have an informed and open debate about all these issues" (DEFRA, 2002b). Concerned with the integrity of the public's ability to engage scientific facts critically, some members of the PDSB felt the Minister's comments

---

[5] The participant states the following:
"There is less interest in the GM issue than there was. February 1999 was the peak for correspondence. As a division they were receiving 600 letters a week, but that has now dropped off to perhaps a dozen a month; maybe 20-30. The GM issue has taken a big dive in public concern, We still, as an agency, conduct market research and there is always question about consumer interest in GM issues. There is a significant background interest in GM, but it isn't the peak that it was, and it is declining. The last report probably had the GM concern dropping 5 or 6%, from 15-20% to 10-15% of people are interested." (Participant V)

suggested a perpetuation of government assumptions about the irrationality of public perspectives of risk. In other words, they worried that the public debate could potentially contribute to the belittling of public views by the Government instead of giving them genuine consideration as had been the AEBC's intention from the outset. The following quotation from the minutes of the PDSB's first public board meeting gives some idea of the contentiousness of this issue:

> "Some board members were clear that the primary objective should include reference to the debate being 'informed'. Other members pointed out that while this was of course desirable, informed debate had pejorative connotations to some, who would understand it in the context of GM as signifying patronising propaganda. Drawing on the nature of the debate as a dynamic dialogue, members agreed to reflect in the primary objective a sense of information and understanding flowing in two directions as a result of interactions between experts and the public." (AEBC, 2002c)

In summary, a key issue facing the PDSB in its attempt to promote a genuine and open public engagement on GM crops pertains to the board's ability to conduct a debate which is free of fact/value distinctions. The success of the exercise hinges, in part, on the ability of the board to provide citizens with the information required to engender a debate, without limiting the debate to a discussion of the 'facts' of agricultural biotechnology.

Presenting A Reflexive Critique of Science and Expertise

A second point of caution, closely related to the above comments, pertains to the ability of the "GM-Nation?' debate to provide a space where the public can offer a reflexive critique of scientific and expert models of risk analysis.

This argument is drawn from the influential PABE report on public perceptions of agricultural biotechnology in Europe. To recall from Chapter Four, PABE researchers sought to demonstrate that the public's concerns about GM crops and foods involved a broad range of moral and ethical concerns about risk, alongside those pertaining to safety issues. In addition, the authors of the report also posit that allowing the public to debate these risks in an official context implies allowing citizens to engage with the processes and assumptions underlying expert risk evaluations. In other words, they suggest that

the public must be permitted to critically reflect on the science of GM crops and the scientific evaluations which dictate current regulatory practice. The following excerpt from the PABE report picks up on these arguments and concisely states the challenge now facing the PDSB:

> "We believe that the objective of public participation should be to open up expert knowledge to reflexive questions about its own framing – how and why did it come to be focussed upon a particular definition of the problem? What were the alternatives and how were these deliberated? And what other possible questions have thus been neglected and why? All of these questions also involve the question: what kinds of knowledge are relevant to this issue? Very often the only effective way to achieve this form of reflexivity is by involvement of participants from outside the expert sub-cultures. This extended peer review may involve both lay publics and critical experts." (Marris et al., 2001: par. 9.6)

With these arguments in mind, the division of the Government's consultation on the commercialisation of GM crops into three strands proposes some critical questions for the PDSB. To recall (refer above), alongside the PDSB's remit to engage the public, a scientific strand and an economic strand have also been established in order to provide expert judgements about the potential risks of GM crops. It is, therefore, possible to speculate that the concerns raised about the Government's persistent reliance on fact / value distinctions may potentially be exacerbated by the Government's insistence on holding a debate in three parts. Some PDSB members have been wary of how the three strands will relate to each other, particularly in terms of how the Government will apply their advice in reaching a decision on commercialisation (AEBC, 2002c)[6].

Responding to these concerns, the Government has sought to reassure the PDSB by committing to an awareness of the uncertainty and variation involved in expert risk assessments as communicated by the science and economic strands. For example, the

---

6 This concern was again partly sparked by the Government's emphasis of the factual nature of the debate in announcing the establishment of the three strands. For example, the Government states:

> "Government intends that there will be three main components to the overall programme of dialogue: a public debate overseen by an independent steering board, and other strands looking at the economics and science of GM. The intention is to create a dialogue between all strands of opinion on GM issues, in light of the fullest available factual information." (DEFRA: 2002b)

Government has instructed the science strand to take account of the variety of conflicting scientific views about agricultural biotechnology. In the same sense that the public debate is not intended to provide a 'yes' or 'no' response to the issue of commercialization, the science strand is not intended to provide a "black or white" evaluation of the science of risk and GM crops. The following comments by Ross Finnie[7], made in a letter to the PDSB on behalf of the four UK administrations, exemplifies the Government's attempt to reassure the board of its commitment to this position. In the letter he asserts that all three parts of the Government's consultation hinge on the ability to contend with, and respect, the complexity of opinions expressed in each area. Moreover, he argues that the decision as to whether or not to commercialize GM crops will not be decided by any one strand alone, but by Ministers looking at the advice as a whole. He states:

> "It would be our intention to ensure that the scientific discussion is a genuine forum for debate where all shades of scientific opinion are exposed and debated. If it cannot attract the diversity of views which we are aware exist, then it will not have fulfilled its purpose. As with the public debate, we do not expect that the scientific or economic strands will draw black and white conclusions but will set out for Ministers the various issues which have been identified during the course of the exercise; issues on which there is a general agreement and issues where there is continuing uncertainty. It will be for Ministers to determine what weight to give any conflict of views which emerge when they consider these matters as part of the decision taking process." (DEFRA, 2002d)

If these comments offer some solace to critics concerned with the fact/value distinctions potentially introduced by the division of the consultation process into three strands, concerns remain about the interaction between the strands. From the outset the Government has been clear that, although the strands are managed separately, they are intended to work in coordination with each other. Finnie, shedding further light on this relationship, describes this relationship as being characterized by a "cross-fertilization" of information (AEBC, 2002d). For example, he suggests that the public consultation could potentially draw on the work of science strand to inform the public's consideration of a particular issue. Or alternatively, the public debate could help identify the types of

---

7 Ross Finnie is Minister of the Environment for Scotland.

risk issues on which the science strand should deliberate.

This interaction thus raises some critical questions for the PDSB in terms of the ability of the public debate to reflexively engage with the expert knowledge being compiled by the science and economic strands. If the economic and scientific strands are intended simply to inform public discussions – to inject scientific and economic knowledge into the debate – little chance may be provided to critically challenge the expert knowledge and the rationalities behind scientific risk assessments. If, on the other hand, efforts are made to allow the public to challenge the factual authority and epistemological assumptions of science and the market, along with the Government's reliance on these assumptions, then the debate may offer more success in engaging public perceptions of risk[8].

Governance and the Public Debate

Finally, the ability of the PDSB to conduct a meaningful and engaging public debate will also depend on how the debate is able to influence the Government's eventual decision on the regulation of GM crops, including those being evaluated as part of the FSEs. In this sense, the issues raised in Chapter Eight concerning the AEBC's uncertain relationship to official processes of decision making and regulation are equally as relevant for the PDSB in conducting the public debate.

In giving the PDSB its mandate to develop the 'GM-Nation?' debate the Government is ambiguous as to how the outcomes generated by this debate will be applied in relation to the regulation of new agricultural technologies. More specifically, the relationship between the public debate and the bureaucratic regulatory system remains indistinct and at time appears closed to discussion. For example, although the Government has been active in encouraging the development of a debate on the

---

8

Although the focus of this discussion has primarily involved the physical sciences and the influence and authority they hold over the determination of risk and the governance of new technologies, this does not mean that scientists are the only experts which can be open to this type of criticism. For example, similar concerns have been raised by members of the steering board about the "present thinking" of the economic strand. Specifically, members of the board were wary of the use of the Cost Benefit Analysis (CBA) approach being adopted by the strand. (AEBC, 2002d: par. 21-27).

commercialization of GM crops, it is also adamant that the debate be clearly separated from any decisions pertaining to the approval of specific crops. These decisions, the Government argues, will be made at a later date on the basis of "an objective assessment of all the available evidence of the Farm Scale Evaluations, other scientific evidence and information about the costs and benefits to the UK." (DEFRA, 2002c). The furthest the Government is willing to commit to the outcomes of the public debate is to state that it will take the public's views into account as far as possible. Responding to the AEBC's initial call for a public debate, the Government states:

> "Ministers will have to decide, within the framework of European legislation, whether the crops grown in the FSEs should be commercialized. Government is committed to taking public opinion into account as far as possible through an open decision-making process. There will be a public debate on the possible commercial growing of GM crops." (DEFRA, 2002a: par. 29)

The point to be highlighted here is simply that the determination of what constitutes "as far as possible" is a subject which is open to political interpretation. What issues are deemed relevant and what factors are deemed of lesser importance is a decision made solely by Ministers.

The concern this point raises is that if the 'GM-Nation?' debate fails to influence how the Government perceives risk in regulating agricultural biotechnology, then the debate process potentially undermines the principles of participation it started out with. If the purpose of 'GM-Nation?' is partly about regenerating trust and legitimacy in the institutions and practices responsible for governing risk and technological innovation, what the Government does with the public's advice is central to achieving this aim.

At points throughout this thesis, it has been argued that strategies to improve communication and build trust between government and the public should seek to create a two-way discussion between the two parties. This opposes past practices, such as characterized the BSE case, where the Government interpreted public concerns about risk as being misinformed, and hence sought to contend with these perceptions by communicating the scientific facts to the public. In this sense, the provision of a public debate is an important step in generating a dialogue between Government and the public which will potentially give a greater voice to citizens in evaluating risks in decision-

making. However, it appears evident that if the public contribution is ignored, or undervalued, in influencing the Government's regulatory position in relation to GM crops, the provision of that dialogue will be undermined. In other words, it is not enough to simply give a space for public voices to be heard. If the dialogue is to be successful then Government will have to demonstrate that it has listened and valued these contributions. To fail and do so could potentially alienate the public further from processes of decision making and generate a cynicism towards these sorts of public engagements in the future. The authors of the PABE report state the case well in arguing that in order to engender trust, governments must demonstrate that the views of the public are "understood, valued, respected, and taken account by decision-makers – even if they cannot all be satisfied" (Maris et al., 2001: p.88)

A member of the AEBC reaffirms this point in her/his own evaluation of the success of the exercise and the difficulty of the task faced by the PDSB. In her/his following comments, s/he identifies some benefits to holding the debate in the first instance. However, s/he further argues that the debate will also need to allow people to feel they have genuinely participated in the decision-making processes and have played a role in the governance of GM crops:

> "I think we are all fairly clear that what you can do is go out and spend money on a very sophisticated and systematic intelligence gathering, in terms of asking people what they think. Asking what people think the roles of these crops are and what they think should go into the final decision is something that the Government has never tried to do, so that would be valuable. But in terms of debating where things are going, that is a hard thing to do practically. But I think ultimately the success of the public engagement exercise depends on whether people can turn around and say 'oh yeah it had a good shot at getting everyone involved in what's at stake here,' and understanding what's at stake, and what should go into the final decision." (Participant J)

In summary, the success of the 'GM-Nation?' debate is likely to involve the ability of the PDSB and the AEBC to convince the Government to go against prevalent structures and ideological assumptions about expertise and governance. It will be necessary to have Government accept that the outcomes of the public debate offer an important and meaningful contribution to the understanding and governance of the risks posed by GM crops.

Conclusion

This chapter set out to provide a brief introduction to the ongoing development of a public debate over the commercialization of GM crops. Moreover, it has speculated on some of the factors which may potentially impact on how successful the 'GM-Nation?' debate will be in constructing a politically accountable and publicly legitimate exercise in governance. Although the overall tone of the chapter has been critical, the intention has not been to discount the potential benefits of this experiment in public engagement. Alternatively, following on from the discussion of the AEBC in the last chapter, the 'GM-Nation?' debate provides a unique opportunity to evaluate how many of the concerns raised by sociologists about the governance of risk and science can be achieved in practice. In this sense, through the above comments, I have sought to outline some critical issues framing how the exercise may be evaluated going into the debate this summer (2003).

Addressing the build-up to the debate, the AEBC and PDSB have had to come to terms with the way in which the idea of a 'public' is defined, and the role it is envisioned to have in the debate. More specifically, they were challenged to free the public debate from the rigid stakeholder politics which are seen to have dominated the controversy over agricultural biotechnology. The solution the AEBC and the PDSB propose to this challenge is to construct a debate which seeks fundamentally to access and give voice to the greatest variety of public attitudes as possible. A key aspect of this approach has been to allow citizens to frame the debate issues by themselves, without being restricted by the motivations of either the Government, or any of the other stakeholder groups. How these ideas are translated into practice during the debate itself remains an important issue in determining whether in fact the PDSB will be able to engender an inclusive and uninhibited debate about the commercialization of GM crops.

Moreover, three further issues were put forward which may create some potential barriers to the PDSB achieving the genuine, open and influential debate it has envisioned. The first two issues raise questions about how the 'GM-Nation?' debate will be able to mediate the relationship between scientific expertise and public knowledge. Building on the critiques made by the PDSB's social scientific panel, it was argued that

if the debate was to be truly genuine, it would be necessary to overcome fact / value distinctions and the hierarchical relationships they propose between science and the public. This implies furnishing a debate in which participants are not limited to debating only the facts about agricultural biotechnology, but in which citizens are able to interrogate factual claims to risks. In a similar vein, it was also argued that it is further necessary to allow participants to reflexively interrogate the scientific pretenses and assumptions which characterize risk evaluation and scientific governance. Finally, the potential influence, or lack of influence, the debate will have on the Government's decision whether or not to permit the commercial growth of GM crops presents a third issue determining the success of the debate. In this sense it was argued that it will be necessary to ensure that members of the public feel they have genuinely participated in, and impacted upon, the decision-making process.

CHAPTER TEN: CONCLUSIONS

As a case study, the controversy over new agricultural technologies has provided a complex and multifaceted picture of the political relations surrounding issues of risk, science and governance in Britain. It is a debate which has risen to prominence in a social context in which concerns over techno-scientific development and its potential hazards are increasingly a part of the nation's political consciousness. After more than four decades of turbulent social critique, agriculture in particular has become an area in which many of the political concerns facing Britons are being expressed and made apparent. The debate over GM crops and foods is, in this regard, linked to a wider debate over the application of science and technology in agricultural development. The controversy over new agricultural technologies can be seen in relation to those surrounding the application of chemical inputs in crop management, the monocultures of the green revolution and the recent outbreaks of BSE and FMD in Britain. Each case has raised questions about the relationship between the modernization of the agricultural industry, the welfare of the environment and the well-being of society. This research project has thus sought to address the particularities of the controversy over agricultural biotechnology, while also linking the issues raised in this case to a wider social and political context.

Conceptual Overview

In regard to this project, the analysis presented in this thesis has addressed the following research objectives. Overall, it has endeavoured to provide an understanding of the politics of new agricultural technologies, and how these politics are discussed and fought over. Guided by sociological research in the field, as well as by the empirical

data, these political struggles have been revealed in terms of debates over risk, science and governance. Through a series of in-depth interviews, and assisted by documentary data, a sample of the heterogeneity of voices and opinions involved in the debate over GM crops and foods has been conveyed by this project. In part, participants' descriptions of the political issues presented contrasting views of the benefits and risks of GM crops and foods. In some cases these explanations involved debates over the consequences of GM crops and foods on human health, or as was more often the case, on environmental welfare. Moreover, participants made these arguments in relationship to a series of normative contestations about the social relationships, values and institutions shaping agriculture, and British society more generally. Participants, in other words, were engaged in a politics characterized by a convergence of uncertainties. These related to anxieties about the immediate consequences of the technologies themselves, but also pertained to concerns about the social networks and normative contexts in which GM crops and foods are being constructed and governed.

The relationship between agricultural biotechnology and the life-industry proved to be one particularly striking feature of the politics of new agricultural technologies. The ways in which participants identified the risks and benefits of GM crops and foods related to their valuations of the role of industry and corporate capitalism in shaping agricultural development. More broadly, the delineation of risk further related to perceptions of the life-industry's actions in engendering either social progress, or regress, depending on one's position in the debate. Arguments such as these were made across a variety of situations. These included, for example, debates over the risks and benefits afforded to Western consumers by nutriceuticals and functional foods, as well as contestations over the capacity of GM crops to provide for the security and welfare of the developing world. Furthermore, participant accounts revealed debates over risk in relation to differing perceptions of the progressive role of the life-industry in society, as related to cultural ideals of democracy. In particular, the data suggests that participants' perceptions of risk are closely tied to beliefs about the life-industry's role in either promoting, or denying, consumers' rights of choice and control over the products they consume.

The role of science in society, and in agricultural development in particular, also emerged as a central feature of the political controversy over new agricultural technologies. Although participants from both sides of the debate saw science to be suffering from a loss in credibility and public trust, it is significant to note that no participant dismissed the progressive potential of science altogether. Rather, the participants described the controversy over GM crops and foods in relation to contestations over the types of science directing agricultural development and the social values underpinning these processes. Stated differently, these politics reflected concerns over what Nowotny et al. (2001) refer to as the social robustness of science – the ability of science to meet the social needs and normative expectations of the public. In part, these contestations appertained to how participants saw agricultural development in regards to differing perceptions of what constituted appropriate relationships between society and the natural world. GM crops and foods, for example, were deemed risky, or beneficial, depending on how they were perceived in relation to opposing visions of sustainability. Likewise, contestations over scientific robustness were made in relation to the ability of science to manage and protect society from the potential dangers of agricultural biotechnology. For example, whether agricultural genetics was deemed a risk to health or the environment, related to perceptions of the corporate control of genetic research and agricultural development.

The governance of agricultural technology, and the evaluation and control of risks in particular, comprised a further theme in this thesis. This topic has been approached analytically from two different directions. Firstly, the way in which participants spoke about and debated the hazards and advantages of GM crops and foods related to their confidence in the ability of governments to effectively manage risk. This included concerns about the ability of governments to protect the health of citizens and the integrity of the environment, but also pertained to a lack of faith in governments to make decisions which reflected the best interests of society as a whole. Linked with debates over the role of science in society, these uncertainties in the institutions of government identified risks in relation to contested perceptions of the factuality and authority of scientific knowledge in decision-making. Stated differently, debates over risk involved conflict over what are sometimes referred to as technocratic forms of

governance.

Secondly, the final three chapters of this thesis have described part of a history which has seen issues of risk and the governance of agricultural biotechnology come to occupy an important place in the official discourse and practice of the Government. In part, this is a consequence of the need for the Government to come to an eventual decision about the commercial regulation of first generation GM crops in accordance with its commitments to the EU. However, the high profile gained by these issues is also the consequence of past failures by governments to contend with risk issues in agriculture. Most significantly, the BSE case and Lord Phillips' report from the BSE Inquiry, have been documented as placing considerable pressures on Government to rethink its approach to risk, expertise and the governance of agricultural development. Following on from Lord Phillips' report, this thesis has observed this pressure being sustained through the establishment of the AEBC and its publication of the *Crops on Trial* report, up until the creation of the forthcoming public debate on the commercialisation of GM crops.

Thus, along with an analysis of the politics of new agricultural technologies, an attempt to document the capacity of the initiatives mentioned above to promote change in government practice has also been undertaken by this thesis. It has addressed the ways in which the types of social and normative politics participants described by participants can be acknowledged in the practices of governance. This analysis has not attempted to cast a final judgement on the success of these events in affecting the Government's approach to the regulation of new agricultural technologies. Nor, does it prejudge the Government's actions in this regards. Rather it has identified some critical issues relating to how successful these efforts may be in building an open, inclusive and meaningful process of understanding and governing risk.

Foremost, the Phillips Report, the AEBC and the 'GM Nation?' debate each contribute towards challenging government's assumptions about the factuality and authority of scientific knowledge. However, further persistence is required as it has been shown that these assumptions are deeply rooted in decision making practices. The challenge involves influencing both how governments and experts think about risk, and also how these assumptions are structured into the regulatory process.

Furthermore, this critique has implied the need to approach scientific expertise in relation to other forms of experiential knowledge, such as voiced by many of the participants in this project. Although the Phillips report is limited in this sense, both the AEBC and 'GM Nation?' have, to an extent attempted to overcome the didactic relationship between scientific expertise and other forms of knowledge. If the AEBC and the 'GM Nation?' debate can influence the Government into moving away from these perspectives, both stand a chance of engendering more democratic and politically accountable processes of decision making. Moreover, the analysis of this thesis suggests that opening the decision making process in this way could allow a wider number of perspectives to make a knowledgeable contribution, and a more robust evaluation of the risks of GM crops and foods.

Finally, in a political context in which 'openness' and 'transparency' have become key concepts shaping the Government's approach to risk. However, how far the Government is willing to take these ideas in regulating new agricultural technologies is a question being contested in the GM case. If these concepts are allowed only to refer to ameliorated processes of communication whereby the Government attempts to better inform the public about risks and about its actions in this regards, this will comprise only one step towards democratizing governance. If, however, ideas of transparency and openness are applied to allow the politics described by participants in this thesis to become acknowledged and considered aspects of governance, then significant progress will be made. Here it is worth noting that many of the participants who have given their time to this project are involved at various levels of the debate and in the governance process. Thus, this thesis does not necessarily propose the need for a construction of a radically new form of governance. However, by allowing social and normative aspects of the debate over new agricultural technologies to become an acknowledged aspect of governance, decisions about the future of GM crops and foods might be made in a more open and accountable manner. This would further enable democracy by allowing members of the public outside of 'expert' communities to engage and potentially even participate in the governance of risk and agricultural development.

Reflections on the Data

It was mentioned above that the analysis of the controversy over GM crops and foods presented in this thesis was motivated by both sociological research in the field, as well as by the interview data. It is the contribution of the latter which has generated many surprises over the course of this project and been responsible for reshaping not only the analysis of this thesis, but its conceptual approach as well.

In particular previous research I had conducted in Canada (Jones, 2000), and supported by a significant body of sociological research (ex. Levidow, 1996; 1991; Macnaghten & Urry, 1998; 1995; and Franklin: 2002), suggested that controversies over risk and biotechnology were shaped by social contestations over moral valuations of nature. Public attitude research in the UK also provided support for the idea that the controversy of agricultural biotechnology related to perceptions that genetic modification constituted meddling with natural systems (Grove-White et al., 1997; Marris et al., 2001). However, although one participant (Participant L) voiced in-depth concerns about biotechnology and the transgression of natural boundaries, her / his comments stood out in their isolation. In many more cases, participants rebuked lines of questioning which raised these sorts of issues. For example, one participant argued that such perceptions were "elitist" and in her/his experience limited to only a few organisations with a religious focus. Most people, s/he suggested were interested in the more tangible issues (Participant C). Another participant, a campaigner opposing the development of the technology, argued that these arguments were only a peripheral part of her/his political engagement with GM. S/he further chided colleagues that had "staked their claims" to the "immorality of biotechnology," and failed to broach the broader issues shaping the technology (Participant Q).

I do not wish to suggest that debates over GM crops and nature are not important factors in the controversy. Indeed, at places in this thesis have shown up in less direct ways. For example, how participants identified the role of science in promoting sustainability was closely linked to what they saw as appropriate society-environment relations. However, for most participants natural transgressions were not the motivating factors influencing their political approach to the controversy.

Alternatively, an unexpected emphasis on risks and social institutions in framing the way in which participants described the debate over agricultural biotechnology emerged in the data. Contestations over the life-industry, scientific expertise were repeating themes expressed by participants from all sides of the debate. The surprise was not that such concerns existed, but the degree and consistency with which they surfaced in the data, as well as the emphasis participants placed on them. Likewise, governance, as a factor influencing perceptions of risk and as a location in which the controversy was taking place, gained increasing prominence as both this thesis and the debate progressed. It is these factors which have shaped the empirical approach of this thesis and guided its conceptual approach, particularly in terms of the application of social theories of risk. In hindsight, a useful area of further research would be to address why moral issues pertaining to nature were not more prevalent in the arguments made by participants in this project, where they have been shown to be in the past.

Furthermore it is important to note that it has not been possible for this thesis to encapsulate the entire range of debates and concerns raised by participants. In this sense, some material has been passed over in favour of engaging with what I have interpreted as the most relevant features of the debate raised by participants. However, many other issues were raised which might very well have fit in with the research aims posed by this thesis and the approach it has taken to responding to these questions. In particular, the reform of the agricultural and food production systems was a further issue raised by several participants over the course of the study. In this regard, matters pertaining to the profitability of farming and the struggles farmers face in creating a livelihood on the farm were important issues raised by some participants. These issues will clearly gain even more relevance as the system of agricultural subsidies is due to be overhauled as part of the upcoming reforms of the EU's Common Agricultural Policy (CAP). Likewise, these debates were also tied to questions about the potential of an organic farming industry to provide an economically and productively viable alternative to industrial models. An analysis of these aspects of the data would, in the future, provide a useful extension to the understandings of risk, science and governance presented in this thesis.

Conclusion

To conclude, the comments of one participant are helpful in drawing out the contribution of this thesis and the sociological approach it has adopted to the understanding of the debate over new agricultural technologies. At the close of an interview where the participant had offered many useful insights about the debate, s/he raised some critical questions about the capacity of sociology to impact on the debate, as opposed to describing it in hindsight. The participant states the following critical challenge to sociology:

> "With all due respect, sociologists do tend to study things after the event. There will be all sorts of people studying nanotechnology in the social sciences in twenty years time, like its fashionable to look at GM now, where it wasn't very popular to look at it in the 1980s... I think that social scientists need to engage with policy processes and civil society, but really ought to move into effecting trajectories more." (Participant O)

On the one hand, I would have to agree with the participant. Sociology has more to offer than an understanding, or accounting, of debates over risk and science. In this regard, this thesis has thus sought to provide an analysis which might prove useful for actors involved in the debate, including the Government, to understand the variety of issues, and opinions at stake. The aim of which has been to provoke a more open and honest discussion of ideas of risk and agricultural biotechnology.

However, on the other hand, I would also have to disagree with the participant's valuations of the contribution of a sociology of GM crops and foods. This thesis has demonstrated that the issues at stake extend beyond the debates over these technologies themselves. Rather, this thesis has outlined several more persistent debates about the cultural values and relationships shaping not only agriculture, but British Society as well. The aim of sociology, as I see it, is thus to seek to engage with trajectories which go beyond the debate over the construction and governance of agricultural biotechnology. This thesis has hoped to shed light on those aspects of risk, science and governance which may also persist through debates over future innovations. Moreover, it has sought to do so in a way which might promote values of democracy, inclusion and equality in these debates, and as relate to knowledge specifically.

References

ABC

2002 *new choices, new challenges, new approaches: moving forward in the GM crops debate.* London: ABC.

AEBC

2002a *A Debate About the Possible Commercialisation of GM Crops.* http://www.aebc.gov.uk/aebc/public_attitudes_advice.html

2002b *GM Public Debate Steering Board, Advisory Discussion with Social Scientists.* http://www.gmpublicdebate.org/minutes/minutes_23102002.htm

2002c *Public Debate Steering Board, Minutes of First Meeting.* http://www.gmpublicdebate.org/minutes/minutes_20020913

2002d *Public Debate Steering Board, Minutes of Second Meeting.* http://www.gmpublicdebate.org/minutes/minutes_20021003

2001 *Crops on Trial, a Report by the AEBC.* AEBC: London.

2000a *Terms of Reference.* http://www.aebc.org.ac.uk/terms.htm

2000b *Membership Details.* http://www.aebc.org.ac.uk/membership.htm

Akrich, Madeleine

1992 "The De-Scription of Technical Objects" pp.205–224 in Bijker and Law (eds.) Shaping Technology/Building Society: Studies in Sociotechnical Change.Cambridge, MA: MIT Press.

Arblaster, Anthony

1994 *Democracy* (2nd ed.). Buckingham: Open University Press.

Atkinson, Paul and Amanda Coffey

1997 "Analysing Documentary Realities" pp. 45-62 in D. Silverman (ed.) *Qualitative Research: Theory, Method and Practice.* London: Sage.

Attaran, Amir and Rajendra Maharaj

2000 "Doctoring malaria, badly: the global campaign to ban DDT." *British Medical Journal* 321 1403-1404.

Banerjee, Subhabrata Bobby

2003 "Who sustains whose development? Sustainable development and the reinvention of nature." *Organization Studies* 24 (1) 43-81.

Bantjes, Rob

2000 "Modernism and the Machine Farmer." *Journal of Historical Sociology*. 13 (2) 121-141.

Barnes, Barry and David Edge

1982 *Science in Context: Readings in the Sociology of Science.* Milton Keynes: Open University Press.

Beck, Ulrich

1998 "Politics of Risk Society," pp. 9-22 in J. Franklin (ed.) *The Politics of the Risk Society.* Cambridge UK: Polity Press.

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

1996 "Risk Society and the Provident State" in *Risk, Environment and Modernity: Towards a New Ecology,* pp. 27-43 in S. Lash, B. Szerszynski, and B. Wynne (eds.). London: Sage.

1994 "The Reinvention of Politics: Towards a Theory of Reflexive Modernization" pp. 1-55 in U. Beck, A. Giddens and S. Lash (eds.) *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order.* Cambridge UK: Polity Press.

1992 *Risk Society: Towards a New Modernity.* London: Sage.

Bell, Michael Mayerfeld

1994 *Childerley: Nature and Morality in a Country Village.* Chicago: University of Chicago Press.

Benton, Ted

1994 "Biology and Social Theory in the Environmental Debate" pp. 28-50 in M. Redclift and T. Benton (eds.) *Social Theory and the Global Environment.* London: Routledge.

Berger, Peter and Thomas Luckman

1967 *The social construction of reality: a treatise in the sociology of knowledge.* New York: Doubleday.

Bijker, Wiebe E.

1995 *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change.* Cambridge MA: MIT Press.

Bijker, W. and J. Law (eds.)

1992 *Shaping Technology / Building Society: Studies in Sociotechnical Change.* Cambridge MA: MIT Press.

Boholm, Asa

1996 "Risk Perceptions and Social Anthropology: Critiques of Cultural Theory" *Ethnos* 61 (1-2) 64-84.

Bowden, Gary

1995 "Coming of Age in STS, Some Methodological Musings" pp. 64-79 in S. Jasanoff et al. (eds.) *Handbook of Science and Technology Studies.* London: Sage.

Brown, Phil

1992 "Popular epidemiology and toxic-waste contamination: lay and professional ways of knowing." *Journal of Health and Social Behavior.* 33 (2) 267-281.

The BSE Inquiry

1998 *Statement No. 31, Statement of John Selwyn Gummer MP.* http://www.bse.org.uk/evidence/ws/ws6.htm

Burningham, Kate and Geoff Cooper

1999 "Being Constructive: Social Constructionism and the Environment." *Sociology.* 33 (2) 297-316.

Burr, Vivien

1995 *An Introduction to Social Constructionism.* London: Routledge.

Callon, Michel

1986 "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St. Brieuc Bay". pp. 192-233 in J. Law (ed.) *Power, Action and Belief: A New Sociology of Knowledge?* London: Routledge.

Carson, Rachel

1963 *Silent Spring.* London: Hamish Hamilton.

Chapela, Ignacio H. and David Quist

2001 "Transgenic DNA introgressed into traditional maize landraces in Oxaca, Mexico." *Nature* 29 (November).

Coffey, Amanda and Paul Atkinson

1996 *Making Sense of Qualitative Data: Complementary Research Strategies.* London: Sage.

Collins, H.M. and Steven Yearley

1992 "Epistemological Chicken" pp . 301-326 in A. Pickering (ed.) *Science as Practice and Culture.* Chicago: University of Chicago Press.

Commoner, Barry

1972 *The Closing Circle: Man, Nature and Technology.* New York: Bantam Books.

Comte, Auguste

1880 *A general view of positivism* (2nd ed.). London: Reeves and Turner.

Cozzens, Susan E. and Edward J. Woodhouse

1995 "Science, Government, and the Politics of Knowledge" pp. 533 - 553 in S. Jasanoff et al. (eds.) *Handbook of Science and Technology Studies.* London: Sage.

Cronon, William (ed.)

1996 *Uncommon Ground: rethinking the human place in nature.* London: Norton & Co.

Dalton, Rex

2002 "Superweed study falters as seed firms deny access to transgene." *Nature* 419 p. 615.

DEFRA

2002a *UK Government, Scottish Executive and Norther Ireland Department of the Environment Response to Crops on Trial Report.* London: DEFRA.

2002b *Interim Response to Debate on GM. http://www.aebc.gov.uk/aebc/response_debate_GM.html*

2002c *Public Dialogue on GM, UK Government Response to AEBC Advice Submitted in April 2002.* http://www.aebc.org.uk/aebc/public_attitudes_debate_gov_response.html

2002d *Debate About the Possible Commercialisation of GM Crops.* http://www.aebc.gov.uk/aebc/public_attitudes_debate_gov_further.html

2001a "The Science of the Farm-Scale Evaluations" *GM Crop Farm-Scale: Background Papers.* London: DEFRA.

2001b *Genetically Modified Organisms: The Regulatory Process* (Booklet). Norwich: Crown Copyright.

DETR and MAFF

2000 *Environmental Protection Act 1990, Sections 111 and 112: Consent to Release Genetically Modified Organisms.* March, Ref. 99/R22/17.

Dickens, Peter

1996 *Reconstructing Nature: Alienation, Emancipation and the Division of Labour.* London: Routledge.

Douglas, Mary and Aaron Wildavsky

1982 *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers.* Berkeley: University of California Press.

Douglas, Mary

1999 *Implicit Meanings: Selected Essays in Anthropology,* 2nd ed. London: Routledge.

1992 *Risk and Blame: Essays in Cultural Theory.* London: Routledge.

1986a *Risk Acceptability According to the Social Sciences.* London: Routledge & Keegan Paul.

1986b *How Institutions Think*, Londond: Routledge and Keegan Paul.

1980 "Environments at Risk" pp. 278-296 in J. Dowie and P. Lefrere *Risk & Chance, selected readings.* Milton Keynes: Open University Press.

1966 *Purity and Danger: An Analysis of Concepts of Pollution and Taboo.* London: Routledge & Keegan Paul.

Downey, Gary

1998 *The Machine in Me: An Anthropologist sits Among Computer Engineers.* London: Routledge.

Durant, John (ed.)

1992 *Biotechnology in Public, a review of recent research.* London: Science Museum.

Eder, Klaus

1996 *The Social Construction of Nature.* Lodon: SAGE.

Einsiedel, Edna et al.

2001 "Brave new sheep – the clone named Dolly" pp. 313-347 in M.W. Bauer and G. Gaskell (eds.) *Biotechnology: The Making of a Global Controversy.* Cambridge UK, Cambridge University Press.

Escobar, Arturo

1995a *Encountering Development: The Making and Unmaking of the Third World.* Princeton NJ: Princeton University Press.

1995b "Imagining a Post-Development Era" pp. 211-227 in J. Crush (ed.) *Power of Development.* London: Routledge.

1996 "Constructing Nature, Elements for a Post-structural Political Ecology" pp. 46-68 in R. Peet and M. Watts (eds.) *Liberation Ecologies: Environment, Development, Social Movements.* London: Routledge.

European Commission

1996 "Commission Decision 96/239/EC of 27 March 1996 on emergency methods to protect against bovine spongiform encephalopathy." *Official Journal of the European Communities.* L78 (28 March): 47.

Ewen, S.W.B and A. Pusztai

1999 "Effect of diets containing genetically modified potatoes expressing *Galanthus nivalis* lectin on rat small intestine" *The Lancet* 354 (9187) 1353-1354.

Ezrahi, Yaron

1990 *The Descent of Icarus: Science and the Transformation of Contemporary Democracy.* Cambridge MA: Harvard University Press.

Fardon, Richard

1999 *Mary Douglas: An Intellectual Biography.* London: Routledge.

Ford, Brian J.

1996 *BSE: The Facts: Mad cow disease and the risk to mankind.* London: Corgi Books.

Foucault, Michel

1979 *The History of Sexuality Vol. 1 An Introduction.* London: Allen Lane.

1977 *Discipline and Punish: The Birth of a Prison.* London: Allen Lane.

1972 *The Archaeology of Knowledge.* London: Tavistock.

Fowler, Cary

1995 "Biotechnology, Patents and the Third World," pp. 214-225 in V. Shiva and I. Moser (eds.) *Biopolitics: A Feminist and Ecological Reader on Biotechnology.* New Jersey: Zed Books.

Franklin, Adrian

2002 *Nature and Social Theory.* London: Sage.

Frewer, Lynn and Brian Salter

2002 "Public attitudes, scientific advice and the politics of regulatory policy: the case of BSE." *Science and Public Policy* 29 (2) 137-145.

Fuller, Steve

2000 *The Governance of Science: Ideology and the Future of the Open Society.* Buckingham: Open University Press.

Gaskell, G., P. Thompson and N. Allum

2002 "Worlds Apart? Public Opinion in Europe and the USA" pp. 351-375 in M.W. Bauer and G. Gaskell (eds.) *Biotechnology, The Making of a Global Controversy.* Cambridge UK: Cambridge University Press.

Ghai, Dharam

1996 "Preface" in Blaikie & Renaud, *Biodiversity and Human Welfare* New York: United Nations Research Institute on Social Development.

Giddens, Anthony

1998 "Risk Society: the Context of British Politics," pp. 23-34 in J. Franklin (eds.) *The Politics of the Risk Society.* Cambridge UK: Polity Press.

1994 "Living in a Post-Traditional Society." pp. 56-109 in U. Beck et al. (eds.) *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order.* Cambridge UK: Polity Press.

1990 *The Consequences of Modernity.* Cambridge UK: Polity Press.

Gillies, Anne (ed.)

1998 *Enclosures of the Mind: Intellectual Monopolies: A Resources Kit on Community Knowledge, Biodiversiy and Intellectual Property.* Ottawa: International Development Research Council.

Goodman, D. and M. Redclift

1991 *Refashioning Nature: Food, Ecology & Culture.* London: Routledge.

Grint, Keith and Steve Woolgar

1997 *The Machine at Work: Technology, Work and Organization.* Cambridge UK, Polity Press.

Grove-White, Robin

2001 "New Wine, Old Bottles? Personal Reflections on the New Biotechnology Commissions." *The Political Quarterly* 72 (4) 466-472.

Grove-White, R., P. Macnaghten and B. Wynne

2000 *Wising Up: The Public and New Technologies.* Lancaster: Lancaster University.

Grove-White, R., P. Macnaghten, S. Mayer, B. Wynne

1997 *Uncertain World: Genetically Modified Organisms, Food and Public Attitudes in Britain. A Report for the Study of Environmental Change.* Lancaster: Lancaster University.

Hacking, Ian

1999 *The Social Construction of What?* Cambridge MA: Harvard University Press.

1998 "On Being More Literal About Constructionism" pp. 49-68 in I. Velody and R. Williams (eds.) *The Politics of Constructionism*. London: Sage.

Hannigan, John A.

1995 *Environmental Sociology a Social Constructionist Perspective.* London: Routledge.

Haraway, Donna J.

1991 *Simians, Cyborgs and Women, The Reinvention of Nature*. London: Free Association Books.

Harper, Douglas A.

2001 *Changing Works: Visions of a Lost Agriculture*. Chicago: University of Chicago Press.

Harvey, David

1996 *Justice, Nature and the Geography of Difference.* London: Blackwell.

Hodge, Bob and Robert Woog

1999 "Beyond reason in hysteria: Toward a postmodern model of communication and control in science," *Social Semiotics* 9(3): 375–92.

Horton, Richard

1999 "Genetically modified foods: 'absurd' concern or welcome dialogue?" *The Lancet* 354 (Oct. 16) 1314-1315.

House of Lords Select Committee on Science and Technology

2000 *Science and Society*. London: HMSO.

Hunt, Jane

1994 "The Social Construction of Precaution" pp. 117-125 in *Interpreting the Precautionary Principle,* T. O'Riordan and J. Cameron (eds.). London: Earthscan.

Independent Expert Group on Mobile Phones (IEGMP)

2000 *Mobile Phones and Health.* Chilton UK: National Radiological Protection Board (NRPB).

Irwin, Alan, Peter Simmons and Gordon Walker

1999 "Faulty environments and risk reasoning: the local understanding of industrial hazards" *Environment and Planning A.* 31 1311-1326.

Irwin, Alan, Allison Dale and Denis Smith

1996 "Science and Hell's Kitchen: The Local Understanding of Hazard Issues" pp. 107-125 in A. Irwin and B. Wynne (eds.) *Misunderstanding Science? The Public Reconstruction of Science and Technology.* Cambridge UK: Cambridge University Press.

Irwin, Alan and Brian Wynne (eds.)

1996 *Misunderstanding Science? The Public Reconstruction of Science and Technology.* Cambridge UK: Cambridge University Press.

Irwin, Alan

2001a "Constructing the scientific citizen: science and democracy in the biosciences," *Public Understanding of Science* 10 1-18.

2001b *Sociology and the Environment.* Cambridge: Polity Press.

1995 *Citizen Science: A Study of People, Expertise and Sustainable Development.* London: Routledge.

Jasanoff, Sheila

1990 *The Fifth Branch: Science Advisers as Policy Makers.* Cambridge MA: Harvard University Press.

Jones, Kevin E.

2003 "A Cautionary Tale about the Uptake of 'Risk': BSE and the Phillips' Report" in Stehr, N. (ed.) *The Governance of Knowledge.* New Jersey: Transaction.

2001 "BSE, risk and the communication of uncertainty: A review of Lord Phillips' report from the BSE Inquiry," *Canadian Journal of Sociology* 26(4) 655–67.

2000 "Constructing rBST in Canada: Biotechnology, Instability and the Management of Nature." *Canadian Journal of Sociology* 25 (3) 311-341.

Kaplinsky, N., D. Braun, D. Lisch, A. Hay, S. Hake and M. Freeling

2002 "Biodiversity: Maize transgene results in Mexico are artefacts." *Nature* 416 (4 April) 601-602.

Kitzinger, Jenny and Rosaline S. Barbour (eds.)

1999 *Developing focus group research: politics, theory and practice.* London: Sage.

Kitzinger, Jenny and Charlie Davison

2001 *Public perceptions of social and ethical issues around GM foods: a focus group study*. London: CMCR, Brunel University.

Kitzinger, Jenny, and Jackie Reilly

1997 "The rise and fall of risk reporting: Media coverage of human genetics research, 'false memory syndrome,' and 'mad cow disease'," *European Journal of Communication* 12(3): 319–50.

Kitzinger, Jenny

1994 "Focus Groups: Method or Madness?" pp. 159-175 in M. Boulton (ed.) *Challenge and Innovation: Methodological Advances in Social Research on HIV/AIDS.* London: Taylor & Francis.

Klintman, Mikael

2002 "The Genetically Modified (GM) Food Labelling Controversy: Ideological and Epistemic Crossovers." *Social Studies of Science* 32 (1) 71-91.

Kuhn, Thomas S.

1962 *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

Lassen, J., A. Allansdottir, M. Liskopoulos, A.T. Mortensen and A. Olofsson
2002 "Testing times – the reception of Roundup Ready soya in Europe" pp. 279-312 in M.W. Bauer and G. Gaskell (eds.) *Biotechnology: The Making of a Global Controversy.* Cambridge UK, Cambridge University Press.

Latour, Bruno and Steve Woolgar
1986 *Laboratory Life The Construction of Scientific Facts.* Princeton NJ: Princeton University Press.

Latour, Bruno
1999a *Pandora's Hope, Essays on the Reality of Science Studies.* Cambridge MA: Harvard University Press.
1999b "On recalling ANT" pp. 15-25 in J. Law and J. Hassard (eds.) *Actor Network Theory and after.* London: Blackwell.
1996 *ARAMIS, or the love of technology.* Cambridge MA: Harvard University Press.
1993 *We Have Never Been Modern.* London: Harvester Wheatsheaf.
1987 *Science in Action: How to Follow Scientists and Engineers Through Society.* Cambridge MA: Harvard University Press.

Law, John
1999 "After ANT: complexity, naming and topology" pp. 1-15 in J. Law and J. Hassard (eds.) *Actor Network Theory and after.* London: Blackwell.
1992 "Notes on the Theory of the Actor-Network: Ordering, Strategy, and Heterogeneity" in *Systems Practice,* 5 (4) 379-393.

Leach, Joan
1998 "Madness, Metaphors and Miscommunication: The Rhetorical Life of Mad Cow Disease," in *The Mad Cow Crisis: Health and the Public Good*, Scott C. Ratzan (ed.). London: UCL Press. 119–30.

Leiss, William
2001 *In the Chamber of Risks: Understanding Risk Controversies.* Montreal: McGill-Queens University Press.

Lepkowski, Will

2001 "Biotech's OK Corral", *Science and Policy Perspectives* 13 (July 9). http://www.cspo.or/s&pp/060902.html

Levidow, Les and Joyce Tait

1995 "The Greening of Biotechnology: GMOs as Environment-Friendly Products." pp. 121-138 in V. Shiva & I. Moser (eds.) *Biopolitics: A Feminist and Ecological Reader on Biotechnology*. London: Zed Books.

Levidow, Les

2002 "Ignorance-based risk Assessment? Scientific Controversy over GM Food Safety", *Science as Culture* 11 (1) 61-67.

1996 "Simulating Mother Nature, industrializing agriculture" pp. 55-71 in G. Robertson et al. (eds.) *Future Natural: nature|science|culture*. London: Routledge.

1991 "Cleaning Up the Farm." *Science as Culture* 2 (4) 538-568.

Little, Gavin

2001 "BSE and the regulation of risk," *The Modern Law Review* 64(5) 730–56.

Losey, John E., Linda S. Rayor and Maureen E. Carter

1999 "Transgenic Pollen Harms Monarch Larvae," *Nature* 399 (20 May) p. 214.

Luhmann, Niklas

1993 *Risk: A Sociological Theory*. Berlin: Walter de Gruyter & Co.

Macnaghten, Phil and John Urry

1998 *Contested Natures*. London: Sage.

1995 "Towards a Sociology of Nature" *Sociology* 29 (2) 203-220.

Mannheim, Karl

1936 *Ideology and Utopia: an introduction to the sociology of knowledge*. London: Routledge.

Marris, Claire, Brian Wynne, Peter Simmons and Sue Weldon

2001 *Public Perceptions of Agricultural Biotechnologies in Europe: Final Report of the PABE research project.* http://www.lancs.ac.uk/depts/ieppp/pabe/

May, Lord Robert

2000 *Review of Risk Procedures Used by Governments Advisory Committees Dealing with Food Safety.* London: Department of Trade and Industry.

Metz, Matthew and Johannes Fütterer

2002 "Biodiversity (communications arising): Suspect evidence of transgenic contamination." *Nature* 416 (4 April) 600-601.

Michael, Mike

1996 "Ignoring Science: Discourses of Ignorance in the Public Understanding of Science" pp. 107-125 in A. Irwin and B. Wynne (eds.) *Misunderstanding Science? The Public Reconstruction of Science and Technology.* Cambridge UK: Cambridge University Press.

Miller, David

1999 "Risk, science and policy: definitional struggles, information management, the media and BSE." *Social Science & Medicine* 49 1239-1255.

Miles, Susan and Lynn J. Frewer

2003 "Public perception of scientific uncertainty in relation to food hazards." *Journal of Risk Research* 6 (3) 267-283.

Millstone, Erik and Patrick van Zwanenberg

2001 "Politics of expert advice: lessons from the early history of the BSE saga." *Science and Public Policy* 28 (2) 99-112.

Motherway, Brian

2001 *The Environment in the Public Sphere: Democracy and discourse in the genetically modified organism debate in Ireland.* (Doctoral thesis) Department of Sociology, University of Dublin.

Murphy, Raymond

2001 "Nature's temporalities and the manufacture of vulnerability: A study of sudden disaster with implications for creeping ones" *Time and Society* 10 (2/3): 329-348.

1994a "The Sociological Construction of Science Without Nature." *Sociology* 28: 957-74.

1994b *Rationality & Nature: A Sociological Inquiry into a Changing Relationship*. Boulder CO: Westview Press.

Narang, Harash

1997 *The Link: From sheep to cow to man, Creutzfeldt-Jakob disease, bovine spongiform encephalopathy, scrapie*. Newcaste-upon-Tyne: H.H Publisher.

National Assembly for Wales

2002 *Response to Crops on Trial*. Cardiff, Minister of Rural Affairs.

Nelkin, Dorothy

2003 "Forward: The Social Meanings of Risk" pp. vii-xiv in B.H. Harthorn and L. Oaks (eds.) *Risk, Culture, and Health Inequality: Shifiting Perceptions of Danger and Blame*. London: Praeger.

Nelkin, Dorothy (ed.)

1992 *Controversy: Politics of Technical Decisions,* (3rd edition). Newbury Park CA: Sage.

Nowotny, H., P. Scott and M. Gibbons

2001 *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*. Cambridge UK: Polity Press.

Olson, Robert L.

1995 "Sustainability as a Social Vision." *Journal of Social Issues* 51(4) 15-36.

O'Riordan, Timothy and James Cameron

1994 "The History and Contemporary Significance of the Precautionary Principle" pp. 12-30 in T. O'Riordan and J. Cameron (eds.), *Interpreting the Precautionary Principle*. London: Earthscan.

Osborne, Thomas

1998 "Constructionism, Authority, and the Ethical Life" pp. 220-234 in I. Velody and R. Williams (eds.) *The Politics of Constructionism*. London: Sage.

Otway, Harry

1992 "Public Wisdom, Expert Fallibility: Toward a Contextual Theory of Risk" pp. 215-228 in S. Krimsky and D. Golding (eds.) *Social Theories of Risk.* London: Praeger.

PCFFF

2002 *Farming and Food a Sustainable Future*. Crown Copyright: London.

Pels, Dick

1996 "The Politics of Symmetry." *Social Studies of Science* 26 277-304.

Perrow, Charles

1984 *Normal Accidents: Living With High-Risk Technologies*. New York: Basic Books.

Phillips, Lord of Worth Matravers, J. Bridgeman and M. Ferguson-Smith

2000a *The BSE Inquiry Report: evidence and supporting papers of the Inquiry into the emergence and identification of Bovine Spongiform Encephalopathy (BSE) and variant Creutzfeldt-Jakob Disease (vCJD) and the action taken in response to it up to 20 March 1996.* London: The Stationary Office.

2000b *The BSE Inquiry – Volume 1, Findings and Conclusions.* London the Stationary Office.

2000c *The BSE Inquiry—Volume 4, The Southwood Working Party 1998–1999.* London: The Stationary Office.

2000d *The BSE Inquiry—Volume 8, Variant CJD.* London: The Stationary Office.

2000e *The BSE Inquiry—Volume 2, Science.* London: The Stationary Office.

2000f *The BSE Inquiry—Volume 5, Animal Health 1989–1996.* London: The Stationary Office.

2000g *The BSE Inquiry—Volume 11, Scientists after Southwood.* London: The Stationary Office.

2000h *The BSE Inquiry—Volume 13, Industry Processes and Controls.* London: The Stationary Office.

Potter, Johnathan

1996 *Representing Reality: Discourse, Rhetoric and Social Construction.* London: Sage.

Pretty, Jules N. and Rupert Howes

1993 "Sustainable Agriculture in Britain: Recent Achievements and New Policy Challenges" *IIED Research Series* 2 (1).

Pretty, Jules

2002 Agri-Culture: Reconnecting People, Land and Nature. London: Earthscan.

Price, Don K.

1965 *The Scientific Estate.* Cambridge MA: Belknap Press.

Prior, Lindsay, Peter Glasner and Ruth McNally

2000 "Genotechnology: Three Challenges to Risk Legitimation" 105-121 in B. Adam, U. Beck and J. Van Loon (eds.) *The Risk Society and Beyond, Critical Issues for Social Theory.* London: Sage.

Proctor, James D.

1996 "Whose Nature? The Contested Moral Terrain of Ancient Forests" in William Cronon (ed.) *Uncommon Ground, Rethinking the Human Place in Nature.* London: W.W. Norton & Company.

Prusiner, Stanley B.

1999 *Prion Biology and Diseases.* Cold Spring Harbor, N.Y.: CSHL Press.

1995 "The prion diseases," *Scientific American* 272(1): 530–31.

Pusztai, Arpad

2002 "GM Food Safety: Scientific and Institutional Issues", *Science as Culture* 11 (1) 69-92.

Radcliffe-Brown, A.R.

1957 *A Natural Science of Society.* Glencoe Illinois: The Free Press.

RAFI

2000 "Biotech's 'Generation 3'" *RAFI Communique* 67 (November). http://www.etcgroup.org (April 2002).

Rayner, Steve

1992 "Cultural Theory and Risk Analysis" pp. 83-115 in S. Krimsky and D. Golding (eds.) *Social Theories of Risk.* London: Praeger.

Richardson, Mary, Joan Sherman and Michael Gismondi

1993 *Winning Back the Words, Confronting Experts in an Environmental Public Hearing.* Toronto: Garamond.

Ridley, Rosalind M., and Harry F. Baker

1998 *Fatal Protein: the story of CJD, BSE and other prion diseases.* Oxford: Oxford University Press.

Rose, Hilary

2000 "Risk, Trust and Scepticism in the Age of the New Genetics" 63-77 in B. Adam, U. Beck and J. Van Loon (eds.) *The Risk Society and Beyond, Critical Issues for Social Theory.* London: Sage.

1998 "Social Criticism and the Human Genome Programme: Some Reflections on the Limits of a Limited Social Science" 115-130 in P. Glasner and H. Rothman (eds.) *Genetic Imaginations: Ethical, Legal and Social Issues in Human Genome Research.* Aldershot: Ashgate.

Rothstein, Henry, A. Irwin, S. Yearley and E. McCarthy

1999 "Regulatory Science, Europeanization, and the Control of Agrochemicals." *Science, Technology & Human Values.* 24 (2) 241-264.

Royal Society

1999 *Review of data on possible toxicity of GM potatoes.* London: The Royal Society.

Sandiland, Catriona

2000 "Domestic Politics: Multiculturalism, Wilderness and the Desire for Canada." *Space and Culture* 4/5 169-186.

Searle, John R.

1995 *The Construction of Social Reality.* London: Allen Lane.

Segal, Howard P.

1985 *Technological Utopianism in American Culture.* Chicago: University of Chicago Press.

Shackley, S. and B. Wynne

1995 "Global climate change: The mutual construction of an emergent science-policy domain." *Science and Public Policy* 22 (4) 218-230.

Shand, Hope

1997 *Human Nature: Agricultural Biodiversity and Farm-Based Food Security.* Winnipeg, Rural Advancement Foundation International.

Shapin, S. and S. Schaffer

1985 *Leviathon and the Air-Pump: Hobbes, Boyle and the experimental life.* Princeton NJ: Princeton University Press.

Shields, Rob

1991 *Places on the Margin: Alternative geographies of modernity.* London: Routledge.

Shiva, Vanada

1995 "Biotechnological Development and the Conservation of Biodiversity" pp. 193-213 in V. Shiva and I. Moser (eds.) *Biopolitics: A Feminist and Ecological Reader on Biotechnology.* New Jersey: Zed Books.

1993 *Monocultures of the Mind: Perspectives on Biodiversity and Biotechnology.* New Jersey: Zed Books.

Silverman, David

2001 *Interpreting Qualitative Data: methods for analysing talk, text and interaction* (2nd ed.). London: Sage.

Simmons, Peter and Gordon Walker

1999 "Tolerating risk: policy principles and public perceptions." *Risk, Decision and Policy* 4 (3) 179-190.

Snow, A., D. Pilson, L. Rieseberg, M. Paulsen, N. Pleskac, D. Wolf, and S. Selbo

2003 "A Bt transgene reduces herbivory and enhances fecundity in wild sunflowers." *Ecological Applications* 13 (2) 279-286.

Spaargaren, Gert and Arthur P.J. Mol

1992 "Sociology, Environment and Modernity: Ecological modernization as a Theory of Social Change." *Society and Natural Resources* 5 323-344.

Tansey, James

2003 "Risk as politics, culture as power" *Journal of Risk Research* (forthcoming).

Tesh, Sylvia Noble

2000 *Uncertain Hazards: Environmental Activists and Scientific Proof.* Ithaca NY: Cornell University Press.

1999 "Citizen Experts in Environmental Risk" *Policy Sciences* 32 39-58.

Thomas, Jim

1993 *Doing Critical Ethnogrpahy.* London: Sage.

Thompson, E.P.

1963 [1991] *The Making of the English Working Class.* Middlesex, Penguin.

Toke, Dave

2002 "Ecological Modernisation and GM Food." *Environmental Politics.* 11 (3) 145-163.

Walker, G., P.Simmons, A. Irwin and B. Wynne

1998 *Public Perception of Risks Associated with Major Accident Hazards.* Contract Research Report. Sudbury: HSE Books.

Watt, Kenneth E.F.

1973 *Principles of Environmental Science.* London: McGraw-Hill.

Welsh, James R.

1981 *Fundamentals of Plant Genetics and Breeding.* New York: John Wiley and Sons.

Wilkinson, Iain

2001 "Social Theories of Risk Perception: At Once Indispensable and Insufficient." *Current Sociology* 49 (1) 1-22.

Williams, Raymond

1997 *Problems in Materialism and Culture: Selected Essays.* London: Verso.

Winner, Langdon

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

Woods, M.

1998 "Mad cows and hounded deer: Political representations of animals in the British countryside," *Environment and Planning A* 30: 1219–34.

Wynne, Brian

2002 "Risk and Environment as Legitimatory Discourses of Technology: Reflexivity Inside Out?" *Current Sociology* 50 (3) 459-477.

1996a "May the Sheep Safely Graze? A Reflexive View of the Expert-Lay Knowledge Divide" pp. 44-83 in Scot Lash et al. (eds.) *Risk, Environment & Modernity: Towards a New Ecology*. London: Sage.

1996b "Misunderstood misunderstandings: social identities and public uptake of science" pp. 19-46 in A. Irwin and B. Wynne (eds.) *Misunderstanding Science? The Public Reconstruction of Science and Technology*. Cambridge UK: Cambridge University Press.

1989 "Frameworks of Rationality in Risk Management: Towards the Testing of Naïve Sociology" 33-47 in J. Brown (ed.) *Environmental Threats: perception, analysis and management.* London: Belhaven Press.

1982 "Natural knowledge and social context: Cambridge physicists and the lumineferous ether" pp. 212-231 in Barry Barnes and David Edge (eds.) *Science in Context: Readings in the Sociology of Science*. Milton Keynes: The Open University Press.

Yearley, Steve

1993 "Standing in for Nature: The practicalities of environmental organizations' use of science." pp. 59-72 in K. Milton (ed.) *Environmentalism: The View from Anthropology*. London: Routledge.

1992 "Green ambivalence about science: legal-rational authority and the scientific legitimation of a social movement." *British Journal of Sociology* 43 (4) 511-532.

1991 *The Green Case: A Sociology of Environmental Issues, Arguments and Politics*. London: Routledge.

Yoxen, Edward

1986 *The Gene Business, Who Should Control Biotechnology*. London: Free Association Books.

Appendix A – Time-line of Selected Events

Date	Event
1973-1985	Early Development of agricultural biotechnology.
1985	First case of mad-cow disease (BSE) identified in Kent, England.
1987	First GM field trial takes place (herbicide tolerant rape seed).
1987	Jeremy Rifkin tour of the UK, sponsored by the Green Alliance.
Feb. 1996	GM tomato paste hits the shelves of Sainsbury's and Safeway.
March 1996	Link established between BSE and vCJD in humans.
Oct. 1996	Importation of unsegregated soy products gains media attention and angers elements of the British public.
1998	Supermarkets (beginning with Iceland) move to remove GM ingredients from their own-label products.
Nov. 1998	English Nature calls for a Moratorium on GM foods and agriculture.
Feb. 1999	GM Foods, and the call for a commercial moratorium on GM crops, become part of the opposition platform of the Conservative Party in the House of Commons.
Feb. 1999	Initial comments concerning Pusztai's study of the health risks associated with GM potatoes are released through the media and taken up by the environmental lobby.
May 1999	Losey et al. Publish initial comments from their study on the effect of transgenic crops on the welfare of the monarch butterfly species.
Nov. 1999	Government and SCIMAC agree to a voluntary moratorium on the commercial growing of GM in order to conduct the FSEs.
Oct. 2000	Publication of Lord Phillips' Report from the BSE Inquiry
Dec. 2000	Monsanto merges with Pharmica and Upjohn to form Pharmacia. This represents a major step back for the life-industry.
Sept. 2001	AEBC publishes "Crops on Trial" report.
Nov. 2001	Chapella and Quist publish findings of their research suggesting occurrences of horizontal gene transference in maize species in Mexico.
April 2002	AEBC calls for a public debate on GM.
July 2002	Government establishes the national debate on GM – GM Nation.
Spring 2003	National Debate on GM – GM Nation
Spring 2003	Final harvest of FSE crops.
Summer 2003	First of FSE results expected. Further results expected in through 2004.

Appendix B – Biotechnology Generations (refer to RAFI, 2000)

Generation 1 – refers primarily to crops which have been genetically engineered to be either resistant to herbicides or to express insecticide genes. Critics of generation one agriculture biotechnology argue that they have been designed to perpetuate herbicide and pesticide usage by linking new crop types to specific chemical inputs. Proponents argue that generation one biotechnology enhances current pest and weed control methods, with the potential for decreasing the impact of agriculture on the environment.

Generation 2 – biotechnology refers to attempts to genetically modify the output traits of plants. Examples of generation two technologies include the genetic modification of fruits, such as the tomato and papaya, to retard their ripening, or the modification of crops for increased oil, protein or starch contents. Proponents of generation two technologies argue that they offer benefit by allowing industry to tailor crops to the specific requirements of the processor or the consumer. For example, slow ripening fruits have increased shelf lives, are easier to transport, have lower levels of wastage and require less inputs in processing. Critics of generation two biotechnology say that the benefits offered to consumers are minimal at best and potentially create environmental or food safety risks (RAFI, 2000).

Generation 3 – technologies designed specifically to offer consumers tangible benefits. These include products, such as functional foods, which are genetically engineered to offer either increased nutrition or other more specific health benefits. Examples include edible vaccines, cancer preventing vegetables, cholesterol reducing grains and foods with increased vitamin and nutritional qualities. The most publicized generation three product is Syngenta's golden rice which has been genetically modified to provide a high source of beta-carotene. The benefits of which, industry argue, are greatest for populations in the developing world where Vitamin A deficiencies and subsequent blindness are chronic problems. Critics, although able to see the potential of generation three technology, argue that the vast majority of products will directed towards consumer populations in the north with the goal of increasing corporate profits, thus detracting from their potential.

Appendix C – Participant Overview

In order to protect the confidentiality of research participants, their names along with the specific organizations they are associated have been omitted. For the same reasons biographical information has been kept to a minimum. Throughout the thesis participants will be referred to by a letter of the alphabet.

Participant	Description
A	• Senior research scientist working for non-profit collective which offers farmers innovations in crop protection and crop breeding. • Not involved in the innovation of biotechnology, focussing more on traditional breeding methods. • Has 30 years experience as an agricultural researcher.
B	• Senior manager of an industry association traditionally focussed on agricultural chemicals, but now with a mandate to represent industry interests in biotechnology.
C	• A lobbyist working for a campaign which has called for a temporary moratorium on the commercial growth and development of GM agriculture. • Has a long interest in social and environmental issues, and has become more politically active recently around the GM debate.
D	• Senior member of a consumer organization in the UK. • Has a twenty year history as a food policy expert in a variety of consumer groups. • Interests cut across the whole spectrum of food policy issues.
E	• Member of Parliament for the Labour Party. • Active in Government on issues of agriculture, biotechnology and governance.
F	• Senior member of a non-profit collective working to offer farmers innovations in crop protection and crop breeding. • Has a background in agricultural science. • Not involved directly in working with agricultural biotechnology.

G	• Member of a group of scientists who support agricultural biotechnology and who are vocal in bringing this message to the public. • Research scientist working the area of genomics in agriculture. • University based, but with links to industry and holds industry funding.
H	• Associated with a small non-profit organization representing the small and family owned farms in Britain. • Has primary interests in the relationship between agriculture and the public and in promoting sustainable agriculture. • First generation farmer with a small dairy herd.
I	• An active campaigner against GM technologies and the life-industry. • Involved as a "crop de-contaminator" in several high profile cases of GM crop picking. • Arrested and convicted on various charges related to the destruction of GM crop trials in the UK.
J	• Senior member of an environmental NGO looking at environmental issues and government regulation. • Member of the Government's Agriculture, Environment and Biotechnology Commission.
K	• Policy officer of an organization which promotes environmental sustainability and social welfare in food and agricultural policy. • Involved in environmental organizations around a variety of issues. • Has an educational background in science and pest management.
L	• Member of Parliament for the Conservative Party. • Formerly an Agriculture Minister and still involved in issues of agriculture and governance. • Has a background in business and the food industry in particular.
M	• Former GM campaigner involved in crop-picking activities. • Has a history of involvement in the environmental movement as a local campaigner. • Motivated to join the GM campaign by the local trialing of GM crops.

N	• Currently associated with a NGO concerned with genetic controversies in Britain. • Also, a member of the Government's Agriculture, Environment and Biotechnology Commission (AEBC) • Has a background in genetic science and activism.
O	• Research scientist and spokesperson for a large agrochemical and biotechnology corporation. • Has a scientific background in agronomy research, applied science and field development. • Involved in industry field trials of GM crops since the early 1990s.
P	• Member of an organization representing the interests of farmers in Britain. • Has responsibilities directly related to the development of agricultural biotechnology. • Owner / operator of a large farm in the United Kingdom.
Q	• Associated with a civil society organization dedicated to addressing issues involving biodiversity, sustainable agriculture and development. • Has been involved in food and agricultural issues in the developing world since the mid-1960s. • Became involved in the GM debate in the early 1980s.
R	• Senior scientists involved in the Farm Scale Evaluation. • Has had considerable involvement with a variety of Government appointed committees involving agriculture, science and technology. • Has a background in biology, although not in direct relationship to biotechnology.
S	• Member of a group of scientists who support agricultural biotechnology and who are vocal in bringing this message to the public. • An ecologist by training with further interests in chemistry and molecular biology. Specifically involved in the risk assessment of transgenic plants. • University based.
T	• A senior campaigner on GM for a large environmental NGO. • Motivated by an interest in natural history and environmental well-being. • Has been an environmental activist involved in a diversity of campaigns going back to the 1970s.

U	• Research scientist employed by a large agricultural biotechnology corporation. • Working on the genetic modification of bananas. • Educated in biology and plant biotechnology.
V	• Senior bureaucrat in the Food Standards Agency since the establishment of the agency in 2000. • Has background in hands-on farming, previously owning and operating a dairy and arable crop farm. • Left farming due to downturn in farm profits and a lack of stability in the agricultural economy.
W	• Research scientist and spokesperson for a large chemical and agricultural biotechnology corporation. • Has a background in crop protection and has been working with crop protection chemistry for twenty years.
X	• Senior bureaucrat within the Department of Environment, Farming and Rural Affairs (DEFRA). • Working in the regulation, control and policy on release of genetically modified organisms. • Has been involved in the regulation of biotechnology since the early 1980s.
Y	• Public Relations Officer of a large agricultural biotechnology corporation. • Has background in communications consultancy. • Educated as a scientist.

"Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot but plainly see that I have kept my word. But I now leave my cetelogical System standing thus unfinished, even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted tower. For small erections may be finished by their first architects; grand ones, true one, ever leave the copestone to posterity. God keep me from ever completing anything. This whole book is but a draught – nay, but the draught of a draught. Oh, Time, Strength, Cash and Patience!"

– Herman Melville, Moby-Dick; or the Whale (1856)