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Competitiveness versus 'clean and green'? The regulation and governance of GMOs in Australia and the UK

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Abstract

It is increasingly argued that we are entering into a "biotech century", in which biotechnology promises major advances in agricultural productivity. The development of biotechnology is not a straightforward affair, however, and the advent of GMOs has led to public protest and consumer resistance. This paper draws upon a comparative Australian–UK project concerned with the role of regulation and governance in mediating the debates and managing the associated risks. Regulatory responses and the mediation of conflicts by the Australian and UK governments have been shaped by the institutional and policy environments in these two countries. The implications of these public debates and regulatory responses for the capture of competitive opportunities are considered. The fact that the two countries have broadly similar systems of governance and regulation reveals how alike the circumstances are in many respects. But at the same time there are important differences in both the *style* and the *content* of the policy debates. In both the UK and Australia, the respective central governments remain committed to a 'biotechnology future'. Against this background, there is little doubt that the choices about biotechnology will play a defining role in shaping the future of rural places.

Keywords: Agricultural biotechnology; Governance; Regulatory analysis; Rural sustainability

1. Introduction

The development of genetically modified organisms (GMOs) is currently positioned as one of the most significant and contentious societal debates globally. Their significance arises from the perceived economic benefits to regions and nations that can successfully capture competitive advantages in research and development, counterposed by the possible threats to human health, long-term agricultural productivity, the pursuit of other competitive strategies for agriculture (such as organics or GM-free agriculture), and the environment (OECD, 2005). This paper is concerned with the development, social contestation, growth and regulation of the biotechnology sector, specifically GMOs in the form of seeds, crops and foods. Through a comparative study of developments in Australia and the United Kingdom (UK), we examine the interplay between the suggested benefits of adopting and encouraging the new technology and the negative aspects that may also arise, and the attempts that have been made through regulation and governance to mediate the debates and manage the associated risks. As Wright (1993) has argued, this kind of comparative analysis of the development of GMOs helps expose the arbitrary and political nature of decisions as well as the influence of agency operating at various levels, including particularly transnationally. Thus, regulatory responses and the mediation of conflicts by the Australian and UK governments have been shaped by the institutional and policy environments in these two countries, and we are interested in the implications of these public debates and regulatory responses for the capture of

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competitive opportunities. In this manner we hope to contribute to debates within geography on biotechnology and begin to tease out how "different assemblages of state-corporate-science networks construct legitimising platforms for continued biotech development" (Bridge et al., 2003, p. 172) and how local actors respond to these legitimising strategies.

Biotechnology promises major advances in the treatment of genetic disorders and disease, as well as prospective improvements in agricultural productivity in the form both of improved yields and lower costs of production (Foster, 2001). Major players in this biotech century are transnational companies seeking a return on their considerable investments in research and development (Hindmarsh and Lawrence, 2001; McCain, 1995). At the same time, national and regional policy makers regard biotechnology as a key to future economic growth and competitiveness (Bridge et al., 2003), and so the technology has become a "tool in the geopolitical strategies of the major industrial nations" (Hayward, 1998, p. 85). A key area in transgenic modification, and one where biotechnology companies have sought to gain global market advantage, is in the production and sale of genetically modified (GM) seeds and crops. The aim has been to produce crops with durable resistance to herbicides, to major insect pests and to fungal and viral diseases using naturally occurring plant genes (Leaver, 1999), in order, it is claimed, to increase food supply and security.[1] Indeed, the development of transgenic plants has been hailed as the advent of a new "green revolution" in agriculture (Leaver, 1999). It was estimated in 2004 by proponents of agricultural biotechnology that 81 million hectares of biotechnology crops were being grown by more than 8 million farmers in 17 different countries, up from around 68 million hectares in 2003 (Biotechnology Australia, 2005). This compares to an estimated 272 million hectares (672 million acres) of land under cultivation worldwide (Pew Initiative, 2004, n.p.).

The development of the biotechnology sector is not a straightforward affair, however. Opponents point out that of the four GM crops "aggressively introduced on the world market" (canola, cotton, maize and soybeans), "most of these GM crops are concentrated in a few countries", with more than 84% of GM crops being grown in the United States, Argentina and Canada in 2004 (FOEI, 2006, p. 6).[2] Their limited geographic spread, so far, is partly a result of the substantial protest movement and consumer resistance, centred especially in Europe. Critics of biotechnology see claims for its benefits as "greenwashing", designed to allay public disquiet (McMichael and Lawrence, 2001, p. 161–162). The opposition arises out of concerns over the environmental implications of GMOs (e.g., cross-fertilisation with native species) and the prospective risks to human health from the long-term effects of ingesting genetically modified foods (Carman, 2004). Additionally, while the assumption is that local and national competitiveness can be enhanced by capturing the *production* side, and especially its research base, there are issues regarding the *consumers* and *customers*. For example, if consumer resistance persists, and consumers and retailers continue to prefer GM-free products, then the competitiveness of local/regional agricultural networks may be threatened (Crook, 2001; Gray and Lawrence, 2001). Concerns have been particularly strong in the UK and Europe about consumer acceptance of GM crops and foods. Governments in Australia and the UK have sought to address these concerns through the development of regulatory structures and legislation.

New technologies invariably present opportunities for economic competition and growth, as well as presenting a range of risk factors, for example in terms of human health, existing economic enterprises and the environment (Crook, 2001; Norton, 2001). As the discussion above suggests, in the case of GMOs there is a tension between the anticipated opportunities for nations and regions that can effectively capture a proportion of the huge investments in R&D and the prospective benefits in terms of expected increases in productivity, and the risks to people and the environment. The benefits and costs are likely to be distributed unevenly; for example, economic benefits will accrue to transnational firms and the producers who adopt the technology, whereas the primary burden of potential risk will be borne by individuals who consume the products, food and fibre producers who opt for 'GM-free' production,[3] and the environment.

Biotechnology therefore raises questions about how its development should be governed and regulated (Polya, 2001). Broadly, governments have two alternative pathways to contemplate. One is to facilitate research in, and the development of, GMOs, reaping the claimed benefits of high yield, disease resistant crops. The other strategy would acknowledge the widespread consumer resistance, take a precautionary approach to the risks, and promote a 'clean and green' food and fibre system. The challenge in terms of governance and regulation is to decide which pathway to take. Not unexpectedly, governments have attempted to tailor responses that have the appearance of achieving a compromise between these two approaches.

Our particular focus in this paper is upon how the state in Australia and the UK, operating at a range of geographic scales (local, regional, national), is responding to

[1] GM crops of this kind are now referred to as "first generation crops [which] are designed for easier production on the farm"; more recently, crops have been developed with special characteristics, such as increased nutrition ("second generation crops"), and for use in producing pharmaceuticals or for industrial purposes ("third generation crops") (Glover et al., 2005, p. 10).

[2] FOEI (2006, p. 7) also claim that data published by industry sponsored organisations are estimates and in some documented cases "vastly inflated".

[3] These producers run the risk that their crops will be contaminated by GM crops grown or transported in the vicinity of their fields with subsequent potential loss of access to those markets where consumer resistance to GMOs is high.

both the opportunities and threats presented by GMOs, and how this intersects with government agendas relating to economic competitiveness and environmental and social sustainability. For example, global market forces impact more strongly on Australia than the UK because of the liberalisation and heavy export orientation of Australian agriculture.

Another question to consider is the extent to which the regulatory agenda is determined at the level of the nation state in the two countries. In Australia's federal political system, the constitutional division of powers and responsibilities between the Commonwealth and the six States[4] enables effective resistance to national environmental and natural resource management policies at the sub-national scale. In the UK, while government from Westminster remains paramount, the devolution agenda of the New Labour government has led to the establishment of the Welsh Assembly and the Scottish Parliament, creating opportunities for place-based resistance to the national GM agenda. The UK's governance structures are also subject to European Union legislation and this is particularly pertinent in the case of GMOs[5] (see Levidow and Borchert, forthcoming).

2. Regulation and governance in the GMO debate

Regulatory analysis provides a rich theoretical and analytical framework through which to investigate the formulation and implementation of policy and regulation. In particular, it affords the opportunity to focus on regulation as a *social process* and to show how the social contestation of regulatory change shapes public policy. In the agri-food sector and more widely, there has been a shift from government to new forms of *governance*, involving a range of organisations from both private and public sectors (Dibden and Cocklin, 2005; Higgins and Lawrence, 2005; Little, 2001; Marsden and Murdoch, 1998), with a consequent blurring of "the old distinction between market, state and civil society" (Goodwin, 1998, p. 10). In adopting a governance perspective, Goodwin (1998, p. 9) asserts that: "The role for government is seen as one of identifying stakeholders and then developing the relevant opportunities and linkages for them to be brought together to act for themselves".

Theories of governance based in regulation theory focus upon the formal policy and regulatory regimes enacted by the state (Lewis et al., 2002), but simultaneously acknowledge the involvement of industry, non-government organisations, communities and civil society in the construction of 'regulatory space' (cf., Hancher and Moran, 1989). A regulationist approach allows us to deal with the 'real regulation' (Clark, 1992) of laws and directives, but also with broader questions of governance involving the interplay between regulators, governments, industry representative bodies, protest and consumer groups, and industry. According to Lewis et al. (2002, p. 99): "[This] approach examines political struggles in and around the state and their mediation through the actual institutions, organisations, juridico-administrative arrangements and law-making in any specific setting…" We employ this state-based perspective on governance in the sense that our analysis is centred on the formal policy and regulatory frameworks governing GMOs in Australia and the UK; and in accordance with this approach our mapping of 'regulatory space' seeks to identify the power and influence of both state and non-state actors.

Regulation theory integrates the structural dynamics of capitalism with the institutional forms of society, two elements that together comprise a 'mode of social regulation' (Peck and Tickell, 1992). According to this theory, the mode of regulation is neither predetermined nor inevitable, as structural forms result from social struggles and conflict. The mode of regulation is the means of institutionalising these struggles between competing interests, establishing the conditions that reproduce and legitimate the balance between production and consumption within a particular "regime of accumulation" (Marsden et al., 1993). In the context of the biotechnology industry, McNally and Wheale (1999, p. 174) argue that biotechnological innovation constitutes a new "regime of accumulation", and the globalisation of intellectual property rights in GMOs and other biotechnologies constitutes a new "mode of regulation". Together they are creating a new global order and a new phase of capitalist development (Heller, 2001).

The regulationist approach places emphasis on the relationships between the main social actors in these processes, including local and national governments, which act as mediators (Hudson, 1994; Gibbs and Jonas, 2000). The strength of the approach is its ability to link economic restructuring to social and political processes and to relate political-economic shifts at local, national and international scales (MacKinnon, 2001). This approach is similar to what is termed the "institutional turn" in political economy, with a focus on the role of social practices and norms in structuring economic activity. Notions of embeddedness within such neo-institutionalist approaches emphasise the role of the wider societal environment of organisations in defining interests, shaping structures and influencing courses of action in order to provide the organisation with social legitimacy. Firms "have to be both economically efficient *and* socially legitimate in order to safeguard their growth and survival" (Dreyer, 1999, p. 89). Hence, we are interested in examining whether governments and biotechnology companies are attempting to construct "a new *discursive moment* to the mode of social regulation"

[4] In addition to the States of New South Wales, Queensland, South Australia, Tasmania, Victoria, and Western Australia, there are two territories (the Australian Capital Territory and Northern Territory) with a lesser degree of autonomy.

[5] The EU approval procedures are set out in Regulation (EC) No. 1829/2003 on genetically modified food and feed, while the approval of other GM products is covered by Directive 2001/18/EC on the deliberate release into the environment of genetically modified organisms. Labelling and traceability are also regulated by Regulations 1830/2003 and 1829/2003.

(Bridge and McManus, 2000, p. 12) to address the wider societal perception of GMOs as environmentally and socially detrimental (Bridge and McManus, 2000). In this manner they are attempting to redefine the discourses that help to legitimate a particular regime of accumulation and mode of regulation for GMOs.

Thus both companies and governments are attempting to redefine the biotechnology sector in terms of its contribution to such laudable aims as sustainable development, the biodiversity of developing countries and alleviating world food shortages, in the process providing a means by which firms can gain legitimacy for their operations (Brooks, 2005; Levidow, 2001). However, "promoters of biotechnology must walk a fine line in this game of symbols… The grand techno-myth is that with genetic engineering we can fine-tune nature, preserve its diversity while reaping its bounty" (Krimsky and Wrubel, 1996, p. 230). This strategy risks being undermined by a widespread "collapse of trust in politicians and 'experts' of all kinds" (Crook, 2001, p. 132), reinforced by reports of releases of GM animals and crops into the food chain and the environment (Hindmarsh, 2001; Panter, 1999; Polya, 2001).

In terms of the geography of regulation (Cocklin et al., 1997), our major focus is in examining how the competing claims over biotechnology play out at the national and regional/local scale. Specific national contexts will determine the trajectory of technological development, and biotechnology is "highly embedded in national environments and in national societal systems" (Hayward, 1998, p. 84). Some agencies in both Australia and the UK have argued that biotechnology should be supported as a key component of a knowledge-based economy and as an important factor in international economic competitiveness. However, in the case of GMOs, this may conflict with other national and local strategies for the agricultural and food processing sectors. For example, the adoption of GM crops could be at odds with the competitive advantage that some producers may gain through GM-free agriculture, organic production, distinctive place-based food products (Marsden, 2001), or the "clean and green" image of their region (DPIWE, 2001).[6]

The geography of regulation is important also because the processes of globalisation inherent in GMO developments are mediated at the national and sub-national levels, with attempts by particular localities to carve a niche for themselves in what may prove to be one of the most dynamic areas of the economy. One strategy has been to attempt to capture the benefits of globalisation in place, through the development of the "entrepreneurial" or "competition" state. As Cerny (1997, p. 272) argues: "the main focus of the competition state in the world… is the promotion of economic activities, whether at home or abroad, which will make firms and sectors located within the territory of the state competitive in international markets". Associated with these changes has been the shift from govern*ment* to govern*ance*, in the case of biotechnology involving not just state agencies but a range of other organisations from both private and public sectors (Hindmarsh, 2003; Parry, 1998). In Australia's embrace of biotechnology, Hindmarsh and Lawrence (2001, p. 23) observe that "a Byzantine web of formal contractual obligations and informal connections has emerged between public-sector research agencies – such as the CSIRO and universities, small biobusiness companies, and large global transnationals".

The shift to governance also involves the rescaling of regulation. Government agencies are the crucial institutional channels through which broader regulatory mechanisms are delivered to regions, acting as a filter to mediate and adapt national regulatory mechanisms (MacKinnon, 2001). While the state retains the ability to set standards through "real regulation", both consumers and companies have greater responsibilities. In the case of GMOs, the risks involved are being rescaled, with nation states and localities seeking to gain the benefits of biotechnology developments, while pushing the risks involved down to the level of the individual consumer and to companies and producers through an insistence on information provision, identity preservation of GM and non-GM produce, and food labelling (Crook, 2001; Lockie et al., 2005). Retail companies may in turn displace risks of consumer resistance onto agricultural producers by imposing requirements for GM-free products (Knight et al., 2005; Levidow and Bijman, 2002; Lockie et al., 2005).

3. Competitiveness versus sustainability: GMOs in Australia and the UK

3.1. GMOs in Australia

It has recently been claimed that Australia is "ranked sixth amongst the top biotech countries in the world and number one in the Asia-Pacific" (Biotechnology Australia, 2005, p. 2), though the basis for this ranking is not specified. There are estimated to be about 400 biotechnology companies operating in Australia, employing in the vicinity of 6100 people (Biotechnology Australia, 2005, p. 2). Only about 65 of the companies are involved in agriculture and, to date, relatively few genetically modified agricultural crops have been approved for commercial use within Australia. The Office of the Gene Technology Regulator (OGTR) has approved for commercial-scale release several varieties of GM cotton, GM carnations, and two varieties of GM canola. Notably, though, of the 300,000 hectares of cotton planted in the 2004–2005 year, 250,000 hectares were of genetically modified plants (Biotechnology Australia, 2005). Licences for limited and controlled field research trials have been granted for a range of other agricultural crops, including grapevines, papaya, sugarcane and wheat, as well as for trials of a cattle vaccine.

[6] For a critical discussion of this marketing claim, see Chang and Kristiansen (2004).

The biotechnology sector generally is seen as vital for national economic development. At the State level, Victoria, Queensland and New South Wales have each positioned themselves as leading centres of research and development in biotechnology, resulting in quite strong inter-State rivalry.[7] As a government report argues:

> Australia's industrial competitiveness, and hence our standard of living, will be strongly influenced by whether we can grasp the opportunities presented by biotechnology (Commonwealth of Australia, 2000, p. 9).

Although government support for the sector is predicated upon the economic contribution that the sector can make to national development, it is also recognised that there are "significant ethical and consumer issues and there are potential risks to the environment" (Commonwealth of Australia, 2000, p. 11). A key assumption of the federal government is that the solution to these challenges will come through engaging the wider community in a (managed) debate on the ethical and regulatory issues in order to gain the confidence of both consumers and potential investors; the inevitability of agricultural biotechnology is not at issue from a policy perspective. How the biotechnology industry develops within Australia will depend very much on how this debate is mediated by the Commonwealth and the extent to which the perspectives of the different stakeholders are accommodated.

To date, the main component of 'real regulation' is the Commonwealth's *Gene Technology Act* 2000 which has as its purpose "to protect the health and safety of people, and to protect the environment, by identifying risks posed by, or as a result of, gene technology, and by managing those risks through regulating certain dealings with GMOs" (Gene Technology Act 2000, section 3). The presumption is in favour of facilitating the development of biotechnology, while the underlying assumption is that public concern can be mediated through the introduction of a regulatory framework which prescribes the identification and management of risk and through dissemination of public information promoting the benefits of genetic engineering (Hain et al., 2002; Hindmarsh, 2001). This framework has been criticised for its focus on scientific assessments of health and environmental risks (narrowly defined) and its exclusion of consideration of potential adverse socio-economic impacts (Hain et al., 2002; Lawson, 2002). Key concerns raised in submissions to a review of the Gene Technology Act in 2005 included criticisms that the way in which the Act is worded or implemented does not take into consideration economic impacts and cultural and ethical concerns, employs a highly restrictive definition of 'environment' (for example, excluding roadside verges), and fails to apply the precautionary principle contained in one section (Gene Technology Act 2000 Review Panel, 2005).

While the Gene Technology Regulator has the authority to approve releases of genetically modified organisms, the various States have the ability to block release within their own jurisdictions. Within Australia, different States have responded in contrasting ways to the GMO debate. For example, while both Victoria and Tasmania see an opportunity for improved competitiveness from the technology, this has played out in different ways over recent years. Tasmania from the beginning expressed reservations about permitting GMOs, and the State Government first introduced (in 2001) and then extended (in 2003) a moratorium on the release of commercial GM crops (Joint Select Committee, 2001). By comparison, Victoria initially adopted a pro-biotechnology stance, with strategies to actively encourage the development of biotechnology in the agricultural and food processing sectors. The Government of Victoria stated in 2001 that: "In order to remain profitable in the face of increased competition and input costs, the agriculture and food sectors must continue to direct operations to the new economic paradigm. In the future agricultural innovation will largely be based on biotechnology" (Department of State and Regional Development, 2001, p. 20). However, the Victorian Government subsequently reversed its position, in mid-2004 introducing a four-year moratorium on the commercial release of genetically modified canola – the first GM food crop[8] approved for commercial release by the Gene Technology Regulator.

The reasons for these States' reluctance to allow introduction of a GM food crop (as opposed to the existing GM crops of cotton and carnations) are grounded in their perception of the risk to their markets. Political differences between Labour-dominated States and the conservative Liberal Australian governments may also have played a part. The Tasmanian government in 2001 placed a moratorium on growing commercial GM food and non-food crops for two years in order to protect the State's "market image". The risks identified were "in respect of Tasmania's international market reputation as a producer of pure, quality clean and green food products" (DPIWE, 2001, p. 20; see also Chang and Kristiansen, 2004). The potential advantages of maintaining GM-free status were considered by an Expert Committee to be that:

> As a niche producer of food and beverage products Tasmania may stand to make economic and market gains from not adopting gene technology until sensitivities in domestic and international markets decrease. Research on Tasmania's markets indicates

[7] Despite this rivalry, these three States formed the Australian Biotech Alliance in June 2003 to promote the Australian biotechnology industry overseas. The Alliance was joined by the other three States and New Zealand in 2004.

[8] However, it was pointed out by a scientist in 2004 that "the fact GM cottonseed oil is used in fast food preparation and sold as vegetable oil makes a mockery of the GM-free claims of some states. … It's really a polite fiction to claim that cotton is not a food crop because roughly 40% of our cooking oil comes from cotton." (ABC, 2004).

> that this may be the preferred option, at least in the short term, for food and beverage products until the economic and market impacts can be accurately quantified (Experts Group on Gene Technology, 2001, p. xvii).

An extension of the moratorium in 2003 for a further five years emphasised the importance of keeping Tasmanian *food* production GM free and specifically prohibited research trials with GM food crops "in the open environment" (DPIWE, 2003, p. 4).

In Victoria, the government's change of heart in 2004 about the commercial release of GM canola was influenced by a number of competing actors. The adoption of agricultural biotechnology was strongly supported by the Victorian Farmers Federation (VFF) and commodity organisations and by a determined lobbying effort by biotechnology companies (Bayer, Monsanto, Aventis) and research bodies. The rationale for the adoption of GM crops was disputed by the Organic Federation of Australia, the Australian Consumers Association, the GeneEthics Network, Greenpeace and an anti-GM farmers' lobby group, the Network of Concerned Farmers. In addition, there were indications that many farmers, including VFF members, were uneasy about the risks associated with adopting GM crops in the face of uncertain consumer responses. The State Premier, in announcing the extension of the GM moratorium, referred to the "deep divisions and uncertainty within industry, the farming sector and regional communities about the impact of GM crops on markets" (Dowie, 2004).

In the end, the decision to ban GM canola for four years was taken as a result of determined lobbying by two export-oriented milk-processing companies (Murray Goulburn Co-operative and Tatura Milk) which were concerned about the prospect of dairy feed supplies being contaminated by GM canola. They argued that "until consumers and markets are satisfied that GM material[s] are safe and environmentally sound, we simply should not risk jeopardising our existing clean-green image and competitive advantage in the market place" (Dowie, 2004). As part of a process that Winter (2003, p. 26) has described as "the construction of quality within conventional farming", Australian dairy processors have adopted rigorous quality standards in processing and have extended these standards to farm production through instituting farm quality assurance schemes (Dibden and Cocklin, 2005). In order to meet the expectations (actual or anticipated) of overseas consumers and importers in major dairy markets such as Japan and Korea, dairy farmers have been required to keep dairy products GM-free by avoiding GM feeds or potential contamination from GM trial plots in the vicinity (see, e.g., *The Weekly Times*, 11 June 2003). The State Government too appears to have swung round to the view that the risks of permitting the release of GMOs were too great. The State Premier related his decision to the importance of agricultural exports to the State, arguing that:

> Victoria is the largest exporter of food and fibre products. In particular, the state is Australia's largest dairy exporter with products worth about $2.5 billion each year … [and] on average, Victoria exports more than $1 billion of grain a year.
>
> We do not believe it is the appropriate time to introduce commercial scale GM technology to Victorian farms and risk overseas markets when Victoria's largest rural exporter and Australia's two major grain exporters have reservations (Dowie, 2004).

Currently the Australian Capital Territory (ACT) and all States (with the exception of Queensland)[9] have imposed moratoria on commercial cultivation (as opposed to field trials) of various types of GMOs for varying periods:

- GM canola in Victoria until February 2008 and the ACT until July 2006,
- all GM *food* crops in New South Wales until March 2008 and South Australia until April 2007,
- *all* GM crops in Tasmania until June 2008 and Western Australia until December 2009 (Agriculture and Food Policy Reference Group, 2006, p. 98).

Within the States, the wisdom of adopting GMOs remains open to debate within the farming sector and more widely: for example, in Victoria, the State Government has launched a consultation on ethical principles for biotechnology, including a discussion paper on community concerns relating to release of GM canola (VBEAC, 2003; see also DHS, 2005). The Australian Government, meanwhile, remains committed to development of all forms of biotechnology, which are seen as the way of the future, and has launched a major publicity campaign through its 'public awareness' agency, Biotechnology Australia, to convince farmers of the benefits of GM production, including a 12-page brochure inserted into rural newspapers. While this information brochure purports to "inform and prompt debate on biotechnology applications that will impact on rural communities in the future" (Biotechnology Australia, 2005, p. 2), it is notable that less than one of the 12 pages gives expression to anti-biotechnology perspectives; of 10 industry, science and farming representatives who are given voice in the publication, only one is opposed to GMOs. The Commonwealth is also reported to have "stepped up pressure on Australian states to lift bans on GM food crops" (Le Grand, 2005). A report released in February 2006 by a Commonwealth-appointed reference group[10] argues that "state governments should lift their moratoriums on the

[9] Queensland does not have a moratorium on growing GM crops and Roundup-Ready cotton is widely grown. However, conditions are considered unsuitable for growing GM canola, the only GM crop grown primarily for human consumption that has been approved thus far.

[10] The reference group is drawn from farming organisations and the food industry, and chaired by the President of the National Farmers' Federation, which strongly supports gene technology.

commercial use of GM crops immediately", despite admitting that there is a need to "clarify legal liability issues surrounding the use of GM organisms in agriculture and food products" (Agriculture and Food Policy Reference Group, 2006, p. 102).

Concerns expressed by dairy companies and other opponents have mainly revolved around the reactions of overseas consumers. However, the introduction of domestic food labelling for products with GM content over 1% per ingredient (Chang, 2005), and the decision to set the threshold for unintentional GM content in canola at the EU standard of 0.9% (Agriculture and Food Policy Reference Group, 2006, p. 100), also increases the requirements (and costs) for non-GM producers since the onus is on them to segregate non-GM from GM food crops (Anderson and Jackson, 2005). The narrow separation distances required by the Gene Technology Regulator have given rise to concern that cross-pollination may occur. In addition, there are doubts about the ability of the food chain to maintain strict separation between GM and non-GM crops – doubts that were underscored in 2005 with the news that GM canola had "been detected in samples of conventional varieties in Victoria" (Thomson, 2005).[11] Insurance against the risk of contamination is a major issue, with opponents arguing that biotechnology companies should accept liability for accidental releases or adverse impacts of releases of GMOs: "Non-GM farmers do not, and should not be expected to, accept liability for economic loss caused by GM contamination" (Network of Concerned Farmers, 2004). The Commonwealth government has, however, thus far argued against making any special provision for liability where segregation of GM products breaks down (Agriculture and Food Policy Reference Group, 2006, p. 99).

One means proposed for maintaining the integrity of non-GM crop production has been the notion of "GE-[or GM-]free zones' – areas within which GM crop production would be prohibited.[12] These exclusion zones have been proposed either for parts of States (e.g., Kangaroo Island and Eyre Peninsula in South Australia), or for whole States in the case of Tasmania and Western Australia (WA). The Premier of WA announced in March 2004 "that the entire State would be legally declared a GM-free area in order to protect the State's 'clean and green' status" (Farmonline, 2004). The preoccupation with maintaining the 'clean and green' image or 'brand' of Australia as a whole or of particular States (e.g., Brand Tasmania, 2005) may be seen as a way of differentiating the bulk commodities which Australia mainly produces and making a virtue of Australia's distance from world population centres (Chang and Kristiansen, 2004).

3.2. GMOs in the UK

Like Australia within its wider region (Asia Pacific), the UK is Europe's leading centre for biotechnology, with some 270 specialist companies employing over 14,000 people in 1999, with a further 200 companies providing related services, employing 25,000 people (DTI, 2000). This accounts for a quarter of all specialist European bioscience companies, with major companies including Glaxo Wellcome, SmithKline Beecham and Syngenta. Not surprisingly, therefore, there have been longstanding UK government strategies to promote the biotechnology sector as a key national strength contributing to the growth and competitiveness of the UK economy (Barry and Paterson, 2003). However, there has been strident public opposition to the development of GMOs, centred on risks to human health and the environment, and as a consequence the UK's major food retailers have taken action to make certain that their food is GM-free and, in some cases, that non-GM animal feed is used in their meat products (Levidow and Bijman, 2002). As the UK Department of Trade and Industry (DTI, 2000, p. 19–20) commented:

> The use of biotechnology in food processing and manufacturing was expected to grow but at present it has been stopped by retailers in response to consumer demand … It remains to be seen whether the companies which are developing GM crops can convince European consumers of the advantages of the new crops and foods.

For the UK national government, the whole issue of GM crops has been problematic. The Labour government has been keen to allow GMOs to be grown in the UK, both as part of its strategy to support the biotechnology sector, but also to avoid damaging UK–US relations. The latter issue is sensitive due to the widespread prevalence of GM crops in the USA and the important role of the US biotechnology industry. In 2003 the US challenged an EU moratorium on GM crops imposed in 1998, arguing that it was an unwarranted restraint on trade under World Trade Organisation (WTO) rules. In 2005, the WTO's provisional report ruled that the ban, based upon the precautionary principle, was a violation of WTO rules because it had caused 'undue delays' in the approvals process, was not based on an adequate risk assessment and was not scientifically justified (Mayer, 2005). The US also challenged EU labelling requirements for GM foods on similar grounds. From 18 April 2004, the EU ended its six year moratorium on GM and permitted GM foods to be sold inside the EU for the first time and in August 2005 granted a 10 year licence for imports of GM maize produced by Monsanto for use as animal feed[13] (*Guardian*, 9 August 2005). However, UK

[11] The Victorian Government dealt with this problem by increasing the level of allowable contamination on a temporary basis, a move seen as the thin end of the wedge by GM opponents (e.g., ABC, 2005).

[12] See Levidow and Borchert (forthcoming), for a fuller discussion of the matter of exclusion zones.

[13] Approval was achieved despite the opposition of more than half of the EU's 25 governments. At an earlier meeting of environment ministers, 14 opposed approval, four abstained and seven (including the UK) backed approval.

government support for the biotechnology sector, and the desire to maintain good relations with the US, has had to be balanced with continued widespread public opposition.

There have been a number of government-initiated attempts to allay fears through public consultation and through trying to establish 'sound science' on which to base policy. The most recent of these was the *GM Nation?* public debate and science and economic reviews. This process involved three years of crop trials in which scientists tried to establish whether GM crops are more environmentally damaging than conventional crops. The trials were limited to examining the impact on insects, weeds and plants of a limited number of crops – winter and spring canola,[14] sugar beet and maize. None of these initiatives produced a clear positive outcome for the government. The field trials showed both GM spring canola and sugar beet to be more damaging to the environment than conventional crops, while GM maize was less damaging. Given the prior approval for commercial planting for Bayer GM maize,[15] this meant that maize could legitimately be grown in the UK. However, a number of issues remained to be resolved, including the requirement to put the maize on the national seed list and the licensing of the herbicide Liberty.[16]

Other elements of the *GM Nation?* debate involved both scientific and economic reviews. The scientific review chaired by the government's chief scientist, Sir David King, emphasised the uncertainties and potential dangers of GM crops and called for greater caution and the need to protect both the consumer and the countryside (GM Science Review Panel, 2003). An economic review by the Prime Minister's Strategy Unit (PMSU, 2003a) concluded that:

> … at least in the short-term, weak consumer demand is expected to limit the demand for products containing GM foods, and therefore the economic value of the current generation of GM crops. In the long-term, public attitudes and the ability of the regulatory system to effectively manage uncertainties, will be key determinants of costs and benefits (PMSU, 2003b).

The report was also concerned that tight regulation would stifle innovation and have an adverse impact on the UK's scientific base. The public consultation exercise also revealed widespread public opposition to GM crops and foods with little confidence in either the government or the biotechnology industry (DTI, 2003; Mayer, 2004). As a newspaper report stated in summary:

> The government is now in a dilemma. With, at best, equivocal results from the farm scale trials, it cannot claim that any of its long consultations has come up with spectacular reasons for allowing GM crops to be grown commercially. But much is at stake, including international trade, relationships with the US and the future of Britain's science research base (*Guardian*, 2 October 2003, p. 4).

As in Australia, one of the problems has been to establish the separation distances between crops and the liability regime if GM crops contaminate ordinary or organic crops. These two issues are interrelated. If the government decides on separation distances that are subsequently found to have allowed contamination, then it raises the question of who the affected farmer can claim against – the GM grower or the government? Concerns over these questions led to government consultation with stakeholders in 2006 (DEFRA, 2006). This proposed requirements for specific standard separation distances for different crops[17] and for farmers to notify their intention to sow GM crops to neighbouring producers. In addition, DEFRA asked stakeholders for their opinions on three options for liability for compensation: using existing law, a voluntary industry-led scheme or a statutory redress mechanism. Government problems have been further compounded by the stance of the European Commission which has argued for wide separation zones between GM and other crops and compensation schemes for affected farmers underwritten by government (*Guardian*, 29 December 2004; see also Levidow and Borchert, forthcoming).

The UK government has suffered additional problems as a consequence of its own devolution agenda. Both the Scottish Parliament and the Welsh Assembly have been opposed to growing GM crops. The Welsh Assembly in particular has been enthusiastic about promoting Wales as an organic and GM-free agricultural landscape in order to reap the perceived commercial benefits of such a stance. Consequently, there has been substantial opposition to the implementation of the 1990 EU Directive on the deliberate release of GMOs. The deadline for implementation was October 2002, but Wales has so far lagged behind other parts of the UK, with the Welsh Assembly stating that it "takes a sceptical stance on GM crops and adopts the most restrictive approach possible within existing EU legislation. Our mission is to address these concerns, develop policies to take them forward and articulate these in both UK and EU arenas".[18] In the case of the Bayer maize, the Welsh Assembly refused to give permission (as did the Scottish Parliament). This had wider implications than for Wales alone, as UK regulations stipulate that a particular crop can only be grown in one country if the other two agree.

[14] Canola is more usually known as oilseed rape in the UK.

[15] The variety is Chardon LL (Liberty Link) T25, designed to be resistant to Bayer's Liberty herbicide.

[16] While licensing is not necessarily a problem, Liberty is thought to be outdated. In the USA farmers growing Bayer's GM maize mainly use Liberty ATZ; this contains atrazine, which is being phased out in Europe. Bayer subsequently announced that they would not market this variety of maize in the UK.

[17] These distances were determined through research by the National Institute for Agricultural Biology. DEFRA suggested distances of 35m for canola, 80m for forage maize and 110m for grain maize (DEFRA, 2006).

[18] www.countryside.wales.gov.uk/fe/master.asp? $n1 = 4$ and $n2 = 152$, Accessed 28 February 2006.

Table 1
Main elements of the UK's policy on GM after the consultation process

- Findings of the farm scale evaluations (FSEs) to be adhered to for maize, sugar beet and oilseed rape, leading to support for commercial growing of maize
- Growing of GM maize to be subject to the regime used in the FSEs for herbicide use
- A statutory code of practice to be developed to govern the growth of GM crops so as to limit contamination to other crops to a maximum of 0.9%[a]
- Possibility of lower thresholds than 0.9% to be explored for organic producers on a crop-by-crop basis
- Consultation to take place on an industry compensation scheme for non-GM farmers whose crops are contaminated and who suffer economic loss
- Government guidance to be provided on establishing GM-free zones
- Adoption of a case-by-case approach on the basis that it is scientifically justified and meets consumer concerns

Source: www.defra.gov.uk/corporate/ministers/statements/mb040309.htm and Mayer (2004).
[a] The 0.9% threshold is to meet EU labelling laws which require products with a GM content above this level to be labelled as such.

Despite the problematic and contentious evidence, the UK government remains favourable towards the use and growing of GM crops. In a policy announcement to the House of Commons on GM policy in March 2004, Margaret Beckett, Secretary of State for the Environment and Rural Affairs stated:[19]

> There is no scientific case for a blanket approval of all the uses of GM. Safety, human health and the environment must remain at the heart of our regulatory regime and rigorous and robust monitoring must be maintained. But equally there is no scientific case for a blanket ban on the use of genetic modification.

The main elements of the UK's policy are shown in Table 1. Despite the lengthy process of consultation and research it would appear that the public remain sceptical about GM crops. While the WTO decision on the EU moratorium could potentially lead to a greater acceptance of GMOs, alternatively it could equally be seen as risking a backlash and further opposition in the UK and the rest of the EU.[20] As Mayer (2004) points out, effectively UK government policy pleases nobody – not only are the wider public unhappy, but so too are the major corporate players. Syngenta moved its research headquarters from the UK to the US in 2004 "to be in a more positive environment for this kind of work" (Grant and Minder, 2006, p. 17), while Bayer CropScience decided to discontinue plans to commercialise GM maize in the UK following the March 2004 policy announcement, citing the economic implications of the delays (Bayer CropScience, 2004).

4. The UK and Australia compared

Wright (1993, p. 88) presents a rationale for cross-national analysis of the regulatory and governance experiences with respect to GMOs:

> … comparative analysis of policy formation in two countries that developed distinct systems of government control for genetic engineering is used for two main reasons: first, because differences in either conception or implementation underscore the arbitrary nature of decisions that might otherwise be seen as 'natural' or 'logical'; second, because interactions between two national systems provide important indications of the operation of transnational influences (especially, in this case, the influence of corporations and international scientific organisations and the interests of international governments in supporting the ability of their scientists and corporations to compete internationally).

Our regulationist framework points to these same lines of convergence/divergence and suggests other dimensions of comparison between national contexts. Common to both Wright's analysis and our regulationist approach is the interest in how social discourses associated with the development of GMOs have been framed, including the role of actors, the lines of argument that have been advanced, and the strategies that have been deployed in presenting arguments for and against GMOs. As our overviews of the UK and Australia reveal, there are obvious similarities. The UK government strategy has been to promote the biotechnology sector as a key national strength, in much the same way as the Commonwealth Government has done in Australia (Barry and Paterson, 2003). For both national governments, it is not just a matter of international competitiveness in the production of food, but also in the advancement of science in what is perceived to be a critical area of the knowledge-based economy.[21] At the same time, in both countries there has been strident public opposition to the development of GMOs, centred on risks to human health and the environment.

Differences in the framing of the debates in each country add interest to the comparison. A significant example of this is the relative importance of production versus consumption issues. In Australia, the debate has increasingly centred on the implications associated with *growing* GM food and fibre, whereas in the UK a great deal of the concern has been focussed on the risks associated with *consumption*. The two are, of course, intricately linked, since

[19] Statement available at www.defra.gov.uk/corporate/ministers/statements/mb040309.htm.
[20] Some commentators have argued that the main significance of the ruling is to gain access to markets in the developing world rather than in the EU (Grant and Minder, 2006; Vidal, 2006).
[21] See Scott (2001) and Watson (2001) for examples of the argument that the future development of developed economies rests upon knowledge-intensive activities.

the UK is a major market for Australian agricultural products. These differences have brought different actors to the fore in the two countries. As our discussion above reveals, in the UK consumer concerns have inspired the supermarkets to ensure their food products are GM free. Consumer pressure has also been effective in inducing the Australian government to introduce GM labelling regulations (Lockie and Salem, 2005), a victory that has largely defused opposition to GMOs by consumer groups.[22] However, as a net exporter of food and fibre, Australian food producers are highly sensitised to international market preferences and so it is at their end of the value chain that resistance to the introduction of GMOs has been both potent and persistent. This is evident in the concerns of both dairy farmers and processors over the use of GM feeds.

The negotiation, resistance and implementation of regulation at local and regional scales in both the UK and Australia points to the importance of place-based resistance. We showed in the earlier discussion that in the UK both Wales and Scotland have expressed strident opposition to GMOs, while in Australia the State of Tasmania has been similarly reluctant to permit the growing of GM crops; other Australian States have imposed moratoria, though possibly with less political commitment. In both the UK (Wales and Scotland) and Australia (Tasmania and Western Australia), proposals have been put forward for the designation of exclusion zones. With evidence of increasing consumer interest in 'clean and green', niche production, short food chains, and point of origin product labelling, these resistances might prove to be critical rural development strategies for some regions.

The social agency in discourses about GMOs and this place-based resistance map out a geography of governance and regulation which, as Wright (1993) suggests above, has an embedded transnational component. International economic and scientific competitiveness underpins the unabashed enthusiasm of both the UK and Australian central governments for GMOs, and aligns them with the transnational corporations, such as Monsanto, Glaxo Wellcome and SmithKline Beecham, that seek to capture the prospectively significant economic returns on investment in technology. In the way of many instruments of globalisation, resistance to GMOs is more locally based; indeed, in the UK it sits on a foundation of consumer concern, while in Australia farm businesses, which are primarily family-owned, have been notable sources of resistance. Some subnational governments in both countries have either sided with the anti-GMO debate or have, at least in the short term, elected to follow a precautionary path. Where resistance has been more ardent (as in Tasmania and Wales), the proposed zones of exclusion would be an emphatic regulatory response.

From a 'real' regulation perspective, the relations of power amongst actors and across the geographical hierarchy are of particular interest. Counter to our intuition, it does seem that the anti-GMO response, which in both countries is locally based and expressed in terms of threats to human health, the environment and local economies, appears to have gained a foothold. As we suggest above, the UK Government has been confounded in its attempts to open the way for GMOs, not the least because of widespread consumer concern. In Australia, all but one of the State governments have imposed temporary moratoria of one sort or another, and two States (Tasmania and Western Australia) are proposing to go further. In what is a possible sign of the success of the anti-GMO lobbyists, in both the UK and Australia transnational corporations (Bayer CropScience and Monsanto, respectively) have recently shelved plans for the development of GMOs. However, it may be questioned whether this represents a genuine retreat or a tactical (and temporary) withdrawal. It is notable that Aventis, which holds licences for GM canola in Australia, continues to campaign actively against the State moratoria with support from pro-GM farmer lobby groups.[23]

The central governments of both Australia and the UK now find themselves in the position of having to mediate social resistance, in the hope that they can hold the interest of global capital in investing in their respective 'biotechnology futures'. As our discussion above suggests, in both the UK and Australia this has involved a resort to the logic of science and community consultation exercises. In Australia, the Commonwealth's regulatory framework emphasises the science of risk identification and minimisation, along with public education (Hain et al., 2002; Lawson and Hindmarsh, 2006). A recent Commonwealth Government information brochure on biotechnology assures the public that: "The Regulator only issues a licence for dealing with a GMO if satisfied that risks to human health and safety and the environment can be managed appropriately" (Biotechnology Australia, 2005, p. 2). However, unlike the procedure adopted in the UK, no independent trials are conducted to check the veracity of the biotech companies' claims about their products. A recent case, where the Commonwealth Scientific and Industrial Research Organization (CSIRO) discontinued development of a GMO because of health concerns, has resulted in a battle of competing discourses: the government presents this incident as proof that the system works, while for opponents of GM technology it reinforces their mistrust of the technology and their doubts that a biotechnology corporation could be relied on to be so honest (Smith, 2005). Science has also not provided the unequivocal support the UK Government was hoping for but, in direct contradistinction to the precautionary princi-

[22] An exception is Greenpeace, which continues to campaign against sale of GM products and distributes a guide to GM content in items commonly sold by retailers. This campaign has, however, been ineffective thus far in persuading the two major supermarket chains to declare themselves GM-free.

[23] The close association between farmer proponents of GM and Aventis was observed by two of the authors at a Gene Technology Act Review consultation session in a Victorian country town in November 2005.

ple, the government has maintained that scientific ambiguity is no reason for a blanket ban (see quote above from the Secretary of State for the Environment and Rural Affairs).

5. Conclusions

Our comparative analysis of the recent experience with GMOs in the UK and Australia emphasises several interesting dimensions of governance and regulation, *viz*:

- The conflicting discourses in respect of GMOs, and the different visions these reveal as to rural futures.
- The role of agency and its influence in the debates over, and governance of, biotechnology.
- The nature of place and interest-based resistance.
- The 'geography' of regulation and governance.
- Power and its role in the mediation and negotiation of social contests over technological futures.
- The shaping by central governments of regulatory and governance responses, which in the case of GMOs in both countries is designed to mediate social resistance.

The fact that the two countries have broadly similar systems of governance and regulation benefits the comparison, and reveals how alike the circumstances are in many respects. At the same time, important differences in the debates in each country add value to the comparison. There are differences in the *style* of the debate, with the Australian government emphasising provision of information in order to persuade the public while the UK government has allowed a more open consultation. There are also differences in the *content* of the debate. A significant example of this is the relative importance of production versus consumption issues. There are also contrasts in the willingness of the national governments in both countries to accommodate (and accept) the legitimacy of farmers' concerns about risks and liability for contamination.

In both the UK and Australia, the respective central governments remain committed to a 'biotechnology future', including GMOs. Interestingly, in both countries the national governments and transnational biotech corporations have been thwarted to some extent in their efforts. The response by the respective governments has been to resort to 'science' in the hope that information and consultation will shift public opinion. Whether science will deliver certainty either way in the near term, or whether the central governments will succeed with the rhetoric of risk-based management, is unclear (Lawson and Hindmarsh, 2006).

As a recent Australian Government publication (Biotechnology Australia, 2005) admits, biotechnology will have important implications for the future of rural places. However, the debates about GMOs in both Australia and the UK expose very different conceptions of what the future should hold. The arguments in favour of GMOs centre on improving economic competitiveness in food and fibre production, the advancement of national science and developing a competitive edge in the 'knowledge economy', as well as invoking issues of global food security. Countervailing arguments focus on purported risks to human health and the natural environment. These discourses raise questions about the 'sustainability' of farming and rural communities; in some cases, they embed conceptions of rural futures that feature local production systems, 'clean and green' production, and short food chains.

What confounds this debate is that it may well not be feasible to keep the way open for both GM and alternative futures.[24] For example, significant risks arise from the "*irreversibility*" of the decision to adopt GM technology (Rix and Denniss, 2003, p. 17). Even if it is possible to achieve separation between GM and non-GM production, the costs of doing so are likely to exceed the willingness of consumers and markets to pay for maintaining this distinction. That being the case, it would almost certainly be the non-GM producers who suffer. There can be little doubt, then, that choices about biotechnology will play a defining role in shaping the future of rural places. We tentatively suggest that this future might be characterised by increased differentiation among commodity sectors and between large and small farms, spatial differentiation between GM and non-GM areas, increased economic vulnerability of producers if consumer resistance to GMOs continues, and increasing social tensions between GM and non-GM producers.

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[24] Cf. the article by Levidow and Borchert (forthcoming).

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