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CHAPTER TWELVE

Governance in Action in the Life Sciences: Some Lessons for Policy

Catherine Lyall, Theo Papaioannou and James Smith

Introduction

This book set out to question conventional notions of governance in response to calls for more critical debate and guidance on its application in specific policy areas such as the life sciences. Our characterisation of ‘governance’ has been broadly that of an increased role of non-government actors in policy-making through various participatory networks and mechanisms. In foregrounding governance as an inherently political process, concerned with articulating different actors’ interests, values and beliefs, we have also aimed at a more nuanced understanding of what ‘governance’ means and how it might be practised.

This book has engaged with the core problem that the life sciences do still require a considerable degree of conventional command and control style regulation. Many of the complicating factors identified in the application of the governance agenda to science and innovation-related issues arise from complex interactions between this still-necessary, government-based regulation and the more participative forms of policy-making that are being fostered both to promote national competitiveness and encourage

public acceptance of these new technologies. We have argued that there are actually limits to the all pervasive notion of 'governance' and that, instead, the multi-faceted policy and regulatory situation that applies to genomics and the life sciences more generally requires the existence of some form of a government-governance continuum or synchrony.

The preceding chapters have considered the application of some of the 'new tools of governance' to the life sciences from ethical, political, legal, social and policy perspectives and through a mix of theoretical, empirical and case study analyses. Despite the political (and academic) rhetoric about new governance approaches, our analysis highlights the enduring capacity of the state (in the North at least) to control and also to frame debates about new technology – hence 'the limits to governance'.

It would be expedient to suggest that, because we are dealing with the life sciences, concerns of biosafety and regulation necessarily keep the focus on government unlike other areas of policy. But this offers an overly simplistic interpretation of the issues. In fact, what this book demonstrates is a complex set of relationships between government and governance which influence all areas of science and innovation policy. This is the answer to Jordan et al. (2005) who ask whether governance has eclipsed government in the context of specific policy instruments and point to the need to move 'beyond theorising and conduct more detailed empirical testing'. In exploring how these new tools of governance might apply to the life sciences we have attempted to lift the debate from the realms of theory and rhetoric to examine real cases of governance in action.

This argument travels and our examples have sought to broaden out from the Westminster model. The cases discussed in the preceding chapters have ranged across

continents (Europe, Africa, Asia and America) and traversed multiple levels of governance including the national, international and supra-national. Authors in this book have examined legal instruments, regulatory systems, international conventions and research initiatives. Our thinking has been guided by a tripartite organising frame consisting of principles, processes and people. In discussing the principles of governance in the life sciences we have examined our conceptions of, and commentaries on, government and governance; how these are established; the role of justice and values, and the management of morality. We next examined some of the processes involved, both those that are well-established (such as the regulation of drug innovation in the US) and those that are in transition in southern African countries, as well as how processes translate across nations. Finally, we focused on people; which actors are involved in governance processes and what limits their involvement.

The Limits to Governance

Whilst it might be editorially convenient to think of *government* in terms of outputs (such as legal instruments) and *governance* as the process by which such outputs may be derived, we recognise that governance is indeed a slippery concept with multiple meanings and interpretations (Chapter 1). This presents difficulties around how and when it can be differentiated from traditional government perspectives. Coupled with this, there are well-articulated concerns that the move from government to governance presents problems of accountability and transparency: governance networks can, in practice, reduce open democratic debate (for example, Greenaway et al. 2007).

While it is common for the literature on governance to explore whether the informal authority of networks has supplanted the formal authority of government, we have turned this discussion on the 'limits to the state' (Rhodes 2007) into a question

about what limits governance. We have suggested that the policy and regulatory situation that applies to the life sciences presents a government/governance paradox. We have argued throughout the book for the existence of some form of government-governance continuum. This is not to resort to a simplified, linear dichotomy where the characterisation of any one policy situation is either ‘government’ or ‘governance’ but rather a duality or co-existence of the two in some measure – the ability to exist in a sense as both at any one time depending on the particular policy situation. Indeed even one of the main protagonists of the ‘hollowing out of the state’ now concedes that ‘the traditional instruments of government co-mingle, compete and conflict with the new instruments of governance to variable effect’ (Rhodes 2007).

We are therefore tapping into a well-rehearsed argument about the role of the state in governance and our argument is in line with other social and political scientists such as Peters and Pierre (2006, 213) who insist that ‘The state that remains in the face of numerous changes in governance is still a powerful actor. There may have been some hollowing out but when assessed more carefully we can ... see that the “shell” that remains retains much of its real power’.

What is novel is the focus that we have brought to bear on the life sciences in this debate where this apparent co-existence certainly does not always imply peaceful relationships. Rather it almost invariably leads to conflicts and tensions. Identifying these limitations can give us a clearer idea of the nature of the co-existence in order for life science technologies to develop and contribute to the public good in ways that are generally viewed as socially acceptable.

Arguing from both theoretical and empirical positions, the preceding chapters have identified a number of limits to governance. We have seen that modern politics

limit the fair distribution of opportunities and risks in genomics through a complex web of existing institutions and a dispersed range of heterarchical networks (Papaioannou). And we have explored cases (Milne and Tait, Laurie et al., Harmon, Nightingale and McLeish, Kanellopoulou) where in each situation, to differing degrees, a 'hard' government structure was still required in order to support the additional layer of 'soft', governance intervention. We have also identified geo-political limits which mean that some of the northern interpretations of governance are much less applicable in developing country contexts (Smith, Mugwagwa); this may in turn place limits on the role of non-governmental actors (Harsh, Bryant).

In highlighting the normative and empirical limitations of a governance approach to the life sciences, these examples of governance in action lead us to four lessons for policy which we now explore in more detail for the remainder of the chapter.

Governance is Dynamic

While the history of governance during the 20th century may appear as 'a shifting balance between government and governance' (Rhodes 2007), this should not be interpreted as a steady, uniform, linear progression from government to governance. Rhodes admits that 'the policy networks literature in general pays too little attention to change' and this is a serious omission in a fast-moving policy field such as the life sciences where, as we have already noted, policy and regulation often struggle to keep pace with the science (Tait et al. 2006, 379).

Although the state and its institutions remain central elements in governance, the latter is a dynamic process that responds to constant change. As Laurie et al. point out (Chapter 3), in the life sciences, change does not only concern biotechnological innovations but also values and interests. Thus, an effective governance regime in the

life sciences implies the ability to anticipate and respond to both biotechnological and ethico-political changes. This ability depends on the mechanisms which are in place to engage with stakeholders throughout the life of the scientific endeavour and thereby to identify, map and respond to any shifting dynamics around their values and interests.

Certainly, society has always had the task of steering its science and innovation activities. Before the term 'governance' was introduced and the model was well defined, steering was associated with the democratic state. However, even in that state-centric situation, the role of non-state actors was crucial. As Pierre and Peters (2000, 30) note, 'We now have better ways of identifying and conceptualising the role of non-state actors, but those actors were influential even before social scientists had the right words to capture their involvement in the process'. In the context of state-centric, democratic process, governance enhances or implicates certain values, and, as suggested by Harmon's case study of the Human Fertilisation and Embryology Act (HFEA) (Chapter 4), it must be continually reconsidered to ensure that those values are appropriate and that it is meeting them effectively. A deliberative governance process should lead to a more detailed and rich understanding of the policy issues and possibilities, including – at least in the life sciences – moral issues. To this end, political institutions and structures should produce a common framework of enforced rules of democracy. As Stoker (2006, 154) points out 'A democratic system does not require the participation of all the people or all of the time; rather, its defining characteristic is its openness to all'.

Democratic governance situations are almost always dynamic, implying not necessarily continuity but also breaks in the chain where, for example, a change in government or another 'event' may cause a disjuncture. Nightingale and McLeish (Chapter 6) illustrate this point in the case of biosecurity where global political events

have caused a backing away from governance measures and the reinvigoration of government controls. Likewise in the case of drug regulation, the Vioxx incident described in Chapter 1 resulted in tighter controls to prevent conflict of interest and ensure greater transparency, contrary to the generally de-regulatory climate. Staying with drug regulation, Milne and Tait (Chapter 5) highlight a complex, dynamic interdependence between government controls and governance processes. Ultimately governance in all its forms and through all its levers, is dynamic because it represents, firstly, an articulation between state and society and, secondly, because it represents a means to articulate values, beliefs and politics. Governance, as both a process and a vision of how state and society ought to interrelate, profoundly reflects the dynamism of change in all its facets, political, economic, societal, and this dynamism is thrown into yet sharper relief by the challenges laid before us by the life sciences. Capturing this dynamism is precisely what governance – as an effective policy process – should be doing. But, what many of the chapters have demonstrated, is that this remains both problematic and increasingly necessary.

Governance is Context Dependent

Recognising that new technologies in themselves shape (and are shaped by) the ethico-political context in which they are developed, exist and impact upon society, Smith (Chapter 7) examines the shifting context of science policy in development countries and reflects on what ‘governance’ actually means in the context of new bio-scientific technologies, weakening states and multiple, complex external dynamics. Many of the constructs and terms we rely on to describe and explain the governance of the biosciences in more developed countries are therefore much less precisely understood in the context of developing countries. Governance has its own genealogy in Africa and in

Europe. Yet the critiques surrounding governance, participation and NGOs in the North and South are similar.

The chapters by Mugwagwa, Harsh and Bryant explore the nature and limits of governance in these contexts where coordination and harmonisation of governance remain firmly centred on the state. As we have seen, using the example of biosafety policy processes in southern Africa, Mugwagwa (Chapter 8) brings to the fore some of the realities that technology governance faces in a developing country setting, making a case for multi-pronged approaches, including a return to government, even in an era where governments are generally agreed to be playing a receding role.

Harsh (Chapter 10), on the other hand, addresses another paradox. While discussions of new modes of governance create expectations and obfuscate the politics inherent in choices about biotechnology, he argues that, despite greater involvement of NGOs in the governance of biotechnology, decisions about developing biotechnologies are generally not more democratic or accountable. The addition of NGOs as another type of development actor has often made projects *less* democratic. Whereas the state's power in Europe may be eroding in a shift to governance, states in Africa have never had as much direct control of decisions. Harsh concludes that there is almost surely more room for the state and for government in the realm of biotechnology in Africa.

Harsh's conclusion provides an empirically grounded backing to one of the most critical arguments against governance; namely that discussions of governance create a misleadingly consensual picture of decision-making, even though there can be significant issues surrounding access, legitimacy and accountability. The problem, as Pierre and Peters (2000, 67) put it, is that governance often invites politically illegitimate and non-accountable actors into the processes of steering. Even if the

intention is to maintain lines of legitimacy and accountability, the complexity of the merging relationships between the state and non-state actors may make it difficult for citizens to understand how legitimacy and accountability function (ibid).

In some developing countries, of course, state actors are virtually absent. Therefore, governance gradually takes the place of weak or non-existent government and regulatory frameworks. In some other developing countries, government and the state facilitate decision-making through governance. The case of Mali (Bryant, Chapter 11) demonstrates an example of decision-making in action and allows us to ask questions about who should be involved in decision-making of this sort, and how *real* dialogue between scientists and citizens can be promoted in order to build better agricultural technologies for Africa's producers and consumers.

In arguing that governance is context-dependent we also acknowledge that, in practice, it can effectively be organised to operate independently or parallel to context, purposefully or not. Several of the chapters that focused on the governance of life sciences in developing countries highlighted the absence, retreat or weakness of the state. This can create spaces in which 'governance' processes may occur in parallel or apart from the state. Issues of scale and scope, both geographical and political, serve to embed or remove governance from its context. Several chapters highlight that the more 'successful' governance processes took place where context was more fully understood and engaged with. There is thus a need to understand how better to use governance to broaden decision-making with and within weaker states in order to bolster their poorer array of options, resources and policy instruments. There is a corresponding need to understand the politics and power of the governance process itself; it may be shaped by contexts but it also shapes contexts.

Governance is Political

The choice of policy tools reflects political and cultural norms (Chapter 1) and it is generally the case that the political sensitivity of the life sciences requires strong, direct governmental control rather than self-regulation. Although networks seem to play an important role in the steering of life sciences innovation, and wider stakeholder and public engagement inevitably leads to demands to bring a range of broader interests and values into consideration in these decisions, this process does not take away the need for political judgements about the direction to be taken. Such policy decisions are ostensibly science-based but have always been influenced by interests and values. The concept of governance has historically emerged from within the very concept of government. Therefore, by definition, governance is political.

Specifically, when it comes to aggregate political issues such as social justice, political judgements are presupposed of policy-making. Governance models need to address the normative and empirical limits of self-organisation and chaotic networking, opening the way for a plausible institutional response based on politically developed principles of distributive justice (Papaioannou, Chapter 2).

Harsh (Chapter 10) and Bryant (Chapter 11) argue that governance may both embody politics (as in the case of the highly politicised and politically-funded NGOs Harsh encountered in Kenya) and provide a means to resist powerful international political forces and engage with them locally – as the case of Mali illustrates. These cases represent different slices of politics and its relationship to decision-making and stand in opposition to the notion of processes and intermediaries as somehow apolitical and interested only in development which is very apparent in discourses regarding the role of science, and the life sciences, in economic, social and political development.

As Laurie et al. have argued (Chapter 3), one way to improve governance models and the experience of those stakeholders involved and affected is through the incorporation of mechanisms that make explicit the value-positions that inform and are supported by decisions or policies, and the articulation of reasons for these decisions or policies as they impact on the governance of the life sciences. However, another way to improve governance in specific areas of the life sciences is to bring back government command and control. Indeed, Nightingale and McLeish (Chapter 6) demonstrate a return to government: a re-emergence of state-centric security measures. In the politically sensitive area of biosecurity policy, rather than a reduction in traditional hard security and an incorporation of ‘new security challenges’, we have seen an expansion of hard security as nation states expand the scope of coercive control and implement new security legislation. The changes in biosecurity policy and its increasing interaction with science policy outlined in Chapter 6 highlight the limits of ‘governance’ as a theoretical concept. It is certainly true that recent changes in biosecurity policy can be easily fitted into a governance framework, but Nightingale and McLeish’s more detailed analysis highlights both major anomalies and more convincing explanations. While the implementation of new biosecurity measures has involved a degree of self-regulation this does not amount to a shift away from the state to public participation in governance.

We stated at the start of this chapter that we were aiming to achieve a more nuanced understanding of what ‘governance’ means and how it might be practised. Central to this is an acknowledgement that there is no ‘most appropriate’ mix of governance or ‘blend’ of policy tools as we discussed in Chapter 1. Instead, there is a constant ebb and flow and a shifting frontier between government and governance and a constant reconfiguration of the roles and limits of modalities of governance.

Governance, through its complexity and binding to context, reflects politics broadly-writ and in doing so reflects multiple contexts and perspectives, dynamism and change, in terms of what it articulates and how it ought to be practised. What is clear is that governance engages politically at multiple levels and in multiple ways.

Governance Cannot Stand Alone

Whatever way society chooses to steer the new life sciences, one thing is evident: governance cannot stand alone. Whether practised as an intimate engagement with the state, that may indeed call for a stronger state (Milne and Tait, Chapter 5) or performed as a series of parallel, external activities more closely linked to markets, innovation or R&D (Smith, Chapter 7), successful governance processes require engagement with government and the political state. Where this engagement takes place reflects the decision-making process, what decision is to be made, and who has the power and authority to make that decision. Informal governance processes do not always need to recognise national boundaries and can connect together new interest groups and interested parties in new ways. In part this reflects the particular nature of the life sciences and the benefits, risks and values it encompasses, in part it represents an increasingly globalised means of engaging with policy but ultimately it reflects the propelling need to engage with government.

Milne and Tait (Chapter 5) illustrate very clearly the necessity to foster innovation, but also to control risk when governing the life sciences. While the scientific complexity and public unease with new healthcare technologies typically proscribe industry self-regulation, overly burdensome regulatory regimes can thwart the speed of innovation and limit the number, dynamism and diversity of innovators necessary for a high-tech field to sustain itself. The premise of their chapter is that the

US Food and Drug Administration (FDA) has two programmes, the orphan product and fast track programmes for the development of new medicines, which serve as useful models of a regulatory system evolving towards a governance approach. These programmes evince certain characteristics associated with governance such as push-pull incentives and a problem-solving philosophy, but also demonstrate features of old-style command-and-control government, but with more control and less command. The authors suggest that these kinds of programmes have applications across a spectrum of different economies and technologies by combining industry incentives, increased government intervention, and stakeholder inclusiveness in an efficient approach that is not contrary to a governance agenda. Despite the tensions between the promotional role of a regulatory agency under governance and its public health oversight role under government, this evolved approach is only limited by the willingness of government to cede control in proportion to the willingness of industry to cede corporate self-interest and of public stakeholders to agree on public health priorities.

The paradox in this chapter is that, although more rather than less intervention from the top down is brought to bear, it is of a complicit rather than compelling nature, facilitating problem solving between policy targets and policy makers. Hence there is 'more control, but less command'. Milne and Tait argue that the orphan and fast track are exemplars of *government* programmes that function as *governance* tools at the regulatory system level. Combining industry incentives, increased government intervention, and stakeholder inclusiveness can be an efficient approach for promoting science and innovation that is not contrary to a governance agenda of encouraging both private sector investment and public engagement in a common goal. Thus we see a pragmatic example of a positive combination of government and governance

approaches although the authors acknowledge that there is a limit to the utility of this model, that limit in essence is framed by the bargain that how much control the government can give up is in direct proportion to how much self-interest the governed are willing to give up.

Several authors demonstrate why the challenges of this 'new governance' of science and innovation lie less in the philosophy of the approach but more in its execution. Laurie et al. (Chapter 3) add a further layer of analysis in their chapter which is the particular role played by interests and values within the rubric of new governance regimes. They describe how the UK Biobank has combined 'hard' government in terms of protecting the interests of participants as well as 'soft' governance taking into account different values and interests and ensuring continuing participation by members of the public in the biobank and its governance processes. Describing this as the 'Ethics+ approach', where the governance regime has been developed over and above existing regulation, they illustrate the way in which government and governance are not functioning as two poles of a continuum nor as two completely intertwined entities, but as a 'soft' wrapping of governance around a 'hard' core of government. These authors conclude that, while it is 'inconceivable' that government alone would provide a sufficient basis for the establishment of the biobank, equally the legislative framework was required to provide a layer of protection to participants without which trust in the biobank would be unlikely to be gained.

Other authors suggest a combination of deliberative governance and political (joined-up) government as a good solution to the problem of effective (both fair and problem-solving) steering of new life sciences innovation (Papaioannou, Chapter 2). This solution presupposes the democratic involvement of the life sciences. Government

and the political state can provide the framework within which deliberation can be realised. To some extent, this has already been happening. For example, the involvement of patient advocacy groups in funding, facilitation and management decisions on biomedical and genomic research is on the increase. This increase is coupled with the creation of innovative modes of governance, such as group management of collective resources (such as tissue banks and databases), contractual agreements, influence on research direction, and intellectual property solutions. But these developments still leave open questions for law and regulation to develop interactive but also hierarchical and control-style governance approaches in genomics (Kanellopoulou, Chapter 9).

Kanellopoulou highlights the necessity to develop new models of group protections that both meet the needs and values of non-governmental stakeholders such as patient advocates, but also reconcile these with the state's ability to exert some degree of control over their activities. In the absence of other protections, patient advocates increasingly seek to negotiate contracts in gene-discovery and drug-related research through private written agreements. Such contractual negotiations can help to avoid disputes but Kanellopoulou warns of significant concerns when groups rely on private means to negotiate and exert substantial control over the terms of research: these 'self-help' models may work in some instances but it is uncertain whether they would be enforced by the courts. This untested form of governance, lacking as it does an underlying legal (government) framework, appears to be the opposite of Laurie et al.'s model. Here we have the 'soft' wrapping of governance without the underpinning of 'hard' government and Kanellopoulou points to significant caveats about the viability of this stand-alone model.

In a similar vein, the HFEA 1990 (and 2001 Regulations) are command and control instruments, that nevertheless require a dynamic and ongoing balancing exercise which is forever being recast or reinvented as new technologies and processes come before the HFEA that were not envisioned when the regime was drafted. Harmon (Chapter 4) thus assesses that the HFEA's processes are an example of governance in action. Harmon concludes that, although the HFEA 1990 constitutes a deliberative democratic exercise closer to the governance pole where both its formulative and its subsequent operative processes reflect many of the elements of a governance model, its output (a legal instrument) ultimately supports the government model.

Mugwagwa (Chapter 8) also discusses the challenges brought to the theory and practice of governance by this multi-dimensional interface between a new technology, limited regulatory preparedness among countries and the (apparently inevitable) plethora of new institutions and processes to manage it. Mugwagwa's case study shows that the new international institutions developed to deal with new biotechnologies in the context of uneven regulation in southern Africa result in more engagement with governments and not less. Supra-national regulatory bodies do not replace national decision-making processes but instead provide new avenues for engagement and negotiation. Governance, ostensibly meant to harmonise regulatory processes and policy, provides new opportunities for debate, around how harmonisation and institutions should be built, and exposes new contexts and perspectives and ways to engage with states in southern Africa.

In underlining that governance is content-bound and political it is almost inevitable to also conclude that governance can only exist in relation to the state. The degree of reliance on the state, with government, hard law and regulation, may differ

through context, application and through time but it is always there. This plurality, which may be highly diverse, often contested and sometimes not visible or intuitive, forms the core of our analysis and of the focus of this book. The relationship between governments and governance may be fuzzy, oppositional, reinforcing or superficial, but it is always present and it is by understanding this relationship and its problematics that we seek to draw conclusions and lessons for policy from across our broad spectrum of perspectives and empirical studies.

Conclusion

According to Rhodes (2007) ‘a decentred approach treats policy advice as stories that enable listeners to see governance afresh’; so what then can we learn from the stories our authors have told?

As outlined at the start of this chapter, we have sought to problematise conventional notions of governance and participatory policy networks and have endeavoured to reconcile them with the often contradictory but still necessary government controls that attempt to both ensure public safety and promote national competitiveness through the life science industries. All of the authors in this book have tried to come to terms with different forms of this government-governance duality in the realm of policy-making for the life sciences. This co-existence is rarely symbiotic or entirely equal. Rather, it is weighted in different ways depending on the context, political system, historical trajectory and so forth. For example, in the context of developed countries and under circumstances of biosafety, we have seen the balance shift back to government control. By contrast, in the context of developing countries and under circumstances of the absence of the state, the balance shifts to governance networks and non-governmental actors. We have seen positive, synergistic

combinations of the two approaches with examples of increased government regulation leading to better governance of innovation (Milne and Tait, Chapter 5); governance processes leading to legislative outputs (Harmon, Chapter 4); and a government framework providing the protection necessary to support a governance approach (Laurie et al., Chapter 3). But we have also witnessed the enduring influence of power and politics, regardless of context.

Placing government and governance at the opposite ends of a hypothetical continuum has forced us to consider how they exist as a duality. We have found that government and governance rarely reside at opposite poles of this continuum. Instead their relationship is dynamic and evolutionary. There is a shifting frontier between government and governance that has to be decided upon on a case-by-case basis depending on the policy context. The cases offered as exemplars in this book demonstrate that this boundary is contested and fought over. This is not to conclude that there are no normative principles of governance of science and innovation. Rather such principles are ethico-political and presuppose the state in order to be implemented.

Certainly, the more deliberative and accountable the governance of science and innovation is, the more value is added to existing regulations. The latter are legitimate frameworks of action only if they are based on values and interests democratically debated through governance mechanisms. The preceding chapters also demonstrate that such governance mechanisms have been used, albeit with mixed success, to fill gaps in regulatory provision.

Chapter 1 set out some of the complicating factors involved in the application of the governance agenda to the life sciences, pin-pointing the challenge of how best to incorporate the most useful aspects of governance-based approaches and reconcile them

with the still necessary systems of regulation. Much has been written about public participation as a new tool of governance for the life sciences and there is broad agreement that we need new rules of engagement in the governance process for the diverse stakeholder groups involved (Chataway et al. 2006). How this engagement takes place again reflects the complexity of context and reminds us how rarely such processes may be applied elsewhere with any degree of success.

Policy-makers clearly believe that governance, in the form of improved participation in the policy-making process, will create more confidence in the resulting policies and ensure more effective implementation. But, as we have noted above, a focus on governance can both create a misleadingly consensual picture of decision-making and often invite politically illegitimate and non-accountable actors into the processes of policy-making. By examining some of the principles and processes of governance and focusing on some of the people and groups engaged in them, the preceding chapters go some way to debunking this 21st century myth that the challenges of policy-making for the new life sciences can be tackled simply by greater consultation. This approach overlooks the unresolved tensions in the expectations that, through participatory governance, policy-makers will simultaneously engage with a wider range of stakeholders; increasingly base their decisions on evidence; *and* be able to reconcile conflicting views of that evidence in order to deliver both greater transparency of new technologies to the wider public and greater accountability of the main commercial producers and users of those technologies.

The prevailing tendency to accentuate public participation in the policy-making process ignores the underlying complexities – and limits – of governance. By

acknowledging some of the limitations of current governance structures that we and our co-authors have identified, a more creative set of alternatives may emerge.

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