

The Best of Both Worlds: Maximising the Legitimacy of the EU's Regulation of Geoengineering Research

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This paper suggests how the regulation of Solar Radiation Management (SRM) field research in Europe could be designed to maximise the possibility of securing legitimacy. It argues that legitimacy is maximised when regulatory frameworks are legal, and also responsive, flexible, deliberative and inclusive. By adopting an 'incorporated' approach to assessing the risk of Solar Radiation Management (SRM) field research, the EU can import elements of 'directly deliberative polyarchy' into its otherwise orthodox constitutional regulatory approach thereby maximising legitimacy. The argument is new in so far as it juxtaposes two conceptions of procedural legitimacy – one institutional and the other functional – in the context of significant scientific uncertainty in the technocratic regulatory paradigm of the EU. The significance of the work is that it draws on these conceptions of legitimacy to advance a pragmatic model of institutional design which comprises procedures that maximise legitimacy with minimal disruption to the EU's institutional balance of powers.

I. Introduction

Back in 2009 the Royal Society's seminal report on Geoengineering the Climate stated that "the greatest challenge to the successful deployment of geoengineering may be the social, ethical, legal and political issues associated with governance, rather than scientific and technical issues".¹ Neither science nor politics can be excluded and both need to be combined in order to provide effective, reliable and legitimate regulation of geoengineering risk in the European context. Given the significant scientific uncertainty of some geoengineering activities, effectiveness and reliability may be more difficult to se-

cure than legitimacy, and so, as far as regulation is concerned, the focus should be upon securing a legitimate process. My contribution seeks to address how this effective, reliable and legitimate regulation can be achieved given the prevailing constitutional framework of the EU. In particular, European regulation of one type of geoengineering research – Solar Radiation Management (SRM) field research – could be designed to maximise the possibility of securing legitimacy.

Geoengineering has been described as "large-scale intervention in the earth's climate system in order to moderate global warming"² and can be disaggregated into at least two broad groups of activities:³ those

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1 John Shepherd et al, *Geoengineering the Climate: Science, Governance and Uncertainty*, (London: Royal Society, 2009), at p. xi.

2 Ibid.

3 There are now a range of different terms used for geoengineering and its component activities, such as 'climate engineering' in

Asbjorn Aaheim et al. "The European Transdisciplinary Assessment of Climate Engineering (EuTRACE): Removing Greenhouse Gases from the Atmosphere and Reflecting Sunlight away from Earth." (2015); 'Climate Intervention' in Committee on Geoengineering Climate, *Climate Intervention: Reflecting Sunlight to Cool Earth*. (National Academies Press, 2015), at p. 2. The debate about the classification of geoengineering techniques is ongoing. See Clare Heyward, "Situating and Abandoning Geoengineering: A Typology of Five Responses to Dangerous Climate Change." *46.01 Political Science & Politics* (2013); Olivier Boucher et al., "Rethinking Climate Engineering Categorization in the Context of Climate Change Mitigation and Adaptation", *5 Clim Change* (2014), pp. 23 et sqq.; Duncan McLaren, "Why We Shouldn't Be in a Hurry To Redefine Climate Engineering", 15th December 2015, available on the internet at <http://>

that remove or reliably sequester carbon,⁴ known as Carbon Dioxide Removal (CDR); and those that reflect sunlight to cool the earth,⁵ known as Solar Radiation Management (SRM).

As field research that takes place outdoors beyond the confines of the lab or the computational model, SRM presents huge regulatory challenges both technical and normative. This paper considers how, principally, the latter of two areas of regulatory scholarship – EU regulation of risk and science, and transnational private regulation (TPR) – may contribute to a solution. As “the new body of rules, practices, and processes, created primarily by private actors, firms, NGOs, independent experts like technical standard setters and epistemic communities, either exercising autonomous regulatory power or implementing delegated powers”,⁶ TPR scholarship offers some potentially useful insights which may also address the reluctance of states to be involved.⁷

Assessing attempts at creating legitimate regulatory frameworks this paper conceives of legitimacy in terms of the ‘legality’ of ‘transnational’ regulation, and briefly draws on Weber’s ‘ideal type’ of value-rational action as the basis of consent to the exercise of legal authority.⁸ However, legitimacy can also be conceived in functional and procedural terms as the conditions by which normative expectations can be met.⁹ Considering four such conditions – responsiveness, flexibility, deliberation and inclusion – this article argues that legitimacy is maximised when regulatory frameworks are both legal *and* responsive, flexible, deliberative and inclusive.

The task of demonstrating *how* a European regulatory framework for SRM field research maximises the possibility of securing legitimacy, by drawing on areas of transnational private regulatory scholarship and EU regulation of science and risk, is challenging, largely on account of the lack of empirical data. In this article I suggest that notwithstanding the germinal state of SRM field research, an embryonic regulatory framework is discernible which can be characterised as nascent transnational private regulation (nTPR) and assumes that, in the EU context, the direction of travel will be from nTPR to more full-blooded EU regulation.

My claim is that where there is significant scientific uncertainty ‘incorporated’ risk assessments, as opposed to ‘isolated’ ones, should be used in the EU’s regulatory frameworks for SRM field research so that legitimacy can be maximised. An incorporated risk

assessment involves science and politics simultaneously and contrasts with the isolated approach – one adopted in the technocratic paradigm – which engages science only in the assessment of risk; politics is consigned to the management of that risk. By adopting an incorporated approach to risk, the EU can maximise legitimacy in three ways: legitimacy as legality, supplementing the conditions for deliberative and inclusive participation in decision-making processes and by transforming a rigid regulatory framework into a flexible and responsive one. This is a novel claim in that it advocates a regulatory mechanism – the incorporated risk assessment – which provides a space for inclusion and deliberation *within* a technocratic regulatory framework.¹⁰

Three substantive sections of the paper set out more fully the problem posed for legitimacy by SRM field research, the difficulties of the EU’s orthodox response to that problem, and finally my alternative response based on the incorporated approach to risk assessment. Section II, A Challenge for Legitimacy, defines SRM ‘laboratory’ and ‘field’ research and goes on to suggest that there may be instances when the effects have significant scientific uncertainty. Sig-

dcgeoconsortium.org/2015/12/15/why-we-shouldnt-be-in-a-hurry-to-redefine-climate-engineering-duncan-mclaren/ (last accessed 6th January 2016).

- 4 Committee on Geoengineering Climate, *Climate Intervention: Carbon Dioxide Removal and Reliable Sequestration*. (National Academies Press, 2015).
- 5 Committee on Geoengineering Climate, *Reflecting Sunlight to Cool Earth*, *supra* note 3.
- 6 Fabrizio Cafaggi, “New Foundations of Transnational Private Regulation”, 38(1) *JLS* (2011), pp. 20 et sqq.
- 7 *Ibid.*, p. 23; K.W. Abbott and Duncan Snidal, “The Governance Triangle: Regulatory Standards Institutions and the Shadow of the State” in W. Mattli and N. Woods (eds), *The Politics of Global Regulation* (Princeton: Princeton University Press, 2009), pp. 44 et sqq.; Galf-Peter Calliess and Peer Zumbansen, *Rough Consensus and Running Code* (Oxford: Hart Publishing, 2010).
- 8 Max Weber, *Economy and Society*, Gunter Roth & Claus Wittich (eds) (California: University of California Press, 1978)
- 9 Jacques Lenoble and Marc Maeschalck, “Renewing the Theory of Public Interest: The Quest for a Reflexive and Learning-based Approach to Governance” in Olivier De Schutter and Jacques Lenoble (eds), *Reflexive Governance: Redefining the Public Interest in a Pluralistic World*, (Oxford: Hart Publishing, 2010), pp. 3-21.
- 10 The technocratic/deliberative distinction of regulatory paradigms is found in other work, such as the Rational-Instrumental and Deliberative-Constitutive paradigms in Elizabeth Fisher, *Risk Regulation and Administrative Constitutionalism*, (Oxford: Hart Publishing, 2010); Transactional and Political paradigms in Bronwen Morgan, “The North-South Politics of Necessity: Regulating for Basic Rights Between National and International Levels”, 29 *J Consum Policy* (2006), pp. 465 et sqq.; and ‘private autonomy’ and ‘collaborative enterprise’ in Tony Prosser, *The Regulatory Enterprise*, (Oxford: Oxford University Press, 2010).

nificant scientific uncertainty is defined and the tension between politics and science introduced. The section suggests that the nascent regulation of SRM research, when viewed as transnational private regulation is suffering a legitimacy deficit because the regulating institutions have no formal legal authority to act. Two significant issues arise: the relationship between politics and science in the regulating procedures and institutions, and the ability of individuals to participate directly or be represented in them.

Section III on the EU's response to the challenge for legitimacy argues that the EU's regulation of SRM research is likely to address the challenge for legitimacy in terms of establishing a firm legal basis to regulate. However, the EU's response is problematic, because as identified in section II above, it fixes the relationship between politics and science so that there is little flexibility and makes it difficult for individuals to participate directly in any meaningful way in regulatory institutions. The EU's response is classified typology as technocratic.

In section IV I offer an alternative response, one that maximises the possibility of securing legitimacy. It seeks to make a small yet significant adjustment to legitimacy as conceptualised in formal legal terms by reconfiguring risk-assessments to incorporate elements of a more deliberative, responsive and flexible approach. This mechanism is taken from a conceptualisation of legitimacy associated with directly deliberative polyarchy. In this way the alternative response aims to combine the best of both worlds and maximise the possibility of securing legitimacy.

II. A challenge for Legitimacy

The effects of SRM field research can be grouped into those that are physical – climatic and environmental –¹¹ and those that are socio-political¹² or non-physical.¹³ In this paper significant scientific uncertainty relates to the physical effects of SRM research; which is not to say that non-physical effects are not significant or do not pose difficulties for legitimacy or do not have implications for SRM governance.¹⁴ I turn to the relationship between physical and non-physical risks in due course.

1. Significant Scientific Uncertainty

Uncertainty is a way of describing the limits of our understanding of a subject. It is “an expression of the degree to which a [subject matter]¹⁵ – such as the future state of the climate system – is unknown”.¹⁶ For SRM field research the subject matters are the physical effects of specific research projects as well as those of the broader SRM research endeavour.¹⁷ All else being equal, as the subject matter becomes more complex, the less likely we are to know this about it. As the limits of our understanding increase so does uncertainty.

It is for scientists to understand the limits of their understanding. In quantifying those limits they make claims about scientific uncertainty. It is scientists, then, that are best placed to determine whether scientific uncertainty is significant or not.¹⁸ An example of when uncertainty is significant is when it is unable to be quantified.

11 Committee on Geoengineering Climate, *Reflecting Sunlight to Cool Earth*, *supra* note 3, p. 47-147.

12 Andy Parker, “Governing Solar Geoengineering Research as it Leaves the Laboratory”, *Phil. Trans. R. Soc. A* (2014), 2730:20140173; Clive Hamilton, “No, We Should Not Just ‘At Least Do the Research’”, 496 *Nature* (2013), pp. 139 et seq.

13 Stefan Schäfer et al. “Field Tests of Solar Climate Engineering.” 3.9 *Nature Climate Change* (2013), pp. 766-766.

14 See papers 10-14 of the Theme Issue ‘Climate Engineering: Exploring Nuances and Consequences of Deliberately Altering the Earth’s Energy Budget’ of *Phil Trans R. Soc.A* 2014: David Morrow, “Ethical Aspects of the Mitigation Obstruction Argument Against Climate Engineering Research.” *Phil Trans R. Soc.A* 372.2031 (2014): 20140062; Adam Corner and Nick Pidgeon. “Geoengineering, Climate Change Scepticism and the ‘Moral Hazard’ Argument: an Experimental Study of UK Public Perceptions” *Phil Trans R. Soc.A* 372.2031 (2014): 20140063; Stefan Schäfer and Sean Low, “Asilomar Moments: Formative Framings

in recombinant DNA and Solar Climate Engineering Research.” *Phil Trans R. Soc.A* 372.2031 (2014): 20140064.

15 I have replaced the term ‘value’ with subject matter in order to reduce its ambiguity. In the context of this paper, value is associated with my definition of political activity and used *contra* science.

16 “Annex II Glossary of Terms” in R.K. Pachauri and A Reisinger (eds), *Climate Change 2007: Synthesis Report – An Assessment of the Intergovernmental Panel on Climate Change* (Geneva, Switzerland: 2007), pp. 75-89.

17 Of course, this analysis of uncertainty could apply equally to non-physical effects of SRM research.

18 I use the term ‘significant’ in its ordinary, not statistical, sense. In this paper the meaning of the word significant is differentiated from its use in statistics because it relates to *scientific* uncertainty rather than *statistical* uncertainty. Scientific uncertainty may or may not be calculated statistically. So, whilst the phrase significant scientific uncertainty could comprise statistical uncertainty, it does not denote it necessarily.

Risk can be differentiated categorically from scientific uncertainty.¹⁹ Risk analysis is meaningful only when the level of uncertainty is low-enough to make reliable statements about the likelihood of events. It is the process of risk analysis that is important not the final outcome. This process is undermined if scientific uncertainty is significant. My focus is on the procedure not the substantive outcome of risk analysis: reference to scientific uncertainty as a means of evaluating field research is not about the safety of those research activities,²⁰ although clearly the certainty of knowledge feeds into the process of risk analysis and into determinations of safety.

a. Significant Scientific Uncertainty in the Context of Specific Research Activities

Owing to observations of volcanic activity, some climatic impacts of SRM are relatively 'certain'.²¹ Some environmental effects are known also with relative certainty whilst the extent of some effects are less certain.²² Despite these relative certainties, the National Academy of Sciences concluded that "unambiguous statements about how an intervention by [SRM] would affect the planet are thus not possible".²³ And whilst it might be straightforward to characterise environmental effects such as chemistry, light intensity and precipitation, detecting their impacts on ecosystems could be much more difficult.²⁴ Moreover, the unknown environmental impacts of SRM and its research are unknown: "there is also of course the possibility of environmental consequences that scientists have not yet identified".²⁵

b. Significant Scientific Uncertainty in the Context of the General SRM Research Endeavour

The unknown unknowns of some SRM research projects raise questions about the broader uncertainty of the entire SRM research endeavour. The Intergovernmental Panel and Climate Change IPCC's 5th Assessment Report (the AR5) of the Working Group I Report quantifies the uncertainty of climate change finding it *extremely likely* (95-100% probability²⁶) that the cause of climate change is anthropogenic. It quantifies uncertainty on the basis of underlying scientific understanding and degree of consensus:

"The degree of certainty in key findings in this assessment is based on the author teams' evaluations of underlying scientific understanding and is ex-

pressed as a qualitative level of confidence (from very low to very high) and, when possible, probabilistically with a quantified likelihood (from exceptionally unlikely to virtually certain). Confidence in the validity of a finding is based on the type, amount, quality and consistency of evidence (e.g., data, mechanistic understanding, theory, models, expert judgment) and the degree of agreement. Probabilistic estimates of quantified measures of uncertainty in a finding are based on statistical analysis of observations or model results, or both, and on expert judgment. Where appropriate, findings are also formulated as statements of fact without using uncertainty qualifiers".²⁷

There is a high degree of confidence that climate change affects the uncertainty of environmental effects such as flooding, volcanic activity and droughts. For example, there is a *high confidence* level that the "uncertainties about future vulnerability, exposure and responses of interlinked human and natural systems are large".²⁸ Natural hazards exhib-

19 Frank H. Knight, *Uncertainty, Risk and Profit*, (London: London School of Economic and Political Science, 1933); For conceptions of uncertainty in the IPCC see Minh Ha-Duong et al. "Uncertainty Management in the IPCC: Agreeing to Disagree." 17.1 *Global Environmental Change* (2007), pp. 8 et sqq.

20 Parker, "Governing Solar Geoengineering Research", *supra* note 12, pp. 3-4.

21 Examples include: the cooling effect of stratospheric sulphate aerosols, Committee on Geoengineering Climate, *Reflecting Sunlight to Cool Earth*, *supra* note 3, pp. 69-71; the delay of ozone recovery, *Ibid*, p. 86; and changes to precipitation, *Ibid*, p. 75.

22 Examples include: the reduction of sunlight intensity, *Ibid*, p. 95; changes to precipitation, *Ibid*; and acidity of snow and rain, *Ibid*.

23 *Ibid*, p. 98.

24 *Ibid*, p. 95.

25 *Ibid*.

26 "Summary for Policymakers" in T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, (Cambridge: Cambridge University Press, United Kingdom and New York, NY, USA, 2013), at Chapter 1, Box TS1.

27 *Ibid*, p. 4.

28 "Summary for policymakers" in C.B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Billir, M. Chatterjee, K.L. Ebi, Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, (Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2014), pp. 1-32, et sqq., at p. 11

it both aleatory and systemic uncertainties “arising both from the inherent unpredictability of the hazard events themselves and from the complex way in which these events interact with their environment and with people”.²⁹ Climate change increases the uncertainty of natural hazard frequency³⁰ and our exposure and vulnerability to it,³¹ yet “it remains unclear whether decreasing the global mean temperature by SRM can reduce the number and intensity of extreme events because of the associated distinct regional pattern in temperature and precipitation changes”.³²

The AR5 is unable to quantify the uncertainty of SRM geoengineering owing to “limited evidence”.³³ Clearly only a fraction of climate science research has been on SRM and some uncertainty, although not all, will be reducible through research.³⁴ It does suggest that “modelling indicates that SRM methods, if realizable, have the potential to substantially offset a global temperature rise, but they would also modify the global water cycle, and would not reduce ocean acidification. ...SRM methods carry side effects and long-term consequences on a global scale”.³⁵

I am not alone in advocating the use of scientific uncertainty as a basis for making some governance decisions. Among other things, it is suggested by Keith et al.³⁶ as the most appropriate scientific criterion

to be taken into account when deciding which field project to pursue.

c. The Problem of Significant Scientific Uncertainty for Decision-making

In its inaugural edition, the European Journal of Risk Regulation published as its opening article the ‘Foundations of Risk Regulation: Science, Decision-Making, Policy Learning and Institutional Reform’³⁷ by Giandomenico Majone.³⁸ In the paper Majone refers to ‘trans-scientific issues’ which are “questions of fact that can be stated in the language of science but are, in practice, unanswerable by science”.³⁹ Frequently these trans-scientific issues arise in relation to the effects of technological activities. To illustrate the point, Majone draws on Weinberg’s example of the certainty of determining the effect on health of low level radiation: “It has been calculated that, in order to determine by direct experimentation at the 95% confidence level whether a level of Z-ray radiation of 150 millirems would increase spontaneous mutation in mice by half of one per cent, about 8 billion mice would be required. Time and resource constraints make experiments on such a scale virtually impossible”.⁴⁰

Trans-scientific issues raise questions about the basis on which decisions about their use are made and by whom. If scientists are unable to answer questions about the effects of research, what is the role of the scientific assessment in the broader risk analysis process? Majone asks “How does a particular institutional design affect the way scientific uncertainties are resolved? What decision rules are appropriate in situations of high scientific uncertainty”.⁴¹ These questions and tensions will be picked up throughout the following sections and lie at the heart of the procedural approach taken in this paper. Decisions about ‘who decides and how’ point to the question of legitimacy of a regulatory framework and it is to theories of regulation and legitimacy that I now turn.

2. Location of Analysis of Significant Scientific Uncertainty in the Context of Existing Broad Regulatory Frameworks

The general position regarding the regulation of environmental and climate-related activities tends to be determined by the existence of physical transbound-

29 Jonathan Rougier, Steve Sparks and Lisa J. Hill, *Risk and Uncertainty Assessment for Natural Hazards*, (Cambridge: Cambridge University Press, 2013), at p. 4.

30 *Ibid*, at p. 2.

31 Steve Jennings, “Time’s Bitter Flood: Trends in the Number of Reported Natural Disasters”, 7(1) *Oxfam Policy and Practice: Climate Change and Resilience* (2011).

32 Jana Sillman et al., “Climate Emergencies do not Justify Engineering the Climate” 5 *Nature Climate Change* (2015) pp. 290 et seq.; Charles L. Curry et al. “A Multimodel Examination of Climate Extremes in an Idealized Geoengineering Experiment.” *Journal of Geophysical Research: Atmospheres* 119.7 (2014): 3900-3923.

33 IPCC 2013, *supra* note 26, at p. 29.

34 David Keith et al., “Field Experiments on Solar Geoengineering: Report of a Workshop Exploring a Representative Research portfolio.” *Phil. Trans. R. Soc A:372.2031* (2014): 20140175.

35 *Ibid*.

36 *Ibid*.

37 1 *EJRR* (2010), pp. 5 et seq.

38 Emeritus Professor of Public Policy at the European University Institute.

39 Majone, “Foundations of Risk Regulation”, *supra* note 37, pp. 5.

40 *Ibid*.

41 *Ibid*.

Broad Regulatory Frameworks by Types of SRM Research				
Type of Research	Laboratory	Field Research		Deployment
Physical Effect	Non-transboundary	Non-transboundary	Transboundary	Transboundary
Examples of Research	Models, Laboratory tests	Technology Development	Process Studies, Scaling Tests	Climate Response Tests, Deployment
Broad Regulatory Frameworks	National		International	
	Member State		EU	
	European Union			
		Transnational		

Table 1 - Broad Regulatory Frameworks by Types of SRM Research: the group of effects and examples of field research is shaded pale grey; EU and transnational regulatory frameworks (engaged in this paper) are shaded dark grey.

ary harm. Where the effects are contained within territorial boundaries then national authorities have regulatory jurisdiction. Where the physical effects are transboundary or global then international legal principles or treaties tend to apply. Table 1 sketches this general position in relation to types of SRM research. It is not intended to be used as a detailed typography but rather a simplified depiction of the relationship between regulated activities and their broad regulatory frameworks.⁴² It will provide a reference point throughout the rest of the paper. Non-physical effects of SRM research are not included in the transboundary/non-transboundary analysis but are for consideration and determination by democratic political decision-making mechanisms associated with the regulatory frameworks.

The upper row bounded in the heavy border sets out the three different types of SRM research. Laboratory research includes computational modelling and indoor laboratory tests, the physical effects of which are non-transboundary.⁴³ At the right end of the row is SRM research that constitutes deployment,

such as climate response tests, the climatic effects of which are by definition transboundary. There are likely to be transboundary environmental effects also.

In the middle of the upper row is SRM field research. It is a broad category of research that takes place outdoors or 'beyond the laboratory'⁴⁴ and which has been sharpened and particularised⁴⁵ to include research whose objective is to test hardware,⁴⁶ 'bridge gaps across multiple scales' of climate models⁴⁷ and to characterise the 'desirable and 'non-de-

42 The transboundary-ness of risks may or may not align with technology development vs. process studies. Likewise, research vs. deployment may or may not align with EU vs. unknown regulation.

43 These may be effects that are localised and minimal, such as increased air-moisture levels resulting from small-scale test of crop-leaf albedo.

44 Parker, "Governing Solar Geoengineering Research", *supra* note 12.

45 *Ibid.*; Keith et al, "Field Experiments on Solar Geoengineering", *supra* note 34.

46 *Ibid.*

47 *Ibid.*

	SRM Field Research	
Scale	Non-Transboundary	Transboundary
Type of effect	Localised Environmental Effects	Climatic Effects Regional or Global Environmental Effects
Example of effect	Localised loss of biodiversity	Climatic (reduced global temperatures) Climatic (delay in ozone recovery) Environmental (variations in precipitation)

Table 2 - Transboundary Analysis of SRM Field Research

sirable' effects of SRM.⁴⁸ The category of field research is bifurcated: some research activities such as technology development have effects that are non-transboundary,⁴⁹ other activities such as process studies could pose transboundary effects.⁵⁰ This paper groups *all* field research together – shaded pale grey – not to be unhelpful⁵¹ but because the focus of this paper is on degrees of scientific uncertainty rather than transboundary harm.

Transboundary effects may or may not be significantly scientifically uncertain. At the start of this section I set out the different levels of certainty for climatic and environmental effects of SRM research. These climatic and environmental effects can represent different scales of physical effects of SRM field research. Clearly climatic effects are most likely to be transboundary. Environmental effects may be trans-

boundary if they cross borders but they may also be contained within a single legal territory such as the UK or the US. Table 2 gives examples of a range of 'transboundaryness' of effects of SRM field research.

Not all transboundary effects of SRM field research are necessarily significantly scientifically uncertain. As we saw at the start of this section, scientists are relatively certain that global average temperatures will drop following SRM deployment/research. Equally, non-transboundary effects of SRM field research may not be significantly scientifically certain. Scientific uncertainty can be determined independently from transboundary effects. Both scientific uncertainty and transboundary effects are likely to shape regulatory frameworks for SRM field research.

Returning to table 1, the lower rows bounded in the heavy border set out three different regulatory frameworks for the three categories of SRM research. The upper row differentiates national and international law on the basis of the transboundary effects of the research activity: national jurisdictions govern research that has non-transboundary effects and international law would govern transboundary effects. The lowest two rows present a more complex view of regulatory frameworks. I suggest that field research may be governed by at least two other regulatory frameworks, which are shaded dark grey in the table. TPR enables public interest functions to be exercised by private organisations comprising highly technical or scientific expertise in relation to activities, such as the development of new technologies⁵² and environmental regimes⁵³ that transcend national boundaries.⁵⁴ The EU regulatory framework com-

48 Ibid.

49 An example might be the Stratospheric Particle Injection for Climate Engineering (SPICE) project, details found at <http://www.spice.ac.uk/>.

50 For example, the proposed SCoPex at Committee on Geoengineering Climate, *Reflecting Sunlight to Cool Earth*, *supra* note 3, p. 161; John A Dykema et al. "Stratospheric Controlled Perturbation Experiment: a Small-scale Experiment to Improve Understanding of the Risks of Solar Geoengineering." 372.2031 *Phil. Trans. R. Soc. A*: (2014): 20140059.

51 Parker, "Governing Solar Geoengineering Research", *supra* note 12.

52 Cafaggi, "New Foundations", *supra* note 6.

53 Colin Scott, Fabrizio Cafaggi and Linda Senden, "The Conceptual and Constitutional Challenge of Transnational Private Regulation" 38(1) *JLS* (2011).

54 Fabrizio Cafaggi, Andrea Renda and Rebecca Schmidt, "Transnational private regulation" in *OECD, International Regulatory Co-Operation: Case Studies, Vol. 3: Transnational Private Regulation and Water Management*, (OECD Publishing, 2013).

	Non-Transboundary		Transboundary	
EU	SSU	Not SSU	SSU	Not SSU
Transnational	SSU	Not SSU	SSU	Not SSU

Table 3 - Introducing Significant Scientific Uncertainty (SSU) Analysis: shaded areas indicate activities that pose difficulties for regulatory frameworks securing legitimacy.

prises decision-making structures for proper functioning of the internal market as well as the protection of the environment.⁵⁵ Whilst they are separated in table 1, transnational and EU regulation need not be disconnected: EU institutions have used the rubric of co-regulation to use fewer resources and regulate more efficiently drawing on private capacity associated with transnational regimes.⁵⁶

There are implications for the regulatory framework of physical effects of SRM field research that are significantly scientifically uncertain. The uncertainty analysis presented in table 3 below, which links the two analyses set out in tables 1 and 2 adds to the earlier analysis based on the scale of effects and type of regulatory framework.

The two columns relate to transboundary characteristics and the two rows to the regulatory frameworks. For both rows there are transboundary and non-transboundary effects which are either significantly scientifically uncertain or not. The shaded areas are characteristics which pose particularly thorny issues for the regulatory frameworks. For both transnational and EU regulatory frameworks, SRM field research effects that are significantly scientifically uncertain pose difficulties. This is important. Both EU and transnational regulatory frameworks are deficient in addressing the issue of legitimacy of SRM field research activities where the effects are significantly scientifically uncertain. The reason for this deficiency stems from the relationship between uncertainty and risk. Whilst uncertainty is a key feature of risk, significant scientific uncertainty means that risk assessments are undermined because scientific information is not concrete or certain enough to provide a reliable assessment. The inability of science to assess risk has implications for the broader analysis of risk which takes into account political and other factors only in the risk management phase. It is

for this reason that Majone identifies “arguably the most important question facing political leaders, citizens, and experts ie how to limit regulatory discretion and enforce accountability in policy areas characterised by high uncertainty and cognitive complexity and that are also politically very sensitive?”⁵⁷ I return to this point in part III.

The EU is able to rely on orthodox constitutional principles developed in caselaw to safeguard legitimacy for regulating activities that are not significantly scientifically uncertain. By contrast, the transnational regulatory framework faces challenges to its legitimacy *across all four types of effects*: transboundary and non-transboundary and significantly scientifically uncertain or not. It is to this issue that I now turn.

3. The Challenge Arising from Nascent Transnational Private Regulation of SRM Field Research

Whilst it has been claimed that there is a gap in the regulation of SRM research particularly at the international level⁵⁸ there is evidence of nascent regulation or at least movement towards regulation.⁵⁹ Be-

55 Asbjorn Aaheim et al, “EuTRACE 2015, *supra* note 3, pp. 90-92.

56 Scott et al, “The Conceptual and Constitutional Challenge of Transnational Private Regulation”, *supra* note 53, at p. 8

57 Majone, “Foundations of Risk Regulation”, *supra* note 37, p. 6

58 UK House of Commons Science and Technology Committee 2010, *The Regulation of Geoengineering*, Fifth Report of Session 2009-10 (UK Parliament, HC 221), at pp. 20-21, where the Committee found there to be a “gap in the regulatory framework”.

59 Jesse Reynolds, “The Regulation of Climate Engineering” 3(1) *Law, Innovation and Technology* (2011) pp. 113-136, at p. 130; Parker, “Governing Solar Geoengineering Research”, *supra* note 12.

ing nascent means that the institutions and procedures governing geoengineering research exist but are difficult to classify. In this section I give an example of how this nascent regulation conceptualised as transnational regulation illustrates the challenges to conceptions of legitimacy posed by SRM field research.

The argument presented here is done so tentatively: there is relatively little SRM research actually taking place,⁶⁰ and the research that *is* taking place is doing so in myriad departments and institutions.⁶¹ In short, SRM and its regulation is at an ‘upstream’ moment of its emergence.⁶² The nascent regulation of SRM research can be conceptualised as ‘transnational’ thereby illustrating challenges to legitimacy understood as the legality of decision-making processes. I take TPR to comprise three elements: regulatory frameworks that “are not constituted through the cooperation of states as reflected in treaties”,⁶³ comprising non-state actors⁶⁴ that exercise either “autonomous regulatory power or implementing delegated power”,⁶⁵ and the development of “new body of rules, practices and processes...primarily by private actors, firms, NGOs, independent experts like technical standard setters and epistemic communities”.⁶⁶

a. Non-state Actors

Solar Radiation Management Governance Initiative (SRMGI) is a “cooperative, international, NGO-driven initiative, co-convened by the Royal Society, Environ-

mental Defence Fund (EDF) and the Academy for the Sciences of the Developing World (TWAS)”.⁶⁷ It was one of the first governance initiatives for SRM⁶⁸ flowing from the Royal Society report of 2009. It is an interesting example of a non-state actor comprising transnational private regulation because of its composition. All three convenors are non-state actors in so far as they have no exclusive legal link to the state. EDF is a leading not-for-profit organisation in the US “linking science, economics, law and innovative private-sector partnerships”;⁶⁹ the Royal Society is the oldest science academy in continuous existence comprising 1400 outstanding Fellows from all areas of science; and TWAS is an independent international organisation whose principal aim is to “promote scientific capacity and excellence for sustainable development in the South”.⁷⁰

SRM companies have yet to become significant actors although this may change if the commercialisation of research leads to marketable technologies.⁷¹ However, additional financial contributions were made to SRMGI by other non-state actors⁷² which aim to tackle climate change through ‘entrepreneurial’ market-based solutions.⁷³

Being a transnational regulatory framework does not preclude the involvement of state actors.⁷⁴ What is important is that it is the nonstate - rather than state - that has become the ‘key’ actor, and that the state has, to some extent withdrawn from the process. In his oral evidence to the select committee, Professor Pidgeon, an influential academic researcher on

60 UK House of Commons Science and Technology Committee 2010, *supra* note 58, pp. 49-52 Conclusions and Recommendations, *et seq.* Ev27-31 Evidence of Joan Ruddock, Minister for State of Department of Energy and Climate Change.

61 Such as law schools, geography departments, earth science schools and meteorological centres <http://www.iagp.ac.uk/> last accessed on 17th May 2015.

62 UK House of Commons Science and Technology Committee 2010, *supra* note 58, at Ev. 31 - Evidence of Pidgeon.

63 Scott et al, “The Conceptual and Constitutional Challenge of Transnational Private Regulation”, *supra* note 53, at p. 3.

64 *Ibid.*

65 Cafaggi, “New Foundations”, *supra* note 6, at p. 21.

66 *Ibid.*, at pp. 20-21.

67 Solar Radiation Management Governance Initiative (SRMGI), *Solar Radiation Management: The Governance of Research*, (2012) at p. 12.

68 Others have been the Oxford Geoengineering Programme and then Geoengineering Governance Research.

69 SRMGI 2012, *supra* note 67, at p. 4.

70 *Ibid.*, at p. 4.

71 On the possibility of accruing carbon credits through SRM see Janine Sargoni and Andrew Lockley, “Environment Policy: Solar Radiation Management and the Voluntary Carbon Market.” 17(4) *Environmental Law Review* (2015), pp. 266 *et seq.* On commercialisation of geoengineering research and vested interests in using geoengineering research, see SRMGI 2012, *supra* note 67, at p. 17; Steve Rayner et al, “The Oxford Principles”, *Climate Change* (2013), pp. 499 *et seq.*, at para. 7.2. For vested interests of SRM research see Jane Long and Dane Scott, “Vested Interests and Geoengineering Research.” 29(3) *Issues in Science and Technology* (2013), pp. 45 *et seq.*

72 Such as the private global non-profit organisations such as the Carbon War Room, <http://www.carbonwarroom.com/> last accessed on 14 May 2015; and Zennstrom Philanthropies <http://www.zennstrom.org/> last accessed on 14 May 2015.

73 Such as the Fund for Innovative Climate and Energy Research (FICER), funded by Bill Gates and managed by the University of Calgary.

74 For a typology of actors see Cafaggi et al, “Transnational Private Regulation: OECD”, *supra* at note 54.

the human psychology of risk associated with geo-engineering recommended that social, political and legal research on governance issues take place alongside scientific research on geoengineering.⁷⁵ It is partly on this basis that the Parliamentary committee recommended that the UK government develop a regulatory framework, particularly for SRM techniques that fall outside international agreements,⁷⁶ and “carry out research...on the legal, social and ethical implications”⁷⁷ of regulation of geoengineering. Rather than adopting these recommendations directly, thereby raising its profile in the area of geoengineering, the government deferred to the SRM governance initiative suggesting an unwillingness to ‘commit’. Nonstate actors such as SRMGI have stepped into the regulatory vacuum.

b. Crystallising Norms and Standard-setting

The development of principles, new bodies of rules or ‘standard-setting’ processes by private actors is also an illustration of TPR. Regulatory principles or standards have emerged for governing geoengineering research including the Asilomar Principles,⁷⁸ and the Oxford Principles which comprise five ‘high-level’ principles⁷⁹ each supported with a short explanatory text.⁸⁰ Every principle carries equal weight:⁸¹ principle 1, geoengineering to be regulated as a public good; principle 2, public participation in geoengineering decision-making; principle 3, disclosure of geoengineering research and open publication of results; principle 4, independent assessment of impacts; and principle 5, governance before deployment.

These principles are gaining traction and are prevalent in literature on governance of geoengineering in general. Although it is too soon to tell, they may well crystallise in the process of rule-making or standard setting and thereby further characterise transnational private regulation.⁸² As well as being considered by the UK Parliament, the Oxford Principles are considered to “provide a sound foundation for the elaboration of more concrete governance arrangements for research”⁸³ by the only draft articles to date for geoengineering research.

What we see is that these governance principles have been developed by non-state scientists. By the term ‘scientists’ I mean researchers that are experts in scientific fields including the natural and social or political scientists. I use the term scientist in the widest sense to differentiate scientific experts from lay persons. For example, the “germ of the idea”⁸⁴ of research guidelines was a conversation between two non natural-science academics, Steve Rayner and Tim Kruger, who went on to consult with other experts from a range of disciplines. In this way the Oxford Principles were drafted by an “ad-hoc”⁸⁵ group of five academics from British institutions: the Royal Society⁸⁶ and the universities of Oxford,⁸⁷ Cardiff⁸⁸ and London.⁸⁹ The academics represent a broad, inclusive range of academic interests including science, law, ethics and psychology. The Oxford Principles illustrate the technical – rather than lay – expertise of rule-making within this transnational regulatory framework. Non-state scientists have also endorsed and developed the Oxford Principles by setting standards taking the form of ‘technology-specific research protocols’;⁹⁰ research guidelines⁹¹ and thresh-

75 UK House of Commons Science and Technology Committee 2010, *supra* note 58, at Ev. 30; <http://www.understanding-risk.org> last accessed on 14 May 2015.

76 *Ibid.*, p. 25 *et seq.*, para. 55.

77 *Ibid.*, p. 33 *et seq.*, para. 84.

78 Asilomar Scientific Organizing Committee, “The Asilomar Conference Recommendations on Principles for Research into Climate Engineering Techniques.” *Washington DC, Climate Institute*, (2010); Margaret Leinen, “The Asilomar International Conference on Climate Intervention Technologies: Background and Overview.” *Stanf J Law Sci Policy IV* (2011), pp. *et seq.* 1-5; Schäfer and Low, “Asilomar Moments”, *supra* note 13.

79 Rayner *et al.*, “The Oxford Principles”, *supra* note 71.

80 *Ibid.*

81 *Ibid.* at pp. 502-503.

82 Donal Casey and Colin Scott, “The Crystallisation of Regulatory Norms”, 38(1) *JLS* (2011), pp. 76. *et seq.*

83 Anna-Maria Hubert and David Reichwein, ‘An Exploration of a Code of Conduct for Responsible Scientific Research Involving Geoengineering: Introduction, Draft Articles and Commentaries’ (Potsdam: IASS Working Paper, 2015), p. 6.

84 Tim Kruger, “A Commentary on the Oxford Principles: Opinion Article”, *Geoengineering Our Climate? Working Paper and Opinion Article Series*, 2013.

85 Rayner *et al.*, “The Oxford Principles”, *supra* note 71, at p. 500.

86 Steve Rayner and Catherine Redgwell.

87 Steve Rayner, Julian Savulescu and Tim Kruger.

88 Nick Pidgeon.

89 Catherine Redgwell, University College London, now at All Souls College, University of Oxford.

90 Rayner *et al.*, “The Oxford Principles”, *supra* note 71, at p. 509.

91 Granger Morgan, Robert Nordhaus and Paul Gottlieb, “Needed: Research Guidelines for Solar Radiation Management”, *Issues in Science and Technology* (2013) 37-44.

olds⁹² and codes of practice.⁹³ The development of governance principles and implementing standards by non-state actors is significant because it demonstrates a nascent form of autonomous regulatory power which characterises further TPR.

c. The Legitimacy Deficit

Autonomous regulatory power poses problems for legitimacy as conceptualised by transnational regulatory theory. On the whole, and according to general constitutional principles, national-centred regulation relies on forms of democratic legitimacy for justification.⁹⁴ However, as regulation is removed from the state, whether that is in terms of a movement from national to transnational settings or in terms of a movement from public to private actors, the constitutional lines of democratic legitimacy become weaker.⁹⁵ A concept of legitimacy that hinges on the legality of the democratic mandate in positive Weberian terms is bound to be reduced in transnational or private regulatory regimes; 'such regimes will necessarily lack legitimacy and any potential for le-

gitimacy, in legal terms'.⁹⁶ For this reason, Majone attributes to the regulatory state⁹⁷ the problem of securing and maintaining legitimacy as it transfers regulatory functions from state to non-state institutions. This is something to which we return later.

But legitimacy becomes particularly problematic when regulation moves away from the state because the orthodox mechanisms of democratic legitimacy are weakened. Transnational regulation "may end up in a democratic cul-de-sac".⁹⁸ Issues of legitimacy are particularly salient for transnational private regulation of public goods,⁹⁹ which the Oxford Principles claim SRM research is.

In the preceding section on SRM field research, I suggested that under conditions of significant scientific uncertainty tensions are produced between politics and science in terms of how to justify who makes decisions about its regulation and how. The sketch of the nascent TPR highlights some of those tensions. For example, regulatory principles are being developed and operationalised¹⁰⁰ by predominantly non-state actors such as scientists, with minimal involvement from democratic institutions or lay persons. Whilst this could be seen as a form of 'endogenous' rule-making identified earlier and justified under certain conditions (something to which we return later), viewed as TPR it suffers a legitimacy deficit: there is no formal legal authority from which those non-state institutions can act. Clearly the legitimacy deficit might be considered less relevant as the regulation is merely 'nascent'. But the question of legitimacy becomes more relevant when thinking about how the regulation develops, as set out in part I: from nTPR to TPR; to EU; or to National or International law. This question of legitimacy is likely to increase in significance as the regulatory framework develops. The deficit as conceptualised in formal legal terms could be minimised if a state institution such as the UK Parliament mentioned above, or the EU, were to oversee the regulatory framework thereby formalising the transnational arrangements. It is to the EU that we now turn.

III. The EU's Response to the Challenge of Legitimacy

There are a number of reasons why the EU would regulate SRM field research: to provide a high level of protection of the environment,¹⁰¹ public health¹⁰²

92 E. Parson and D. Keith, "End the Deadlock on the Governance of Geoengineering Research" 339 *Policy Forum* (2013) 1278-1279, at p. 1278.

93 Morgan, Nordhaus and Gottlieb 2013, *supra* note 91, at p. 41; UK House of Commons Science and Technology Committee 2010, *supra* note 58, at p. 29.

94 Keith Syrett, *The Foundations of Public Law: Principles and Problems of Power in the British Constitution* (Basingstoke: Palgrave Macmillan 2011); J. Koppell, "Global Governance Organizations: Legitimacy and Authority in Conflict" 18 *Journal of Public Administration Research and Theory* 2008, 177-203, at p. 190.

95 S. Cassese, "Administrative Law Without the State – The Challenge of Global Regulation", 37 *New York University Journal of International Law and Policy* (2004) 663.

96 Julia Black, "Constructing and Contesting Legitimacy and Accountability in Polycentric Regulatory Regimes" 2 *Regulation and Governance* (2008) 137-164, at p. 145.

97 Giandomenico Majone, "The Rise of the Regulatory State in Western Europe" 17 *West European Politics* (1994) 77; Giandomenico Majone, "From Positive to the Regulatory State: Causes and Consequences of Changes in the Mode of Governance", 17(2) *Journal of Public Policy* (1997) 139-167

98 B. Eberlein and E. Grande, "Beyond Delegation: Transnational Regulatory Regimes and the EU Regulatory State", 12(1) *Journal of European Public Policy* (2005) 89-112, at p. 106.

99 Scott et al, "The Conceptual and Constitutional Challenge of Transnational Private Regulation", *supra* note 53, at p. 6.

100 Hubert and Reichwein, "Draft Articles for Code of Conduct", *supra* note 83.

101 Article 191 TFEU.

102 Article 168 TFEU.

or to ensure the proper functioning of the internal market¹⁰³ – were one to emerge – through the approximation of laws. In Table 1 above, I set out the broad position regarding types of regulatory frameworks based on the ‘transboundary’ scale of effects of the regulated activity: national regulation for SRM research whose physical effects are contained territorially; and international regulation for effects that cross territories. EU regulation was depicted as extending beyond those levels to include regulation of SRM research in the laboratory as well as field research comprising transboundary effects. In practice this means that the EU regulatory framework would govern all SRM field research, even those that do not have transboundary effects. The regulatory framework would apply to specific research proposals as well as the general SRM research endeavour. By comparing briefly the regulation of genetically modified organisms, or agricultural biotechnology, I set out the reasons below.

The EU regulates the process¹⁰⁴ of agricultural biotechnology through a matrix of secondary legislation.¹⁰⁵ The legislation differentiates research that takes place in the laboratory, under the Contained Use Directive,¹⁰⁶ and experimental releases into the environment in the form of crop trials, part B of the Deliberate Release Directive.¹⁰⁷ Non-experimental releases into the environment and the internal market are covered under part C of the Deliberate Release Directive.

Both relevant directives – the Deliberate Release Directive and the Contained Use Directive – demonstrate some of the complexity associated with implementation.¹⁰⁸ For example, the Contained Use Directive effectively allows member states to implement national rules as it chooses whereas part C of the Deliberate Release Directive, relating to the marketing of biotech crops, is implemented at the EU level with member states given very little discretion as to how to make or apply those rules. Part B of the Deliberate Release Directive – regulating experimental releases such as crop trials – is somewhere in between; certain elements are left to member states and others remain with the EU. The extent to which the principle of subsidiarity¹⁰⁹ is applied is linked to the functioning of the internal market.¹¹⁰ This internal market rationale has been confirmed by policy officers at the Commission; however, in terms of deliberate releases of biotech products, a combination of two other rationales is evident. One pertains to the level

of ‘containment’¹¹¹ of the product: contained use (such as within a laboratory) is highly contained; crop trials are fairly contained; whilst marketing a product for circulation across the EU is uncontained. The other rationale pertains to the territorial ‘scale’¹¹² of potential transboundary harm arising from the release of the product: if the harm is contained to a laboratory or a member state, then discretion is high; if the threatened transboundary harm is to the wider EU community or beyond then discretion in implementation is low. The European Food Safety Authority provides independent scientific advice to the European Commission on applications for release into the environment.¹¹³

The UK implements part B of the Deliberate Release Directive through the Environmental Protection Act 1990 (EPA) and the Deliberate Release Regulations 2002.¹¹⁴ Consent to release any biotech product is required by section 111 of the EPA.¹¹⁵ The specific details of the consent process are set out in the Deliberate Release Regulations, including the information required with an application for consent.¹¹⁶ The regulations mirror the requirements set out in

103 Article 114 TFEU.

104 By contrast, the US regulates biotechnology through the existing regulations for specific products, eg biotech crops are regulated under the Plant Protection Act which gives the US department of Agriculture and its agency the Animal and Plant Health Inspection Services authority to regulate biotechnology products of plants and plant pests.

105 Details of the relevant legislation can be found at http://ec.europa.eu/food/plant/gmo/legislation/index_en.htm.

106 Directive 2009/41/EC (Recast) [2009] OJ L125/75

107 Directive 2001/18/EC 90/220/EEC [2002] OJ L106/1

108 For an overview of the regulation of GMOs generally see Maria Lee, *The EU Regulation of GMOs: Law and Decision-Making for a New Technology* (Cheltenham: Edward Elgar, 2008)

109 Article 5 TEU.

110 Article 114 TFEU on for the approximation of laws in order to establish the proper functioning of the internal market, is the legislative base of competence of the EU to pass the Deliberate Release Directive, whereas the Contained Use Directive is attributed to article 192 of Title XX on the protection of the environment, rather than exclusively on the functioning of the internal market.

111 Commission Policy Officer Interview.

112 Commission Policy Officer Interview.

113 Regulation 178/2002/EC.

114 The Deliberate Release Regulations were created pursuant to, but also amended, the EPA and repealed the previous 1992 deliberate release regulations, see the Explanatory Note on GMO (Deliberate Release) Regulations 2002/2443.

115 Under section 118 EPA, it is a criminal offence to fail to comply with section 111 EPA.

116 Reg 11 Deliberate Release Regulations.

the Deliberate Release Directive.¹¹⁷ The Department for the Environment, Food and Rural Affairs (DEFRA) is the competent authority¹¹⁸ and, amongst other things, is required to examine the application for its conformity with the rules, evaluate the risks of damage and take into account representations¹¹⁹ prior to its decision to grant consent.¹²⁰ However, despite the national authority having competency to regulate, the criteria for conducting environmental risk assessments found in Annex II of the Deliberate Release Directive stand as the test by which experimental releases,¹²¹ as well as those for wider release through marketing,¹²² are assessed.¹²³ So even where member states have competency they must nevertheless comply with standards or processes set at the EU level.

Applying this analysis to the regulation of SRM field research we might expect to see the EU develop a regulatory framework for the process of SRM, that is, the general scientific endeavour, which is able to assess research projects on a case-by-case basis. The regulatory framework could grant regulatory control to member states for contained or laboratory research as well as for non-transboundary field research. However, the EU is likely to reserve for itself

control over transboundary research, possibly creating a new European independent scientific advisory committee or by using an existing one. Whilst the impact on the market is not yet significant for SRM, that is not to say that it may not exist in the future or that other products become significant for the research, such as materials to be used for SRM technology research.

Assuming that the EU regulates SRM research, the issues posed by significant scientific uncertainty identified in part II will continue. In the following section I explain how the EU might respond to the legitimacy of decision-making where science is unable to adequately assess risk.

1. Attempting to Safeguard Legitimacy

The EU's orthodox response to the question of legitimacy lies with the landmark case of *Meroni*.¹²⁴ The case involved a decision by the European Coal and Steel Community's High Authority to require two agencies, known as the Brussels Agencies, to administer a new scrap metal equalisation scheme. *Meroni* was a steel company subject to the scheme and required to contribute to the fund by the High Authority. *Meroni* successfully sought an annulment of the High Authority's decision on the basis, in part, on the misuse of powers. The court enunciated four principles regarding delegation of powers. Firstly, the powers delegated must not be more extensive than the power of the delegator. Secondly, a delegation must be express not implied. Thirdly, only permissible powers can be delegated: only those powers that are 'clearly defined executive powers' rather than discretionary powers can be delegated; the consequences of the delegated power must necessarily be the same as the exercise of delegating power. Lastly, the delegation must not disturb the Community's 'balance of powers'.¹²⁵ *Meroni* and subsequent case law has acted as a constitutional limit – the *Meroni* doctrine¹²⁶ – to the delegation of discretionary powers by Community institutions.¹²⁷

Regulatory agencies, including independent scientific authorities such as the European Food Safety Authority, remain purely advisory in the light of the *Meroni* doctrine and are not "fully-fledged" regulatory agencies¹²⁸ because they lack legislative and executive functions. Technical and scientific assessment of risk undertaken or reviewed by them are commu-

117 Schedules in the Regulations link with appendices in the directive, in so far as they require the same technical information, although differently numbered.

118 Section 126 EPA.

119 Deliberate Release Regulation 20.

120 Deliberate Release Regulation 21.

121 Part B Deliberate Release Directive.

122 Part C Deliberate Release Directive. For marketing biotech products that are not grown in the EU but imported see article 5(5) Food and Feed Regulation, 1829/2003/EC.

123 Some amendments to Annex II have been proposed as General Guidance by EFSA. A differentiated procedure can be used by member state, in which case it will be the ERA confirmed by that member state as approved by the Commission. See Annex A on legal position on ERA in Annex II.

124 C-9/56, *Meroni & Co., Industrie Metallurgiche, Spa v High Authority of the European Coal and Steel Community* [1957-58] ECR 133.

125 Article 4 of the Treaty of Rome, article 7 EC Treaty, now repealed by article 13 TEU listed Community institutions and that they must act 'within the limits of the powers conferred upon them by this Treaty'.

126 Stefan Griller and Andreas Orator, "Everything Under Control? The "way forward" for European Agencies in the Footsteps of the *Meroni* Doctrine", 35(1) *European Law Review* (2010) 3-35.

127 Majone, *Foundations of Risk Regulation* 2010, *supra* note 37, at p. 16.

128 Giandomenico Majone, "The new European Agencies: Regulation by Information", 4(2) *Journal of European Public Policy* (1997) 262-275, at p. 262.

nicated to political bodies to manage that risk politically, so that no discretionary political power is delegated. In the Pfizer¹²⁹ case and in the context of the precautionary principle, the Court of First Instance reiterated the distinction between the scientific risk assessment and political risk management functions carried out by expert scientific committees and political community institutions respectively. It found that risk assessment constituted a procedural safeguard to the arbitrary exercise of discretion by Community institutions so that “a scientific risk assessment carried out as thoroughly as possible on the basis of scientific advice founded on the principles of excellence, transparency and independence is an important procedural guarantee whose purpose is to ensure the scientific objectivity of the measures adopted and preclude any arbitrary measures”.¹³⁰

This quotation is significant. It articulates the basis of the conceptual separation of risk assessment and risk management set out in the US National Research Council’s Red Book¹³¹ as being the prevention of biases pandering to public opinion.¹³² The separation of risk assessment and risk management is at the heart of the EU’s approach to risk analysis. The decision not only articulates this separation but underscores the separation by linking it with the separation of science from politics and links that, in turn, with the safeguarding of the EU’s balance of powers. The effect of the court’s decision is to confirm that the composition of regulatory institutions is inextricably linked to safeguarding the balance of powers through the process of risk analysis.

a. Safeguarding Democratic Legitimacy

The *Meroni* doctrine safeguards democratic legitimacy by institutionally retaining political control of decision making for risky activities. The safeguard is effective and appropriate where the scientific uncertainty is not significant, that is, where the science is certain enough to form a reliable basis for assessing risk. In short, science is able to do the ‘assessment’ part of the risk analysis, which can then be communicated to the political management so that legitimacy is safeguarded.

This analysis of *Meroni* can be applied to the relationship between EU and transnational regulation based on set out in table 3 of part II. You will recall that the shaded areas identified aspects of the regulatory frameworks which posed difficulties for legiti-

imacy. For the EU regulation of field research having non-significantly scientifically uncertain effects – the unshaded areas – legitimacy is not problematic – because *Meroni* is effective at safeguarding democratic legitimacy. For transnational regulation, legitimacy is challenged on two accounts: for the absence of ‘input’ legitimacy – common for all transnational regulation – and for the challenge posed in the event of significant scientific uncertainty. Drawing on the concept of legitimacy set out in *Meroni* would serve to address the legitimacy deficit for nTPR in some respects but not others; that is, for transboundary effects but not under conditions of significant scientific uncertainty. The shaded areas identifying the legitimacy deficit for non-significant scientific uncertainty would be ameliorated. However, for SRM field research that is significantly scientifically uncertain, legitimacy conceptualised as ‘legality’, would continue. What connects nTPR and EU regulation is that these difficulties remain also for SRM field research regulated by the EU.

b. Remaining Difficulties for Legitimacy

Whilst the EU’s response addresses some of the challenges to legitimacy raised by the conceptualisations of nascent regulation, some significant difficulties remain. Firstly, *institutional* arrangements force science and politics to take place as mutually exclusive activities when risk is analysed. The *Meroni* doctrine ensures that legitimacy is retained only by the political – risk management – institutions which are thereby able to differentiate and distance themselves from ‘independent’ scientific – risk assessment – institutions. Following this doctrine, the institutions for the analysis of risk of SRM research are likely to be bifurcated into the political and scientific; each addressing in turn separate parts of the process of risk analysis. In so doing the EU is situated squarely in Fisher’s rational-instrumental paradigm of risk reg-

129 T-13/99, Pfizer Animal Health SA v Council of the European Union [2002] ECR II-03305

130 Ibid. at para. 7.

131 National Research Council, *Risk Assessment in the Federal Government: Managing the Process*, (Washington DC: National Academic 1983), available on the internet at <http://www.nap.edu/read/366/chapter/1> (last accessed 14 May 2015).

132 S. Gabbi, “The Interaction between Risk Assessors and Risk Managers: The Case of the European Commission and of the European Food Safety Authority”, 3 *European Food and Feed Law Review* (2007) 126-135.



Figure 1 - Institutional Separation of Science from Politics and the Regulatory 'Lock' into Isolated Risk Assessments.

ulation: the administration of risk “is understood...to identify and assess a specific risk as well as assess the possible consequences of possibly regulatory actions to manage that risk. This should involve a collection of all the information available and an assessment of that information by experts”.¹³³

Secondly, the institutional separation of science from politics necessarily leads to a regulatory principle underpinning risk analysis which I call ‘isolated’ risk assessments. The role of science in assessments of risk is isolated so that risk is to be ascertained by scientific expertise alone. The institutional arrangements – the ‘administrative constitution’ - do not allow there to be any other information upon which risk is assessed (only ‘managed’). Figure 1 depicts the relationship between the *Meroni* doctrine, the institutional separation and the lock into isolated risk assessments.

The regulatory lock applies to risk assessments only. I am not suggesting that risk analysis, which includes the political management, communication and scientific assessment elements, is bereft of any political or value-laden consideration. Clearly values are included in analyses of risk at the management stage. The lock applies to assessments of risk that can take place solely by scientific institutions and can only ever be based on scientific information alone. Majone claims that the institutional separation of risk assessment from risk management is counterproductive because “while the two functions are conceptually distinct, in practice they are closely intertwined”.¹³⁴ Whilst this lock may be appropriate where science is certain enough to formulate meaningful risk assessments, I suggest that the lock is in-

appropriate where there is significant scientific uncertainty because assessments on scientific information alone are likely to be meaningless.

The regulatory ‘lock’ into isolated assessments marks a return to a point foreshadowed in the introduction, namely that the EU’s regulatory structure for risky activities tends to be rigid and technocratic. The principle of isolated risk assessments is rigid because it is unable to apply different types of risk assessment such as the incorporated risk assessment. It prevents the regulatory framework from responding appropriately to differing levels of scientific uncertainty posed by different activities. It is unable to respond to the high level of scientific uncertainty characterising trans-scientific issues¹³⁵ such as significant scientific uncertain SRM field research. In short the EU’s response as articulated in the *Meroni* doctrine is counterproductive in maximising legitimacy because of the assumption it makes about the ability of science to assess the risk of SRM and its research. So the legitimacy deficit of nTPR might be ameliorated through the EU’s formalisation and commitment to *Meroni*’s principle of non-delegation but the resulting framework might also be unresponsive, inflexible, exclusive and technocratic.

IV. An alternative Approach

This is the story so far: SRM field research is a trans-scientific issue when its effects are significantly scientifically uncertain thereby raising challenges for legitimate decision-making. Conceptualising the regulation of SRM research as nTPR allows us to view those legitimacy challenges in terms of the legality of decision-making institutions and processes. The EU’s response to the challenge of legitimacy is focused on the legal constitutional principle of non-delegation, thereby safeguarding the EU’s institutional balance of powers. In so doing the EU safeguards le-

133 Fisher, *Risk Regulation*, *supra* note 10, at p. 28.

134 Majone, “Foundations of Risk Regulation”, *supra* note 37, at p. 18.

135 *Ibid.*

gitimacy as conceptualised by the transnational approach but results in inflexible, unresponsive, exclusive and technocratic frameworks. To ameliorate these problems, we can turn to an alternative conceptualisation of regulation and concomitant views of legitimacy.

There are three parts to this final section in which I set out an alternative response to regulating SRM field research that is better able to maximise the possibility of securing legitimacy. Firstly, I illustrate the conceptualisation of regulation as ‘directly deliberative polyarchy’ through the example of responsible research and innovation. I use this functional approach to identify other significant aspects of legitimacy – responsiveness, flexibility, deliberation and inclusion. Secondly, I suggest that an incorporated approach to risk assessment can promote elements of deliberation and inclusion within the existing EU regulatory paradigm. Finally, in looking at the implications of adopting the incorporated risk assessments, I suggest that the EU will be required to take the counter-intuitive response to safeguarding legitimacy by departing on occasion from its strict non-delegation position, but in so doing a more flexible, responsive framework can emerge that is better able to maximise the possibility of securing legitimacy.

1. Illustrating an Alternative Conceptualisation of Regulation and Legitimacy

What follows is an illustration of how the regulation of one type of SRM field experiment helps us think about alternative conceptualisations of legitimacy and the degree to which they are able to address the deficiencies presented by legitimacy as ‘legality’ under the conditions of significant scientific uncertainty.

a. SPICE – An Example of ‘Responsible Research and Innovation’

The Stratospheric Particle Injection for Climate Engineering (SPICE) project¹³⁶ investigated the effectiveness of SRM by exploring how the mimicking of natural processes of volcanic eruptions by injecting sulphate particles into the stratosphere might lower average global temperatures. There were three working packages which aimed to evaluate candidate par-

ticles, test delivery systems and model climate impacts.

SPICE is an example of SRM field research because the second of its working packages aimed to investigate “the feasibility of putting particles into the stratosphere in order to affect global temperatures”.¹³⁷ This part of the project was to take place outdoors in order to explore potential delivery systems of the particles into the stratosphere¹³⁸ by studying a large balloon tethered by a 25km length of pipe to a pump on the ground. Unlike other proposed tests whose effects could be transboundary¹³⁹ it was unlikely that this technology development test¹⁴⁰ would generate transboundary effects. It falls under non-transboundary SRM field research of table 1. SPICE is an appropriate example because it was more than only a proposed test; it commenced and was subject to regulation. It provides a site in which to consider different conceptualisations of regulation and legitimacy.

The progress of SPICE’s second working package is an example of the governance framework called ‘responsible innovation’, which I suggest can be classified as a type of reflexive governance. One of SPICE’s funders¹⁴¹ was the Engineering and Physical Sciences Research Council (EPSRC) which is committed to responsible innovation. Working Package 2 of SPICE was required to pass through a ‘stage-gate’: “a decision point where [the EPSRC] considers whether to continue an activity, add additional resource based on progress achieved, or reduce or stop funding. Stage-gating also allows major changes in direction to be agreed, guided by the results obtained to date”.¹⁴² In October 2011, EPSRC’s Societal Issues Panel postponed the field trial for six months and in

136 <http://www.spice.ac.uk/> (last accessed 12th May 2015).

137 <http://www.spice.ac.uk/project/about-the-project/> (last accessed 12th May 2015).

138 Working Packages 1 and 3 are laboratory based, but Working Package 2 takes place outdoors.

139 *Supra* note 55.

140 For example, process studies, scaling tests and climate response tests in Keith et al, “Field Experiments on Solar Geoengineering”, *supra* note 34.

141 Two other funders are Natural Environment Research Council (NERC) and the Science and Technology Facilities Council (STFC) which all comprise part of group of Research Councils in the UK (RCUK).

142 <http://www.epsrc.ac.uk/about/plans/implementingdeliveryplan/transchange/research/stagegating/Pages/stagegating.aspx> last accessed on 17th April 2014.

May 2012 cancelled it altogether¹⁴³ for reasons relating to its governance, intellectual property and insufficient deliberation and stakeholder participation.¹⁴⁴ The stage-gate provides an opportunity to evaluate the extent and nature of stakeholder deliberation and direction of the research prior to allocation of subsequent tranches of research funding.

Since that time the principles of responsible innovation have become more common-place.¹⁴⁵ The European Commission has identified similar initiatives in other member states which it calls 'Responsible Research and Innovation', recommending a 'comprehensive approach to achieve...improved alignment'.¹⁴⁶ It might now be argued that it has developed into a framework¹⁴⁷ – although not formally part of EU policy – exhibiting four dimensions: anticipation; reflexivity; inclusion; and responsiveness.¹⁴⁸

b. An Illustration of 'Directly Deliberative Polyarchy'

Despite lacking conceptual weight,¹⁴⁹ responsible research and innovation can be viewed as a new governance of science¹⁵⁰ that is redolent in a number of ways of a broader regulatory theory such as Sabel and Zeitlin's democratic experimentalism.¹⁵¹ Democratic experimentalism is an approach to regulating "intractable problems that cannot be resolved by a simple appeal to 'the facts'"¹⁵² characterised by processes of co-design, benchmarking and monitoring.¹⁵³ Drawing on regulation as democratic experi-

mentalism to think about legitimacy for regulating SRM field research is appropriate for numerous reasons. Firstly, it is appropriate for the regulation of highly complex problems and solutions¹⁵⁴ under conditions of strategic uncertainty.¹⁵⁵ For the purposes of this paper, in situations where the physical effects of SRM field research are significant, scientific uncertainty is indicative of an intractable scientific problem that cannot be resolved by science alone. And whilst Sabel and Zeitlin refer to strategic uncertainty as "meaning that policy makers recognise that they cannot rely on their strategic dispositions...to guide action in a particular domain"¹⁵⁶ there is clearly the possibility that a parallel could be drawn with scientific uncertainty.

Sabel and Zeitlin call this new form of governance 'directly deliberative polyarchy': "It is deliberative because it uses argument to dis-entrench settled practices and open for reconsideration the definitions of group, institutional, and even national interest associated with them. It is directly deliberative because it uses the concrete experience of actors' differing reactions to current problems to generate novel possibilities for consideration...It is polyarchic because it is a system in which the local units learn from, discipline and set goals for each other".¹⁵⁷

Responsible research and innovation views itself as experimentalist to the degree that it promotes social learning and democratisation¹⁵⁸ in much the same way as Sabel and Zeitlin's directly deliberative polyarchy. Both are procedural. Directly deliberative polyarchy, characterised as a form of reflexive gover-

143 <http://www.guardian.co.uk/environment/2012/may/16/geoengineering-experiment-cancelled> and <https://www.newscientist.com/article/dn21840-controversial-geoengineering-field-test-cancelled/>.

144 <http://thereluctantgeoengineer.blogspot.co.uk/2012/05/testbed-news.html>.

145 IAPG, "The Public and Other Stakeholder Perception of Geoengineering: Facilitating Responsible Innovation" Briefing Note 2, available on the internet at: http://iagp.ac.uk/sites/default/files/IAGP_Briefing_Note_2.pdf (last accessed on 14 May 2015).

146 European Commission DG for Research and Innovation Science in Society "Options for Strengthening Responsible Research and Innovation" EUR25766 (2013), at p. 3.

147 Jack Stilgoe, Richard Owen and Phil Macnaghten, "Developing a Framework for Responsible Innovation", 42 *Research Policy* (2013) 1568-1580; Rene Von Shomberg "Prospects for Technology Assessment in a Framework of Responsible Research and Innovation", in M. Dusseldorp and R. Beecroft (eds), *Technikfolgen Abschätzen Lehren* (VS Verlag für Sozialwissenschaften, 2012)

148 Ibid.

149 Ibid p. 1570.

150 Ibid p. 1577.

151 Charles, F. Sabel and Jonathan Zeitlin, "Learning from Difference: The New Architecture of Experimentalist Governance in the EU" 14(3) *European Law Journal* (2008) 271-327

152 Olivier De Schutter and Jacques Lenoble (eds), *Reflexive Governance: Redefining the Public Interest in a Pluralistic World*, (Oxford: Hart Publishing, 2010), pp. xix.

153 Charles F Sabel and Jonathan Zeitlin, "Experimentalist Governance", in David Levi-Faur (ed.), *The Oxford Handbook of Governance*, (Oxford: Oxford University Press, 2012), pp. 169 et sqq.

154 Joshua Cohen and Charles Sabel, "Directly-Deliberative Polyarchy" 3(4) *European Law Journal* (1997), pp. 313 et sqq.

155 Sabel and Zeitlin, "Learning from Difference", *supra* note 151

156 Ibid., p. 280.

157 Ibid., p.. 276.

158 Stilgoe, Owen, Macnaghten, Developing a Framework 2013, *supra* note 147, at p. 1577.

nance¹⁵⁹ is a dynamic, functional regulatory process that aims to maximise its members' normative expectations through conditions of collective action¹⁶⁰ in the same way that responsible innovation is "a transparent, interactive process by which societal actors and innovators become mutually responsive to each other".¹⁶¹

Legitimacy as conceptualised in directly deliberative polyarchy can be characterised as inclusive and deliberative. It is the normative expectation of *members* that are met, not solely groups of scientific experts or politicians. Technocratic forms of authority are *dis-entrenched* through the democratising destabilisation¹⁶² of directly deliberate polyarchy. And it is the *concrete experience of actors' differing reactions to current problems* which generates new innovated solutions. SRM research community members, university ethics committees, research councils etc. are able to participate in transformative politico-scientific decision-making processes through stage-gate processes, inclusively composed committees, and other procedures.

Legitimacy as conceptualised as directly deliberative polyarchy can also be characterised as responsive and flexible. It is the responsiveness and flexibility of the regulatory framework which is significant here. So the framework that comprises institutions and procedures that enable members to interact, learn from and mutually respond to one other will be more legitimate than a framework that does not. Being flexible marks a regulatory framework as capable of change; of disturbing settled practices; of facilitating change through learning.

2. Incorporated Risk Assessments

Thus far the focus of SRM field research has been on its physical effects and the problem for legitimacy raised under the conditions of significant scientific uncertainty. SRM field research is, as Majone calls it, a 'trans-scientific' issue when its effects are significantly scientifically uncertain, for which science alone is unable to assess risk owing to the 'inherently unpredictable'¹⁶³ outcome of action. This section marks a return to an issue touched upon earlier, namely the non-physical impacts of SRM research; the different types of sensitivities aroused by SRM research which relate to political, moral, ethical, as well as scientific issues. I suggest an alternative approach to reg-

ulating risk which accounts for non-physical effects of SRM field research in assessments of risk where there is significant scientific uncertainty.

This alternative approach is one based on what I call an 'incorporated' approach to risk assessment. An incorporated approach is more inclusive and deliberative and better able to meet members' normative expectations. There are two elements to incorporated risk assessments which link to inclusive and deliberative regulatory mechanisms. Firstly, they allow for science and politics to be considered simultaneously *during the risk assessment phase*. To this extent, risk can be 'co-assessed' just as it is 'co-produced'.¹⁶⁴ Thus, rather than politics being consigned to representative interests in democratic institutions such as in the legislature through formal processes such as law-making, political involvement is able to take place in the administration of regulation at the point of assessment of risk. It is incoherent to use science as the basis for assessing risk where scientific uncertainty is significant, and as a result something *more* is needed. By incorporating other bases for its assessment risk can be constructed in ways that reflect members' values rather than on incomplete scientific data.

Secondly, incorporated risk assessments are spaces in which individuals can participate directly should they choose. There are formal opportunities for individuals to participate in decision-making processes such as in the form of written comments on proposals as well as in attending meetings. Direct individual participation means that it may be possible for lay knowledge to be included in decision-making processes on the basis that the participation is

159 Jacques Lenoble and Marc Maesschalck, "Renewing the Theory of Public Interest: The Quest for a Reflexive and Learning-based Approach to Governance" in Olivier De Schutter and Jacques Lenoble (eds), *Reflexive Governance: Redefining the Public Interest in a Pluralistic World*, (Oxford: Hart Publishing, 2010), pp. 3-21.

160 Ibid; De Schutter and Lenoble, *Reflexive Governance*, *supra* note 152; Part of the Sixth European Framework Programme for Research and Development REFGOV papers found on the internet at: <http://sites.uclouvain.be/cpdr-refgov/> (last accessed 14 May 2015).

161 Von Shomberg, *Prospects for Technology Assessment*, *supra* note 147.

162 Sabel and Zeitlin, *Learning from Difference* 2008, *supra* note 151, at p. 277.

163 Fisher, *Risk Regulation*, *supra* note 10, at p. 7.

164 Cass Sunstein, *Designing Democracy: What Constitutions Do* (New York, Oxford University Press, 2001).

deliberative. Participation does not dispense with expertise but includes all “generally reliable knowledge, subject to methodological and epistemological limits”.¹⁶⁵ Risk is assessed through a process of deliberation with participation by lay persons and through interest group representatives.

It is arguable that deliberation and inclusion by different interest group representatives should take place in *all* risk assessments, based on the politically contingent nature of science itself. This is accepted. But as I set out in the introduction, the intention of this paper is not to critique the orthodox epistemology of science nor to call for a wholesale shift from the technocratic to the deliberative paradigm. My approach is pragmatic instead: only where there is a significant degree of scientific uncertainty should incorporated approach to risk be facilitated. In so doing my aim is to minimise the disruption to the ‘constitutional administration’ of the regulation of SRM research.

I am not alone in advancing a risk-incorporated approach. Pidgeon et al¹⁶⁶ report the results of one of the first public engagement studies into acceptability and ethics of the feasibility test in SPICE; the test bed for the pumping of water into the sky using a one-kilometre pipe. The findings from the public engagement research are very interesting. They include the imperative for international governance based on consensus; concerns over the unintended consequences of science; knowledge limitation and the links between ‘subscale and transboundary effects’, and communication between politicians and researchers. The most significant finding is developed into the discussion of the paper where Pidgeon et al refer to the ‘intertwining’ of epistemological, societal and institutional ambivalences with the strictly technical and scientific question which, they claim, “will pose the greatest challenge”¹⁶⁷ for future governance research.

My suggestion is that where scientific uncertainty is significant there is an intertwining of the scientific, the social and the political, which evidences the need for a risk-incorporated approach to risk assess-

ment. It is the significance of scientific uncertainty that triggers the need for a risk-incorporated approach so that the scientific, the social and the political can intertwine.

As I suggested above, taking an incorporated approach to risk assessment makes it more inclusive and deliberative by providing opportunities for lay persons to be directly involved in assessments of significantly scientifically uncertain SRM field research. There are other notable advantages for the EU: employing an incorporated approach to risk assessment would to develop a regulatory framework in the EU that is more flexible and responsive, and therefore better able to maximise legitimacy. It is to these last characteristics that we now turn.

3. Implications for the EU

In section III this paper suggested that the EU’s response to safeguarding legitimacy was based on the principle of non-delegation. The case of *Meroni* illustrated the EU’s preservation of the institutional balance of powers, which in turn preserves the institutional separation of science and politics in the assessment and management of risk respectively. I suggested that the *Meroni* doctrine – this regulatory procedure – ‘locks’ the EU’s regulatory framework into one specific type of risk analysis. It is less able to respond to different types of activities because change can only take place pursuant to treaty revisions. In short the framework is rigid, not flexible and unresponsive. As a result it is less able to maximise legitimacy as conceptualised by directly deliberative polyarchy because it cannot respond to members’ normative expectations.

My suggestion is that a risk-incorporated approach is better able to maximise the possibility of securing legitimacy for a regulatory framework in the context of highly scientifically uncertain SRM field research by being more flexible, preventing regulatory lock-ins and facilitating participation in decision-making processes. By adopting a pragmatic stance, elements of directly deliberative polyarchy can be incorporated into the administrative constitutionalism of the EU.

However, as the EU stands, there is little possibility of creating the space for an incorporated approach to assessing risk because the principle of non-delegation set out in *Meroni* precludes the delegation of po-

165 Fisher, *Risk Regulation*, *supra* note 10, at p. 33.

166 Nick Pidgeon, Karen Parkhill, Adam Corner and Naomi Vaughan, “Deliberating Stratospheric Aerosols for Climate Geoengineering and the SPICE Project”, 3 *Nature Climate Change* (2013), pp. 451-457.

167 *Ibid*, at p. 454.

litical powers to scientific institutions. The implications for the EU of developing a regulatory framework that maximises the possibility of securing legitimacy by being flexible is that it will be required to take the counter-intuitive step to delegate decision-making authority in certain circumstances to politically and scientifically composed regulatory bodies. Changing the approach set out in *Meroni* will prevent the lock-in of institutionally separating risk from politics and can allow institutions to evaluate risk by incorporating, rather than separating, politics and science.

The step is counter-intuitive precisely because that delegation will be seen to disturb the constitutional balance of powers that has ties to democratic legitimacy as its core. Moreover, in the context of decision-making around scientifically uncertain activities, the *Meroni* doctrine safeguards against otherwise scientific decision-making on the grounds of efficiency.

It is arguable that these disturbances would reduce formal legal legitimacy. But the disturbance can be minimised in three ways. Firstly, the delegation can be controlled; it can be subject to procedural safeguards such as those set out in the Administrative Procedure Act¹⁶⁸ in the US. Safeguards include participatory procedures for decision-making, such as the Notice and Comment procedure¹⁶⁹ and requirements for transparency and accountability of committee reporting under the Government in the Sunshine Act.¹⁷⁰ Secondly, the composition of committees would have to be inclusive so that delegated decisions would not be made by scientists solely. The institutions co-assessing risk would necessarily be required to be both political and scientific and the composition would reflect that. So, for example, committees would be inclusive and comprise lay members as required by the Federal Advisory Committee Act.¹⁷¹ Lastly, strict conditions will be imposed on when the delegation can take place. In the context of SRM field research this will be when a threshold of scientific uncertainty is significant.

The threshold for significant scientific uncertainty is noteworthy because it is the point at which a move from the isolated to incorporate risk assessment is triggered. Who decides this threshold? I suggest that it be agreed by political institutions on advice from scientists as a 'framework threshold' in much the same way as 'framework goals' such as 'good water status' comprise part of the EU's experimentalist architecture identified by Sable and Zeitlin.

By contrast, the decision as to whether SRM field research actually falls within the threshold and therefore classifiable as significantly scientifically uncertain rests with scientists themselves. Again, this poses difficulties. There may be problems about whether scientists are likely to be biased and want to preserve for themselves their own autonomous space. There is also the charge that the decision to use the risk incorporated mechanism thereby triggering a delegation of decision-making power has simply replaced the scientific assessment of risk: the decision about risk has been shifted further up the line to question of whether the technology is scientifically uncertain or not.

These problems are valid but not insurmountable. The pragmatic stance accepts that decisions about scientific uncertainty need to be taken somewhere and by someone. Climate scientists are able to quantify uncertainty; such quantifications from the basis of IPCC AR reports. In the past significant scientific uncertainty has led to scientists calling for governance arrangements. The Berg letter of 1974 announced the limits of scientific understanding associated with the development of biotechnology. The Royal Society's own 2009 report is an example of the scientific community announcing the discipline's concerns over levels of certainty. Moreover, the US National Academy of Science Committee on Geoengineering the Climate recommended a 'serious deliberative process' to decide governance issues¹⁷² as well as natural scientists and engineers suggesting governance thresholds for SRM field experiments.¹⁷³ It is arguable then that scientists are capable and willing to make decisions about uncertainty even if that means triggering rules for constraining the scientific enterprise.

The call to 'mellow' the *Meroni* doctrine¹⁷⁴ and permit delegation subject to strict safeguards is, to some

168 5 U.S.C. § 551.

169 5 U.S.C. § 533.

170 5 U.S.C. § 552b(e)(3).

171 5 U.S.C.

172 Committee on Geoengineering Climate, *Reflecting Sunlight to Cool Earth*, *supra* note 3, at p. 190.

173 Keith et al, "Field Experiments on Solar Geoengineering", *supra* note 34.

174 Jacques Pelkmans and Marta Simoncini, "Mellowing *Meroni*: How ESMA can help build the Single Market" *Centre for European Policy Studies: Commentary 18th February 2014* (2014), pp. 1-5.

extent, pushing at an open door. The UK failed recently in its attempt to have annulled by the EU Court of Justice based on *Meroni's* principle of non-delegation a discretionary power conferred to the European Securities and Markets Authority (ESMA) by the Council and European Parliament.¹⁷⁵ Article 28 of the 'short-selling' regulation¹⁷⁶ gives ESMA the power to adopt intervening measures to ban short-selling 'in exceptional circumstances' where there is a threat to the proper functioning of the financial markets. The Court rejected the UK's plea that the power entails 'a very large measure of discretion'¹⁷⁷ on the basis that they are amenable to judicial review¹⁷⁸ and therefore suitably circumscribed.¹⁷⁹

The judgment does not undermine the constitutional principle set out in *Meroni* and the necessity of the balance of powers. The ESMA case is situated in a different context to that of scientific uncertainty in this paper and adopts a different basis of legitimacy, arguably output legitimacy¹⁸⁰ but it does place greater weight on the conditions of delegation and the availability of judicial review, which arguably have changed since *Meroni*. The overall point is that *Meroni* has not been applied strictly to preclude regulatory measures by ESMA and my suggestion that delegation take place subject to strict safeguards is not entirely unprecedented.

The pragmatic stance and incorporated risk assessment advanced in this paper balances the need of objective certainty from science (as opposed to decision made on politically arbitrary public opinion or other criteria) with the understanding that under certain conditions alternative constructions of risk should be recognised. My approach differs from Fisher's deliberative-constitutive paradigm in which a shift from one paradigm to another requires a substantial change to the administrative constitution. The pragmatic stance accepts that whilst there may be desirable elements of the deliberative paradigm, there

need not take place a wholesale change in the administrative constitution away from the technocratic paradigm. The pragmatic stance minimises the disturbance of the EU's constitutional balance of powers, and as such may be considered an improvement on a regulatory framework located in the deliberative paradigm alone.

V. Conclusion

Claims about the legitimate regulation of SRM field research are easy to make but difficult to substantiate. Firstly, the current absence of a formal regulatory or legal framework for SRM field research makes it difficult to suggest improvements that strengthen its legitimacy. Secondly, the significant scientific uncertainty of SRM field research and its effects link to questions of risk and the relationship between science, politics and other value-systems. Thirdly, there is no certainty about what kind of regulatory framework will emerge, leading to similar uncertainty about the conceptions of legitimacy that will be relied upon. In trying to suggest mechanisms to maximise the possibility of securing legitimacy, this paper has engaged with many variables: what sort of regulatory framework will emerge; how can risk be regulated; and what concept of legitimacy will be employed? It is within the context of these significant variables that the paper's central claim has been made.

The paper suggested how the EU regulation of SRM field research could be designed to maximise the possibility of securing legitimacy. Under conditions of significant scientific uncertainty, SRM field research poses challenges for its legitimate regulation. The EU's orthodox response to the challenge of legitimacy is to ensure the institutional 'balance of powers'. This response is deficient because it entrenches a risk analysis approach that is inappropriate for significantly scientifically uncertain SRM technology. My suggestion is a pragmatic one. It is to institutionalise an incorporated approach to risk which provides space for deliberative and inclusive decision-making in the technocratic paradigm as part of a responsive and flexible framework whilst retaining the general institutional balance of the EU. In doing so, the EU develops spaces for more directly deliberative polyarchy without jettisoning its orthodox constitutional approach.

175 Case C-270/12 United Kingdom of Great Britain and Northern Ireland v European Parliament and Council of the European Union [2014]

176 European Parliament and Council Regulation (EU) No 236/2012 on short-selling and certain aspects of credit default swaps, OJ 2012 L 86.

177 *Ibid.*, at para. 54.

178 *Ibid.*, at para. 53.

179 *Ibid.*, at para. 45.

180 *Ibid.*, at para 35: ESMA's measures "require a high level of technical and economic expertise and information".

In the introduction I explained why the paper engages with two substantial areas of regulatory scholarship: EU regulation of risk and transnational private regulation. In exploring the relationships between conceptualisations of legitimacy and their respective regulatory frameworks, this paper is not situated firmly in the literature on transnational private regulation or in EU regulatory scholarship. Instead it spans both. The aim has not been to contribute solely to one or other area of scholarship but to eval-

uate how each views legitimacy and then apply it in the context of the regulation of SRM field research. The paper is intended to be of interest to both audiences because it provides an opportunity to apply the concept of legitimacy beyond the terms ordinarily expected of each respective regulatory theory. In so doing the paper endeavours to provide a theoretical opening in which both audiences are able to think about how to govern SRM field research that best maximises the possibility of securing legitimacy.