cess, or failure, of the regulation to achieve its multifaceted objectives; ensuring a high level of protection of human health and the environment, while enhancing competitiveness and innovation of the European chemical industry. The authors - while proposing valid indicators to assess the potential answers to this question - acknowledge, that it is premature to draw far reaching conclusions from the analysis of the first six years of REACH experience. The goals of the Regulation were set with an aim to transform the European chemical industry of the future by promoting safer alternatives of existing chemicals. The short term impact of the immediate obligations of REACH may not be conclusive in assessing whether this aim will actually be achieved. The authors conclude, however, that achieving these objectives, the regulation has to be implemented and applied in an efficient and predictable way. A very interesting Chapter 15 provides an original insight on how the regulation might be reformed to promote this efficiency and predictability, contributing to its final success.

The book adds well to material already available on the application of REACH and definitely brings added value with its overview and practical insights over the REACH processes and obligations, thus complementing well the other reference manual on the Regulation, published at the same time, i.e. the Best Practice Guide to Regulation (EC) No 1907/2006, Drohman/Townsend, which took a different stance to explaining the different pillars of the Regulation, and rather than trying to do it all, it went into greater details in some chosen areas of its provisions.

Vulnerability in Technological Cultures: New Directions in Research and Governance
   by Anique Hommels, Jessica Mesman and
   Wiebe E Bijker (eds.)
   MIT Press, 2014, 382 pp.
   € 29,62; paperback

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At a time when the Ebola epidemic has seen the deaths of thousands living in poor communities in West Africa, and when a rash of political and economic instabilities in the Middle East have brought a different form of death to thousands of others, social and personal risks and vulnerabilities loom large,

as much in their invisible as their highly visceral and material forms. Systems of control and surveillance are mobilised while local practices and everyday life are turned upside down, and coping strategies only just coping. Powerful command and control resources are deployed in an effort to contain, to kill off, to eradicate visible and invisible threats, though hospital camps, vaccines, drones, and bombs. The lesson of this book is that while there may be a place for strategies based on risk reduction and control, understanding the ways in which vulnerabilities characterise socio-technical systems – technological cultures – and wider society will help build more effective, optimal forms of resilience. Indeed, command and control responses are more rather than less likely to create new risks and less resilient systems, as we have seen for many years in the maelstrom of the Middle East. Even in less fractured and peaceful worlds, the attempt to manage complex systems through more rigorous forms of control may not succeed: 'the more tightly coupled and the more complex a system is, the more it is prone to failure' (p 15). The take-home message of the book is that vulnerability can in fact be a positive aspect of socio-technical systems inasmuch as it engenders – or in principle should engender – a recognition of the need to embrace uncertainties and a pragmatic ethics towards their management.

The book is a rich and extensive exploration of the meaning and dynamics of vulnerability in a diverse range of contexts, or technological cultures: in hospital settings, the chemical industry, the rail industry, oil production platforms, and agricultural systems in low income economies. The aim of the book is that by understanding the complexities of vulnerability itself it is possible to help shape policy and practice in more socially robust ways based on a strong normative subscription to transparency, diversity, and a dialogue between local coping practices – the bricolage of everyday (working) life - and global systems of risk management. In doing so, the book shows how and when vulnerability can be *both* a problem and an asset, a vehicle through which a culture of social accountability can be built.

The book is structured into three parts. The first examines the meaning of vulnerability in a diverse

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range of settings within the global North and South and shows how vulnerability is best understood as an emergent not intrinsic property of socio-technical systems, and how it changes over time, and space. For example, Jasanoff shows how the Bhopal explosion in India, whose legacy continues decades later, resulted from a transnational vulnerability caused by a failure to understand how socio-technical cultures (of chemical production) could not be transposed from the US to India. Moreover, in a similar story that appears later in the book by Hommels *et al.* about Seveso , it is clear that national risk governance regimes fail to deal with globalised technical systems, while the legal and regulatory regimes of the powerful fail to serve the interests of communities hit most hard by these events.

The second part offers a rich and empirically grounded discussion of the conceptual terrain upon which the book is built drawing on a number of detailed ethnographies of vulnerability and its performativity. I use this term as it is evident from the chapters by Prasad (on the language and practice of innovation in social systems in India), by Healy and Mesman (on different varieties and levels of resilience), and by Wackers and Sanne (on the cultural framing of risk-taking and strategies through which risks are survivable in the off-shore oil industry and the 'railroad' respectively) that vulnerability is constructed, shaped, orchestrated and refashioned by social actors. It is a highly plastic process and one that is far removed in conception from objectivist notions of risk-management, which are a critical target for this book.

The final part is made up of a series of chapters tackling the difficult question of how, in light of the preceding debate, it is still possible to move from a deconstructivist position on risk to one that offers insight into what might be appropriate forms of governance for technological cultures. The overall perspective here is to adopt the precautionary-based approach, but to do so in a much more refined way than is found in much of the literature today. This is especially seen in the chapter by De Vries, Verhoeven and Boeckhout who discuss how risk-related responsibilities are allocated when dealing with uncertain or ambiguous problems, those that formal legal or regulatory procedures often ignore or are incapable of handling. In such circumstances, the authors make a good case for a move from trying to determine responsibility based on 'outcomes' to one that asks in-stead about where and with whom 'obligations' sit? In a similar fashion, Palmboom and Willems go on to suggest– through a case study of health screening - that a sharing of responsibilities for the unknown across patients, clinicians and public health agencies is a much more promising strategy than formal attributions of liability and risk. This they call (drawing on Antonovsky) a 'salutogenic' approach to public health, an embrace of uncertainty that is embedded in community and individuals alike. A similar argument is advanced by Keulartz and Schermer who advocate a strong pragmatism in coping with vulnerable cultures, one grounded in an adaptive rather than pre-cast approach to risk. Finally, a highly theorised piece by Stirling sets out a concluding model which speaks for the book as a whole, a model that integrates an understanding of epistemic, normative and ontological aspects of risk.

The book, therefore, is a fresh attempt to move towards an understanding of vulnerability – indeed it describes itself as a contribution to 'vulnerability studies', and is far removed from the conventions of risk management theorising. It is also very 'Dutch' (meant in a complimentary sense) inasmuch as its authors (not all of whom are Dutch!) seek to build a consensus around a democratic framing of living with and mobilising vulnerabilities. It does not however run shy of offering strongly critical commentary on systems of power and injustice. What, however, are the likely limits of this approach in practice – maybe more likely to have impact in rethinking the social management of Ebola than the political interventions and counter responses in the Middle East. It would have been useful too to look at the growth of 'Big Data' systems that have very different spatial and temporal characteristics to those settings discussed in the book, driven by real-time data-driven algorithms that enable not forecasting but 'nowcasting'. Is this a qualitatively different technological culture, heralding new forms of vulnerability?

The book will be of value to academics and students as well as those in the policy world keen to cope with the risk society. It is well written and well organised and offers a new perspective on key notions such as resilience. It would be good to see whether future work will build on this and not only cover the digital as mentioned above but thereby try to see whether it is possible to produce a model of different types of technological cultures that map onto discrete forms of vulnerability.