Emerging technologies and risk: the social, cultural and political dimensions

Bronislaw Szerszynski argues that when it comes to new technologies, technical risk assessment is not enough.

We are living at a time in which the pace of technological innovation seems unprecedented. Indeed, some futurologists predict that by the end of the current century, developments in areas such as genetics, robotics, information technology and nanotechnology will have produced a step change in humanity's capacity to control its destiny.[1] But such grandiose narratives often neglect the lessons of history – that technologies rarely, if ever, simply deliver their promised benefits; they also change the world both materially and socially in complex and unpredictable ways. New technologies, then, are risky.

But how should we understand risk? Fundamentally, risk is a particular way of thinking about and handling situations where the outcomes of our actions are uncertain – either just because our knowledge is incomplete, or because the outcome is genuinely unpredictable. Formal, technical risk assessment tries to domesticate such situations by the use of probabilities: we may not know which of the possible outcomes will occur, but if we know their probabilities we can use this knowledge to guide our actions. In this way of thinking, risk is defined as the probability of a negative impact multiplied by the size of that impact: so, for example, if a hazard has a 1% chance of producing 100 deaths, it is equivalent in risk terms to another hazard that has a 50% chance of producing two deaths.

However, the sociology of risk suggests that this is too narrow a view, and that we need to think about risk and new technologies in a more complex way. Firstly, not all situations fit the criteria for risk thinking. The logic of risk assessment is arguably well suited to situations where we are dealing with familiar hazards with known impacts and known probabilities. But the more a situation departs from this ideal, the less helpful risk calculation becomes. In some situations, although we might be confident what possible impacts might follow, we might be unable to assign reliable probabilities to them. In others, we might not even be confident that we have identified all the relevant impact pathways that we ought to be concerned about, let alone their probabilities. This, with hindsight, was the situation that scientists were in when chemicals such as CFCs and PCBs were introduced, and is arguably the case today in respect of emerging technologies such as geoengineering. Under such conditions, conventional risk management is inadequate, and responsibility requires that one proceeds in a precautionary manner, in order to reduce the possible impact of surprise.[2]

Secondly, we might want to question the basic definition of risk as 'impact-times-probability'. It is well known from social psychology that members of the public tend to rate technological risks in a rather different way.[3] They are not only interested in the quantitative characteristics of risks, such as the likely number of casualties over a particular time period; they also respond to qualitative characteristics, such as whether the hazard is familiar or unfamiliar, whether the risks are voluntarily taken or imposed by others, and whether they are fairly distributed. It is important to recognise that it is legitimate to have different priorities and concerns in relation to technological risk.

Thirdly, there is also a danger that the social authority granted to risk as a way of governing technological innovation might result in the neglect of a whole range of other kinds of concerns that people might legitimately have. These include, for example, global equity, the concentration of power, and the subtle shaping of human wants and aspirations. There are many concerns that people might have about new and emerging technologies that cannot be reduced to physical harm to humans or other organisms. Risk talk can *itself* be risky if we allow it to delegitimise such concerns.

Culture and the technological fix

An examination of the role that technology plays in society shows us that it does not simply serve as a means to an end. It also carries complex cultural meanings, both individual and collective. This is a commonplace observation in relation to the public; the public, it is complained, do not react to the real risks of technologies such as nuclear power or genetic modification; instead, they react to meanings that they have projected onto them.

But it is important to insist that cultural meanings and narratives are in play on the *supply* side of technological innovation as well. Institutions involved in all aspects of innovation – science, industry, investment, regulation – are all shot through with their own imaginaries of the future, guiding narratives, values and symbols.

Here I want to focus on one such cultural syndrome: the 'technological fix', also known as the 'magic bullet' or the 'silver bullet'. This is the persistent belief in the possibility of solving complex systemic problems with narrowly technical solutions. The term was originally popularised by the American nuclear physicist Alvin Weinberg in a 1967 book in which he identified what he saw as cheap and effective fixes for a number of complex social problems, ranging from the population explosion, the threat of war between east and west, and social unrest in the inner city.[4]

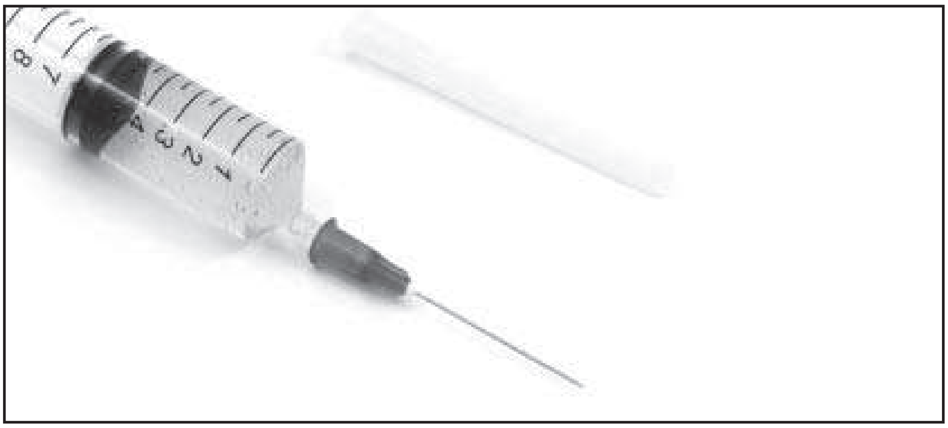
Many have since pointed out the over-simplistic nature of such approaches.[5] Yet the syndrome refuses to go away.

- For example, we know that *food insecurity* is exacerbated by a complex matrix of factors, including the integration of indigenous agro-food systems into global technological and economic flows, resulting in the loss of local knowledge, varieties and agronomic viability. Yet policy responses tend to focus disproportionately on trying to increase crop productivity through high-tech interventions such as GM crops.[6]
- In *health*, too, the emphasis has been on knowledge-intensive forms of medicine such as genomics. Yet experiments in less industrialised countries suggest that developing better health systems, which target resources in line with the local 'burden of disease', can be a far more effective way to improve health levels and life expectancy.[7]
- The rise of *geoengineering* as a serious contender to join mitigation and adaptation as a major element of climate policy also suggests the enduring allure of narrowly technical solutions to complex socio-technical problems.

Why does this way of thinking persist? As Lily Kay commented, one answer, at least, seems to lie in the need of social elites to feel that they can cut through the complexity of the world and find a simple lever that they can pull and change the world.[8]

The role of capital[9]

Innovation is, of course, also shaped by the search for profit, a dynamic that has been strengthened and transformed by the post-1978 rise of neoliberalism, a political ideology favouring markets, trade, property rights and deregulation. In particular, neoliberalism has shifted relations between science, state and markets, encouraging scientists to adopt the



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entrepreneurial and utilitarian cultural codes of the private sector, and repositioning universities as would-be engines of a new, knowledge-based economy.

However, this new economy has failed to provide the sort of innovations that could return Western economies to the conditions enjoyed during the ‘long boom’ that lasted from 1945 to 1973. Those decades saw a massive improvement in productivity, health, and standard of living as a result of the final fruition of a cluster of hugely significant inventions that had emerged in the late 19th century: electric light and motors; the internal combustion engine; the chemicals industries including petroleum, plastics and pharmaceuticals; communication and media technologies; and plumbing and sanitation.[10]

By contrast, despite the proliferation of consumer electronics, the contemporary new knowledge economy has so far not produced anything equivalent to those ‘killer’ technologies. For example, the application of information technology to industry and office work has seen diminishing returns in terms of productivity.[11] In addition, although the ‘biotech revolution’ has accelerated drug discovery, this has not followed through into drug development and clinical practice, so has failed to reverse the decline in productivity of the pharmaceutical sector.[12]

The clash between this ‘innovation crisis’ and capital’s endless need for profit has had a perverse effect on the course of technological innovation, with consequences for risk.

- Firstly, it has seen companies going for ‘low-hanging fruit’ to gain rapid returns on their R&D investment by releasing suboptimal technologies with debateable risk profiles, such as herbicide resistant GM crops.
- Secondly, it has shifted science and technological innovation towards an economy of promise and financialisation, with all the attendant dangers of speculative bubbles.
- Thirdly, the continuing difficulty in obtaining significant profits from conventional commodity production, or by investing in new production technologies, has led companies to seek other ways of increasing profits, by capturing value produced elsewhere in the economic system. Examples here include strategies of concentration (witness Monsanto purchasing large parts of the seed industry) and the ‘primitive accumulation’ involved in the private appropriation of knowledge produced outside the profit system, for example in indigenous societies or the university system. Such developments involve a different kind of risk, through the undermining of commons, the further impoverishment of the global poor who cannot compete or transform their agriculture, and the increased power of corporations.

Conclusion: letting the public in?

Such observations suggest important roles for the public and civil society in shaping the direction and pace of technological change. Past experience of the introduction of new technologies shows that the ‘core sets’ of technical experts involved in the development and regulation of technologies are prone to a misplaced confidence in the reliability and comprehensiveness of their knowledge. Taking relevant lay and local knowledge seriously can help scrutinise the robustness of knowledge bases, reduce blind spots, introduce a wider set of values and framings, and help to reduce institutional obstacles to learning.[13]

The rise of neoliberalism has, if anything, moved things in the opposite direction, encouraging a scientisation of risk regulation in which a narrow ideology of ‘sound science’ is used to exclude the consideration of wider values or precautionary concerns. It is important that such developments are resisted, so that the power to shape our technological future, currently highly concentrated, is more widely distributed in society. Following this latter path could constitute a genuine democratisation of technological change, by bringing into play a wider set of visions of the future and ideas of risk, grounded in the worldviews and experience of the many, not the few.[14]

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References

(web links correct as of 15 September 2011)

1. For example: Kaku M (1997). Visions: How Science Will Revolutionize the 21st Century. New York: Anchor Books.
2. See: European Environment Agency (2002). Late lessons from early warnings: the precautionary principle 1896-2000. Environmental issue report No 22. Copenhagen: EEA. http://www.eea.europa.eu/publications/environmental_issue_report_2001_22
3. Slovic P (2000). The Perception of Risk. London: Earthscan.
4. Weinberg A (1967). Reflections on Big Science. Cambridge, MA: MIT Press.
5. Rosner L (ed) (2004). The Technological Fix: How People Use Technology to Create and Solve Problems. New York: Routledge.
6. Wallace H (2010). Bioscience for life? Who decides what research is done in health and agriculture? GeneWatch UK. pp.103-115. http://www.genewatch.org/uploads/f03c6d66a9b354535738483c1c3d49e4/Bioscience_for_life.pdf
7. de Savigny D, Kasale H, Mbuya C, Reid G (2004). Fixing Health Systems. Ottawa: IDRC.
8. Kay L (1993). The Molecular Vision of Life: Caltech, the Rockefeller Foundation, and the Rise of the New Biology. New York: Oxford University Press.
9. This section draws on research conducted with Laurence Reynolds.
10. Smil V (2005). Creating the Twentieth Century: Technical Innovations of 1867-1914 and Their Lasting Impact. New York: Oxford University Press.
11. Gordon R (2000). Does The ‘New Economy’ Measure up to the Great Inventions of the Past? Journal of Economic Perspectives, 14(4), pp.49-74.
12. Nightingale P, Martin P (2004). The Myth of the Biotech Revolution. TRENDS in Biotechnology, 22(11), pp.564-9.
13. See footnote 2.
14. Wynne B, Felt U (2007). Taking European Knowledge Society Seriously. Brussels: European Commission D-G Research, Science Economy and Society Directorate. http://ec.europa.eu/research/science-society/document_library/pdf_06/european-knowledge-