



New vistas for technology and risk assessment? The OECD Programme on Emerging Systemic Risks and beyond

Tomas Hellström*

CIRCLE – Center for Innovation, Research and Competence in the Learning Economy Lund University, Box 117, 221 00 Lund, Sweden

A B S T R A C T

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This paper presents a framework for understanding risk from the perspective of technological innovation and change. Special focus is put on systemic technological change, which tends to affect several dimensions of society at the same time. By drawing on innovation theory, and exemplifying by reference to the OECD futures project on Emerging Systemic Risk, the article elaborates a framework for technology assessment where the central elements are ubiquitous technological change and risk. Several key dimensions for technology assessment of this kind are identified, including increased mobility of people and goods, magnitude and concentration of humans, the speed and depth of change in the risk landscape, public to private shifts in the 'ownership' of risk, and the role played by expectations and perception to risk. The article ends with suggesting a number of new norms for risk and technology assessment coupled with new risk methodologies for further investigation.

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1. Introduction

Modern society seems to increase its rate of risk production constantly, and this is due not in the least to an increasing production of advanced technology and large infrastructural systems. These systems create new possibilities for individuals and social groups and new sources of growth. They promote health, fresh ideas and applications; they affect our way of communication and, in extension, stimulate new visions of what democratic society may look like. The flipside of this image is an increased absence due to illness, creeping health risks such as stress related decease, personal financial and institutional vulnerability, technological isolation of growing social groups, e.g. people of age. The cost of natural disaster has increased almost exponentially over the past 50 years, partly as a result of technological and industrial clustering – the same type of clusters that are now on top of the agenda for countries seeking to exploit systems opportunities in search for higher rates of innovation. An increasing number of catastrophic accidents originate in technological industrial systems, e.g. Bhopal, Piper Alpha, and Chernobyl.

It is becoming increasingly difficult to separate sources of risk from societal processes, and from the social order to which many of us have committed ourselves. We appreciate the ease with which computer systems and software communicate now as compared to a few years ago. It has been a long time ambition among many countries to increase the computer literacy of their populations. At the same time Robert T. March, Chairman in the *Presidents Commission for Critical Infrastructure Protection*, warned already in 1997 that this has created a threat in the form of the development and distribution of computer viruses – so-called "cyber terrorism" and associated vulnerability. The word then was that the hazard derived from this new

* Tel.: +46 706 56 66 00; fax: +46 46 222 41 61.

E-mail address: tomas.hellstrom@circle.lu.se

literacy in conjunction with the connectedness of public and private computer networks, and those physical processes that these often control [1].

These are a few examples of modern life's maybe most fundamental dilemma that development often, if not in some sense always, walks hand in hand with uncertainty and threat. The principle is illustrated by closely observing basically any technological system or artifact, large or small. The introduction of new, or the development of old technology is therefore always a question of taking, managing or maybe more appropriately developing risk, because technological development is in every situation a matter of balancing danger against relative safety, between opportunity and threat.

One may reflect that we have in many cases been more creative in developing new technologies, products and processes, than we have in attempting to understand how these affect people and societies, and not least how they relate to other technologies. In many ways *Homo Faber* still dominates *Homo sapiens* – work, and making things work, takes precedence over reflection. This has implications for how we understand risk, as well as for our systemic and long term ability to manage it. Taking its points of departure from the OECD project on Emerging Risks in the 21st Century [2], this paper aims to provide a background discussion on how technological risk may be interpreted and assessed according to a set of somewhat more flexible principles than has previously dominated, and further to connect such an analysis to existing notions of technology assessment that may aid in this process. In doing so, this paper will also touch upon some of the background literature and theoretical perspectives within technology assessment and innovation studies. The main purpose of this paper however is to draw out some implications of the OECD study's conception of technological systems and risk. After having reviewed some key notions of innovation and technological change, a review of the OECD report will be conducted. This review will then be put into a technology assessment perspective, and key suggestions for systemically oriented risk and vulnerability analysis of emerging technological systems will be proposed.

2. Technological innovation and society

As previously mentioned, emerging technological systems represent an expanding source of new risks and vulnerability in society. Such risks may be exemplified by the close coupling of Information and Communication Technologies (ICTs) and critical infrastructures, new production and distribution systems (e.g. modularity in product design and manufacture and just-in-time organizing of value chains), as well as various forms of automatization of the workplace as well as of society at large [3]. The development of risk and society seems to melt into one. For some commentators, e.g. Ulrich Beck, the utility of techno-economic production is now wholly overshadowed by the production of risk [4].

Others talk of an essentially precarious ontology, where risk is no longer a factor external to life which may be compensated for in various ways, but rather an integral part of the modern experience. Risk – and its closest ally technology – is a part of, rather than apart from, life. It follows that risk and technology should be studied in the same way, as an integrated part of people's life-world, of their interpretations, actions, and their situated role in the development of society. Similarly to technology, the production of risk will mimic people's creative actions and responses, rather than follow some detached trajectory of its own. A closer look at a few generic forms of technological innovation will illustrate this point.

Technological development often appears as complex, unpredictable, and stable, all at the same time. This characteristic points to two contrasting yet strongly related forms of technological innovation: incremental innovation and innovation in the techno-economic paradigm, or radical innovation [5]. Incremental innovation implies gradual modifications or additions to existing systems, where each increment adds some to the level of complexity that the system displays. Note that these changes often come as a result of suggestions for improvement, from engineers/operators and other users.

From a risk perspective incremental innovation seems less problematic than radical innovation, which of course introduces new and previously unexperienced technology-society interfaces. However, incremental innovation can be associated with a particular family of risk, namely path dependent, or creeping risk, where a system becomes gradually more entrenched in a particular developmental trajectory, and where the cost of 'going back' or replacing the system is financially, socially, or politically very high. Again, the radical form of innovation consists of thorough or sweeping technological change, which tends to affect large sections of society, as exemplified by rapidly developing information and communication technologies, such as the Internet and mobile telephony. In these cases incremental innovation combines with completely new ways of using technology, and the consequences of such transformations are difficult to oversee as they tend to involve several levels of society at the same time (for instance how new products are created, how they are sold, how work is conducted, modes of communication, etc.). In the first instance, technological risks result from myopia, in the second, from action in the face of genuine uncertainty.

Of course, when it comes to risks from incremental innovation and path dependence, analyzing the systemic consequences of small adjustments together with an active search for 'consistent', regular 'miscalculations' and slips can lessen the risk from myopia. This means questioning notions of how a system should develop that are often taken for granted, and, as the system may be laden with risk, trying to establish its sphere of 'risk redundancy'. When it comes to radical innovation and innovation in the techno-economic paradigm, more speculative approaches are called for, where imagination is given more room to envision strange new situations and consequences, e.g. in various forms of scenario analysis.

Still, in both cases it is the negative synergies between technological innovations, social and economic institutions, and critical infrastructure, which create new vulnerabilities. Therefore, these factors will have to be analyzed in conjunction as a basic prerequisite for understanding how risk is to be reduced in a given situation. These conclusions have been at the center of OECD's study of emerging systemic risks introduced above. Not unexpectedly, the OECD study emphasizes in many respects

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