

Chapter 16

Human Action in the Loop: Ethical Considerations and Standardization

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ABSTRACT

Extremely complex systems like the smart grid or autonomous cars need to meet society's high expectations regarding their safe operation. The human designer and operator becomes a "system component" as soon as responsible decision making is needed. Tacit knowledge and other human properties are of crucial relevance for situation-dependent decisions. The uniform modeling of technical systems and humans will benefit from ethical reflection. In this chapter, we describe human action with technical means and ask, on the one hand, for a comprehensive multidisciplinary technology assessment in order to produce supporting knowledge and methods for technical and societal decision making. On the other hand—and here is the focus—we propose a system life cycle approach which integrates the human in the loop and argue that it can be worthwhile to describe humans in a technical way in order to implement human decision making by means of the use case method. Ethical reflection and even ethically based technical decision making can support the effective control of convergent technology systems.

HUMANS, TECHNOLOGY AND STANDARDIZATION

Humans act to reach their targets. They are able to justify these targets and they are able to use means, often technological means, to reach them. In this scenario, the human as the actor uses and controls the technical means and bears responsibility for the consequences of the action. This idea of technological progress was a kind of unwritten rule because there was societal agreement that the development of technological means for human action is a substantial pillar of human well-being. However, this changed in the second half of the last century. Major accidents (such as Chernobyl or Fukushima), environmental

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consequences (e.g. of Bhopal), consequences for human health (e.g. of asbestos), cultural consequences (e.g. of pre-implantation technology) were described as side-effects of technical developments that seriously questioned the benefit of the technology itself (Grunwald, 2002).

The complexity of large technical systems and their implementation as discrete manufacturing factories or continuous/batch processing plants, including the interface systems supporting the interaction with technical infrastructures, transportation, energy supply, etc.), pose particular challenges for research in technology assessment. Obviously, this research is increasingly focused on non-technical and socially relevant aspects such as economics, legislation, social issues, and ethics.

Considering standardization, we find a similar situation: For decades and from the very beginning, standardization was, and up to a large extent still is, dealing with well-delimited fields of *technology* and the related product-oriented technical issues. As a result of the extreme multiplicity and variety of such fields and issues, a world-wide task force of millions of technical experts is co-operating in national and international technical committees (TCs), creating and maintaining the currently available set of international and national standards and technical rules. Representing the current state of the art in specific fields of technology, such standards, however, must take the form of multidisciplinary documents as soon as we start dealing with technical *systems* and their convergence of technologies which nowadays are becoming crucial for the implementation of complex and “smart” systems such as smart grids or electro-mobility.

With the standard ISO 26000 on Corporate Social Responsibility (2010), the earlier concentration on the standardization of technologies and materials started to become obsolete. A proof of this trend can also be observed in the foundation of CEN/TC 389 Innovation Management in 2008. Thus, human behavior issues and the support of (non-technical) management issues through international standards will pave the way for consideration of ethics in and for standardization.

The issue of convergent technologies is internationally understood to be increasingly important for the standardization of systems, of system components, and of interoperability. As an example we would like to shortly mention the German standardization strategy from the year 2003. As another representative example of such highly complex systems we refer to “e-mobility.” The convergence of well-established and presently separated technologies such as the automotive technologies (DKE, 2012) and the “smart grid” technologies (DKE, 2011) must be understood as a socio-technical innovation. Technology Convergence results in a number of societal consequences such as:

- necessary adoption of road traffic codes
- legislation and regulation
- extension of safety-related specialist training of workshop staff

Thus, (electro-)mobility is a perfect field for considering technical aspects combined with societal perspectives, such as ethical, social, legal and/or economic issues relevant to standardization.

Multidisciplinary is also required in the personal profiles of operators and decision makers during the design and the operational phases of complex systems. We need technology experts with an explicit readiness to deal with complexity and to take responsibility in unexpected operational situations of complex systems in real-time. In chemical production facilities, highly critical situations may arise from unexpected catalytic reactions. In such dangerous system states, the process operators may find themselves confronted with an unprecedented responsibility for making decisions at the right time. The operator’s explicit and, perhaps much more importantly, his/her tacit knowledge becomes the “ultimate resort” for

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