

# Chapter XXIII

## Disruptions in Global Industries Caused by Controversial Technologies: The Case of Lead-Free Soldering in Electronics

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### ABSTRACT

*In this chapter, the raise of a business phenomenon is introduced and illustrated with the case of the ban of lead-bearing solders in electronics manufacturing: The disruptions caused by controversial technologies. Technologies are praised initially as problem solvers and frequently evolve into problem causers themselves. Affected companies are facing the threat of technological obsolescence and fundamental change processes. A framework of the social environment and the value chain helps the management to better understand the relevant mechanisms. Using the case of lead-bearing solders, the chapter illustrates the far-reaching consequences of the forced phase-out of these alloys, which have been used since the beginning of industrial electronics production. Lead bearing solders are one example of many technologies, which are candidates to become controversial. Increased awareness of side effects, globalization, and intensified use of single technologies indicate that this management task will gain momentum in the electronics industry and others.*

## INTRODUCTION

Already, one year after the discovery of x-rays in 1885, reports about people losing their hair after having been exposed to a high dose of x-rays occurred; other early researchers reported skin injuries (Gee et al., 2001, p. 31; Radiologie.de, 2006). Despite these adverse effects, x-rays have been successfully applied in various fields such as medicine or material analysis. Also for other technologies, early warnings about side effects of their application were known since their market introduction, but they were not taken serious or the merits of the application surmounted the possible drawbacks. Such technologies are the use of asbestos as an insulation material (D'Agostino & Wilson, 1993, p. 186) or the application of Bisphenol A as a plasticizer (Cook, Dodds, & Hewett, 1933; Hentges, 2003). But not all of these early warnings prove to be of relevance: The most prominent examples of exaggerated precaution towards a new technology are the fears of adverse health effects on the travelers caused by the unnatural high traveling speed at the introduction of railways during industrialization.

The application of technologies will always be accompanied by assumptions of possible side effects. If these side effects are not accepted anymore, the technology is endangered of being banned. A recent example of such a process is the European restriction of the use of lead in electronics manufacturing, which caused big efforts to the affected companies and generated technological and regulatory uncertainty. Other materials were affected and future regulations are expected. Due to the global interweavement of the electronics industry, the European ban has led to a global phase-out of lead bearing electronics.

To master such controversial technologies successfully, companies need to understand the relevant social mechanisms and the interweavement of the value chain. Therefore, this chapter starts with the introduction of a framework that helps the management to understand these rela-

tionships. Afterwards, the framework is applied to the case of lead-bearing electronics.

## FRAMEWORK FOR THE DESCRIPTION OF CONTROVERSIAL TECHNOLOGIES

Many decision processes in the environment of a controversial technology are less technologically driven, they are ill defined problems and thus driven by power and politics. According to Haller (1999, p. 79), the activities and decisions of one social group do affect other social groups. To create an understanding of the overall mechanisms, a basic understanding of the involved actors is needed.

### The Framework

Pistorius and Utterback distinguish four different areas that influence the technological environment of a company: Technology-related, raw material, market and political developments (1995, p. 220). Having the technology user in the middle, the framework takes these four possible influences into account. It consists of two main areas: Society and the value creation chain (see Figure 1).

Changes in public acceptance and new regulations do not happen overnight. There are long evolutionary processes going on that can be identified and monitored (Liebl, 1991, p. 34). As Maguire has identified in the case of the insecticide DDT, social discourses about a controversial technology can significantly influence their future (Maguire, 2004, p. 129). Especially in the public discourse, different pictures of realities are constructed that are accepted by actors. Research in the field of scientific uncertainty stresses the importance of such considerations as well (Shrader-Frechette, 1996, p. 12). As Barnett and Breakwell show in the case of the 1995 oral contraceptive pill scare, the approach of the social amplification of risk emphasizes the importance of social mechanisms

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