Chapter 1.4
Information and Communication Technologies for a more Sustainable World

Lorenz M. Hilty
University of Zurich, Switzerland & Empa, Swiss Federal Laboratories for Materials Science and Technology, Switzerland

ABSTRACT

As has been discussed for decades, a reduction of the input of natural resources into industrial production and consumption by a factor of 4-10 is a necessary condition for Sustainable Development. This paper discusses the potential contribution of Information and Communication Technology (ICT) to such a dematerialization of the industrial societies and introduces a conceptual framework which accounts for positive and negative impacts of ICT on physical flows. This framework addresses three levels: the ICT life cycle itself, life cycles of other products influenced by ICT applications, and patterns of production and consumption. The conclusion is that ICT will only contribute to Sustainable Development if this technology is recognized and used as an enabler of a deep structural change; a transition towards an economic system in which value-creation is mainly based on information processing while keeping the physical properties of material within some limits that ensure that it can be recycled. This structural change will include the transition from a material-property-transfer mode to a service-transfer mode of consumption in areas where this is technically feasible and beneficial in terms of resource productivity. In such a post-industrial society, which may also be called a sustainable information society, open technological standards will play a crucial role, since they allow for complexity reduction while keeping competition alive, thus minimizing the risk of unmastered complexity in new critical infrastructures.

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INTRODUCTION

The most prominent definition of Sustainable Development was given by the World Commission on Environment and Development, also known as the "Brundtland definition": In order to be considered sustainable, a pattern of development has to ensure "that it meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).

Read as a normative statement, this definition combines two ethical claims, intragenerational justice (meeting the needs of the present) and *inter*generational justice (not compromising future generations). This double claim leads to a dilemma, since it is impossible to extend the present consumption patterns of the rich industrialized countries to all parts of the world without putting a great burden on future generations.

In order to solve or at least mitigate the dilemma, the global economy will have to learn to produce more quality of life with less input of material and energy.

It is apparent that the widespread use of Information and Communication Technology (ICT) is changing our world, a development taking place even faster than political decision makers can react to the changes. The Internet (with e-mail, the Web, VOIP and unlimited future applications), the mobile networks (with 4 billion subscribers world-wide), Radio Frequency Identification (RFID) systems and embedded ICT systems (to which 98% of all microprocessors belong) have massive economic, social and ecological effects on a global scale.

This chapter brings together the issue of Sustainable Development with perspectives of an information society that is post-industrial in the sense that the throughput of material and energy needed to satisfy human needs would be much lower than today. The chapter also presents a conceptual framework to assess the material effects of ICT, providing a basis for political strategies towards a sustainable information society.

PERSPECTIVES OF ICT AND SUSTAINABILITY

Starting from the issue of economic dematerialization as a necessary condition for Sustainable Development, a conceptual framework will be presented and exemplified which accounts for positive and negative impacts of ICT on material and energy flows at different levels: the ICT life cycle itself (first-order effects), life cycles of other products influenced by ICT (second-order effects), and patterns of production and consumption (third-order effects).

The Dematerialization Issue

The dematerialization discourse was started about two decades ago with statements such as the following:

"Considering the fact that for every person in the United States we mobilize 10 tons of materials and create a few tons of waste per year, it is clearly important to gain a better understanding of the potential forces for dematerialization. Such an understanding is essential for devising strategies to maintain and enhance environmental quality, especially in a nation and a world where population and the desire for economic growth are ever increasing" (Herman et al., 1990, p. 346).

At the global level, 58 billion metric tons of resources were extracted from nature in 2005 (OECD, 2008). This includes fossil fuels, metals, industrial and construction materials as well as biomass. Although the current rate of resource extraction seriously affects the global ecosystem, the increase is expected to continue. This even includes the use of fossil fuels, although that is supposed to be limited by climate policies. The OECD estimates that global resource extraction will exceed 80 billion tons in 2020. This means that mankind will have doubled the annual global rate of resource extraction within only 40 years (1980-2020).

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