Chapter 1
Efficiency:
A Guiding Principle of Corporate Environmental Management Information Systems

Andreas Möller
Leuphana University Lüneburg, Germany

ABSTRACT

Recently, there has been increasing recognition that computer-based information systems should better support corporate sustainability management. New administrative approaches, e.g. in the field of emission trading, and recommendations, for instance regarding carbon footprints of products, require a new type of information systems in companies. These new components can be called corporate environmental management information systems (CEMIS). What is the purpose of these systems? They should provide the required information for environmental or sustainability management. But what is the idea behind? What is the guiding principle of these systems? This chapter discusses efficiency as a guiding principle of CEMIS. It helps to understand better basic methodologies like life cycle assessment, and it provides presuppositional knowledge for the challenge of introducing these information instruments.

INTRODUCTION

Taylor described in his book "The Principles of Scientific Management" the introduction of so-called scientific management at the Bethlehem Steel Company and especially pig-iron handling (Taylor, 1911, p. 24). His observations for a loading process showed that a pig-iron handler loads 12 ½ per day. Further analyses of the process discovered that 47 or 48 tons per day were possible. To achieve that outcome Taylor established task work as a new type of organization and combined it with an optimized workflow. Instead of $1.15 per day, the pig-iron handlers earn $1.85 per day if they load 47 tons based on Taylor's specifications. Obviously it was not possible to increase the output without increasing the expenses but it was possible to optimize the ratio: 47 / 1.85 = 25.4 instead of 12.5 / 1.15 = 10.86. With other words, Taylor optimized the labor efficiency of pig-iron handling.

DOI: 10.4018/978-1-61520-981-1.ch001

BACKGROUND

The introduction of scientific management at Bethlehem Steel Company stands for Taylor's philosophy: Main purpose of scientific management, and therefore of appropriate management information systems, is to increase efficiency. Taylor cited in the introduction of his book the former US president Roosevelt: "The conservation of our national resources is only preliminary to the larger question of national efficiency" (Taylor, 1911, p. 7). Today, Taylor is regarded as one of the most important representatives of the so-called efficiency movement in the early 1900s.

As in the pig-iron handling example, efficiency can be defined as a relationship between positive outcomes and required effort. A typical form of efficiency is a ratio. Coelli et al. call the ratio "productivity" (Coelli et al., 2005, p. 3). The enumerator represents the outcomes, e.g. in terms of revenues for sold products, the denominator the effort. The effort can be quantified by costs. With regard to environmental protection and sustainability other indicators come into consideration, e.g. contributions to climate change or cumulative energy demand. Other variants of eco-efficiency could be environmental intensity of production, environmental improvement cost and environmental cost-effectiveness (Huppes & Ishikawa, 2005c, p. 45). Schaltegger et al. consider eco-efficiency as a basic strategy in sustainability management. They compare efficiency with other basic strategies: sufficiency: "When an individual has enough of something then demand ceases and unnecessary use of resources is curtailed" (Schaltegger et al., 2003, p. 25), and consistency: "a composition of matter streams and energy forms which is able to exist permanently in an industrial ecology" (Huber, 1998, p. 27, cited and translated by Schaltegger et al., 2003, p. 26).

In case of pig-iron handling the information system was fairly simple. Taylor's insights were based on investigations and experiments (Taylor, 1911, p. 31), performed in company with a "young college graduate" and a stop-watch as an information instrument. Nowadays companies use more complex information systems and simulation tools. Nevertheless, these software systems have mainly the same purpose: they should help to discover inefficiency.

Taylor's two pillars of information – investigations and experiments – are supported by different types of information systems. Nowadays, investigations in larger organizations are based on enterprise resource planning systems (ERP systems). The ERP systems provide routinely generated information, whereas experiments can be performed using software tools, for example simulation tools. The purpose of experiments is to find and to enforce standards like Taylor's adaption of task work for pig-iron handling at Bethlehem Steel Company. The specification of processes, work flows and economic incentives should establish an adaptive control system. Ideally, such a system does not require further investigations and control at regular intervals.

Today's companies optimize not only labor efficiency but as well environmental performance: resource, energy and eco efficiency (Busch et al., 2006; Huppes & Ishikawa, 2005a, p. 2; Kuosmanen, 2005, p. 15). These new types of efficiency reference to global environmental problems (Huppes & Ishikawa, 2005b, p. 34) and damage categories, in particular human health, ecosystem quality, climate change and scarcity of resources (Jolliet et al., 2003, p. 324). Damage in the different categories can be result of different environmental interventions of human activity. For example, scarcity of resources is a problem of consumption of non-renewable energy or extraction of scarce minerals (Goessling-Reisemann, 2008, p. 10). Indictors closing the gap between human activity and damage categories are called midpoint indictors. One important damage category has only one midpoint indicator: climate change. The midpoint indictor is called global warming and expressed in carbon dioxide equivalents. As mentioned, scarcity of resource has two midpoint