Requirements Prioritization and Design Considerations for the Next Generation of Corporate Environmental Management Information Systems: A Foundation for Innovation

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ABSTRACT

A multitude of heterogeneous data must be converted to environmental-conscious information and kept ready by Corporate Environmental Management Information Systems (CEMIS) to support environmental protection, sustainability, and energy efficiency within companies. Since these systems are currently not applying strategic information and decision support, contemporary systems do not cope with requirements from the sustainability discussion. Early identification of cause-and-effect-relationships is vitally important to be able to anticipate environmental impacts of decisions and, thus, to intervene in time. Otherwise the potential for acting precautious would remain unemployed. A resource-friendly design of business processes and their energy- and material-efficient control additionally demands for sustainability-oriented organizational structures as well as incentives for all stakeholders involved. The authors strive for developing a new generation of CEMIS that copes with strategic sustainability aspects. They present the results from a survey that prioritizes the requirements the authors have gained from former inquiries, workshops and expert interviews. As a direct result of the survey, first implications for architectural concepts are presented.

Keywords: Corporate Environmental Management Information Systems (CEMIS), Environmental Information Systems (Environmental IS), Green Information Systems (Green IS), Green Information Technology (Green IT), Reference Architecture, Requirements Engineering, Sustainability

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1. INTRODUCTION

The advancing deterioration of the natural environment, such as proceeding scarcity of natural resources and the climate change, is putting pressure on governments, organizations and individuals alike. Governments pass laws to enforce mitigation of the environmental impact of organizations’ operations; special interest groups, such as Greenpeace, and the general public demand information about organizational and production practices concerning environmental sustainability (Grote, Jones, Blount, Goodyer, & Shayler, 2007; Kleindorfer, Singhal, & Wassenhove, 2005) with increasing emphasis on end-of-life solutions for products (He et al., 2006). Striving for a balance between economic, environmental and social aspects (the so-called triple bottom-line of sustainability (Elkington, 1998), renders decision making and prediction of the respective consequences rather complex.

Currently, information systems (IS) are lagging behind their own possibilities and are often seen as an opposing force in the effort to reduce mankind’s impact on the environment (Melville, 2010). However, IS can be used to reduce its own demand, e.g., by using virtualization of servers, but also to mitigate the environmental impact of a whole organization (e.g., by enhancing corporate environmental responsibility, enabling the efficient management of resources and emissions).

Present CEMIS follow a rather operative approach with tasks such as legally required reporting (Loos et al., 2011), therefore, there is little assistance in strategic decision support (El-Gayar & Fritz, 2006; Teuteberg & Marx Gómez, 2010). The integration with other systems (e.g., ERP, CRM, publicly available data) and automated sustainability reporting has been broadly discussed in literature, but is yet to be implemented (Teuteberg & Straßenberg, 2009). These are key components of the future CEMIS, since sustainable development can only be achieved by the recognition of causes and effects of ecologic, social and economic key performance indicators (KPI) and an efficient way of handling relevant data.

It is very important to know what practitioners and researchers believe to be the most important design properties of future CEMIS systems. Without this knowledge, developers may invest valuable time and resources into needless features and miss important ones that would assist sustainable development of the organizations.

The main questions guiding this research are as follows:

RQ 1: What are the critical design properties of next generation’s CEMIS that strongly influence software evaluation and selection?

RQ 2: What should a basic architecture of CEMIS include based on the results of RQ 1?

RQ 3: What future steps should be taken to promote advancements in this field?

This paper addresses researchers currently investigating the possibilities of CEMIS or related fields, but also providers, users and corporate decision makers working on the topic.

The Section 2 of this paper describes the theoretical background and defines central terms. Then, the research methodology that was applied will be explained. Section 4 will offer a selection of related work. The collection and a first prioritization of the design properties preceding the survey will be explained in Section 5, after which the results of said survey will be presented and interpreted. In Section 7, the results of the survey will be used to derive a reference architecture that can contribute to designing the CEMIS it describes. After that, we will shortly focus on stakeholders relevant to CEMIS. In the last section, the research will be concluded by listing the contributions and limitations of the paper at hand and indicating further research directions.

2. THEORETICAL BACKGROUND

Environmentally conscious practices in managing IT are summarized under the terms Green IS and Green IT (Mithas, Khuntia, & Roy, 2010);
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