The market for Corporate Environmental Management Information Systems (CEMIS) – Theory and Practice

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Abstract

Corporate Environmental Management Information Systems (CEMIS) have been on the market for more than two decades. They were created so that companies can easily comply with environmental requirements and reduce their impacts on the natural environment. Nowadays, a large variety of heterogeneous solutions for the specific environmental issues exist on the market. However, it is uncertain whether the scientific discussion and the available CEMIS on the market are able to meet the demand of the companies for these products. As for now it seems that even though there is a great offer, hardly any company use CEMIS on a regular basis. In order to understand the scientific background of CEMIS we give a brief insight into the scientific discussion in German speaking countries of the last years followed by an analysis of the available CEMIS on the market. Additionally, the paper will give an overview about background and outcomes of this approach, taking into account CEMIS listed in databases on a national and international level and giving an overview of what is the demand of the market, as far as possible. Moreover it will be discussed whether the scientific basis aligns with actual approaches from a practical point of view.

1. Introduction

During the last two decades a wide range of different Corporate Environmental Management Information Systems (CEMIS) have been developed. As a consequence, the market today provides different software solutions to approach environmental issues in companies. Even though there seems to be a large number of products, hardly any company uses CEMIS on a regular basis. Having a deeper insight on the supply of CEMIS, it turns out that an overview of available products is rather difficult to perceive for the German market. Due to the fact that no overview was available, it was difficult to analyse whether the supply and demand is in equilibrium for products currently available on the market.

In this paper we present the results of a market research for CEMIS in German speaking countries. Additionally, a similar database, the Environmental Tools Directory from the UK, is analysed with regard to its CEMIS products. A short survey of publications in German speaking countries dealing with a categorization of the different types of CEMIS forms the basis for a structured comparison of these two databases.

Based on our investigation we try to find gaps between the theoretical approach and the products available on the market and compare the shares of different CEMIS categories in the two databases. A special focus is put on the question whether the three different approaches “speak a common language.” We will deduce some impetus from our investigation that can be used for the alignment of supply and demand side of the CEMIS market, and thus, may help for a more widespread implementation of CEMIS. We also uncover some weaknesses of the current theoretical approaches.

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2. CEMIS and their fields of application

In German literature the so called morphological box is a common approach when dealing with a categorization of CEMIS. The morphological box is an attempt to describe the wide range of tasks possible with CEMIS. In a two-dimensional approach a set of criteria is defined on the vertical axis that addresses specific technological or organizational aspects (or categories) describing the characteristics of software systems. On the horizontal axis all possible manifestations for each of these categories are listed to show variations a specific CEMIS software tool can address. In a brief overview of recent German literature the following possible fields of application for CEMIS are identified that appear regularly in a morphological box (Manthey 2012):

- Material (and Energy) Flow Management
  “Material Flow Management is the goal-oriented, efficient use of materials, material streams and energy.” The first step is an analysis of the company’s processes with regard to its material and energy consumption, as well as, the occurring emissions, including waste and other unused output. The determination of input-output balances of each process step enables the analysis of the process chain with regard to so called “hot spots”, meaning the most resource consuming process steps. A graphical interpretation (“Sankey diagram”) visualizes the process model and shows the major energy and resource consuming process steps. Based on these efforts, the process optimization leads to a more resource efficient production processes. Material Flow Management is also strongly linked to related disciplines such as: Material Flow Cost Accounting, Energy Management, Energy Efficiency, and Environmental Cost Accounting.

- Life Cycle Assessment (LCA) and Environmental Labelling
  An LCA quantifies a product’s impact on the environment. Based on the material and energy input and output over the whole life cycle of a product (“cradle-to-grave”), one can calculate the resulting CO2-emissions, the overall energy consumption and other indicators of environmental relevance. Special forms of an LCA are Environmental Product Declarations (EPD) or the popular Carbon Footprint.

- (Environmental) Legal Compliance
  An increasing number of laws and regulations with regard to environmental issues lead to a simultaneously growing number of related tasks for environmental management in companies. When reporting to public agencies companies ensure that the daily work is in accordance with these laws and regulations. Further tasks are the documentation, planning and realization of measurements and the corresponding control to ensure environmental legal compliance.

- Hazardous Substance and Waste Management
  Waste management is one of the most established aspects in corporate environmental management and could probably be seen as a specialized form of legal compliance. Important tasks are monitoring of all forms of produced waste, as well as, its adequate disposal and necessary transportation. Waste management is strongly linked to environmental legislation, and therefore, has to deal with many bureaucratic aspects. As many forms of waste are at the same time hazardous substances, securing adequate treatment, storage and transportation of all hazardous substances is listed in this group.

- Environmental Management Systems (EMS) and Eco-Controlling
  The most important standards for EMS are ISO 14001 and EMAS. These standards are “intended to provide organizations with the elements of an effective environmental management system (…) and help organizations achieve environmental and economic goals.” (ISO 14001, 5) Thus, an EMS is a systematic way to manage a company’s environmental affairs. Central elements are the PDCA Cycle (Plan-Do-Check-Act) that provides for the continuous improvement of the overall environmental performance of the company. Implementing an EMS is also a good basis for Eco-
Controlling that monitors Key Performance Indicators e.g. energy consumption and or CO₂-
emissions. Thus, it delivers also important input for internal or external environmental reports.

Area specific systems
Area specific systems deal with environmental monitoring and control of one or more areas of a
company. These areas may include, for example, procurement, production, marketing, research and
development or any other field of a company’s activities.

In many cases it is hard to define a clear dividing line between different categories and CEMIS respec-
tively. Nevertheless, this categorization scheme may function as a basic theoretical approach to assign a
specific software system from the market (practice) to a specific field of application (theory).

3. CEMIS available on the market

3.1 Market need for CEMIS

In order to support companies to fulfil the requirements for sustainability regarding social, ecological and
economic responsibility from a technical perspective, a wide range of Corporate Environmental Manage-
ment Information Systems (CEMIS) were developed during the last two decades. Even though it can be
assumed that the demand for CEMIS is constantly rising, as for now, approximately 70 % of the industry
are using programs for spreadsheet analysis only in dealing with environmental issues (Golinska, 2011).
Supporting this statement is a survey from 2006 that was conducted by the Fraunhofer Institut in South
Germany. Within the survey 160 companies were questioned on how often they used CEMIS (Heubach/Lank-Koetz, 2006, 24). One outcome was that hardly any of the companies use CEMIS in their
daily business. In contrast, a study in 2011 revealed that no matter of the size of the company questioned,
more than 40 % of them were willing to invest in CEMIS (BIKTOM 2012, 18). The results of the survey
are shown in the figure below. It was conducted within 10 different industries. The companies were small
to medium sized.

Figure 1
Planned Investments
Source: BIKTOM, 2012, p.18
Figure 1 above shows that companies indeed are willing to use CEMIS products. But even when summarizing the above mentioned surveys, it is nearly impossible to obtain a detailed overview of the demand for CEMIS. So far, no research results exist that might give an idea about which CEMIS products are wanted by the market and which industries have the greatest interest in specific products. Therefore, we try to pave the road for a more in-depth survey by categorizing the available products on the market based on the theoretical discussion. A common approach for CEMIS categories shall enable an effective communication between theory and practice, and as well, within the scientific communities.

3.2 German speaking countries

In an empirical study (Perl, 2006, 16) the reason for insufficient usage of CEMIS are:

- high costs to supply the systems,
- high expenses to install and maintain such systems and
- absence of necessary information

The study displays that there is, next to financial issues, a lack of information regarding the spectrum of services offered by CEMIS. Therefore, the project “IT for Green” endeavoured to close the gap by collecting and transparently classifying the range of CEMIS available on the German market. The database is at the disposal for teaching and research purposes.

In 2011 the preliminary results were summarised within the EnviroInfo Conference 2011 (Allam, Junker, 2011, 692-700). Since then the database has been expanded. In total 228 products and 124 suppliers of CEMIS were collected.

The collection contains general information about the supplier and the product, as well as, technical specifics regarding interfaces, updates, system requirements or the target audience. In order to fulfil the scientific requirements, the products within the database were classified in the above mentioned six categories: Material Flow Management, Life Cycle Assessment and Environmental Labelling, Hazardous Substances and Waste Management, (Environmental) Legal Compliance, Environmental Management Systems and Area Specific systems. The figure below shows how these six categories are segmented based on the database.

![Figure 2: Share of the categories in the German market](image-url)
In the figure it is clearly shown that CEMIS for Environmental Legal Compliance is, with about 64 %, the one most available on the market in German speaking countries, followed by software for Environmental Management Systems with nearly 40 %. It also reveals that there are only a few CEMIS available for Life Cycle Assessment, Hazardous Substances and Waste Management and none available for Area Specific Systems.

3.3 International market

The freely accessible Environment Tools Directory is the "largest independent database for environmental software tools anywhere on the web", currently listing 527 "green accounting tools" (Aether Ltd. 2012). The idea behind the database is bringing together developers and people in need of "doing some form of environmental assessment (and particularly quantification)." Obviously, the provider has a more practical point of view, and moreover, puts a focus on the measurement of environmental impacts. Nevertheless, the categorization used in this database shall be analysed for a comparison with both the theoretical discussion and the database described above.

The database allows for a filter based search, using different criteria like function, sector, target group, scope, impact assessment, methodology, and geographical restrictions to reduce search results. For our investigation, the 18 functions are of special interest because they can be seen as the equivalent of the categories defined in the theoretical discussion.

Each of the listed software tools in the Environment Tools Directory is linked to at least one of 18 functions that address different forms of “environmental impact assessment” (EIA), like LCA and footprinting techniques. The term EIA is in contrast to the term LCA, as used in the theory (see discussion for a more detailed distinction). Another aspect that is not addressed in the theory so far is the Management of Carbon Emissions and related aspects like Clean Development Mechanism (CDM) activities. As these are strongly related to Carbon Footprints, we insert it as a preliminary sub-category to EIA tools, understanding that Carbon and Greenhouse Gas Management is constantly gaining more and more attention, and thus, would deserve to be dealt with in an extra category. Nevertheless, as for now we stay with our categorization that was derived from the theoretical discussion.

Three of the remaining function groups used in the UK database deal with tasks that can be assigned to Environmental Management and Eco-Controlling, while one function, namely 'automatic data collection from meters', is dealing with an issue related to Material and Energy Flow Management. Another three functions describe special techniques (projections, scenario analysis) or focus on weather recording. These are summed-up in a category "other" as they could not be clearly assigned to one specific category.

As the main focus of the database is on measuring the environmental impacts, consequently, there is not a single mentioning of a legal compliance software tool. In addition, area specific systems and tools for management of waste and hazardous substances respectively were not listed. Instead, we find four additional functions that (directly or indirectly) deal with specific economic tasks and can be found in many of the "green accounting” tools, namely financial analysis & costing, risk assessment and workflow management. Figure 3 shows the share of the listed 527 tools that is linked to each of the sub-categories in the Environment Tools Directory. In a preliminary version, we also assigned each of these sub-categories to the corresponding categories from the theoretical discussion.
4. Discussion

The content of both CEMIS databases was checked against a categorization scheme that was derived from a survey of a theoretical description of CEMIS in German speaking countries. Both databases allow for an assignment of each CEMIS to multiple categories. In contrast to our own database that contains product from German speaking countries, the Environmental Tool Directory claims to be the “the largest independent database of environmental software tools anywhere on the web.” Therefore, we used it to cross-check its contents with our own survey, on the one hand, and against a theoretical approach to categorize CEMIS (the morphological box), on the other hand.

The comparison of the two databases reveals that there is no common understanding of theoretical categories that may be used to distinguish different CEMIS. While such a classification seems feasible in the database for tools from German speaking countries, such a classification seems too difficult for the UK database for two reasons: Firstly, its focus is on impact measurement tools, and thus, explicitly not on the whole range of possible fields of applications CEMIS can be used. Secondly, the definition of the categories is on a more detailed level than derived from the theory. Despite the fact that the categories used in
both databases do not fit exactly, figure 2 and 3 give an idea about similarities and differences of the two different approaches.

The theoretical categorization scheme was designed to be as simple as possible when describing the different fields of application for CEMIS. First limitations of this approach show up if we try to use it for a survey of the software tools available on the international market. While the German database CEMIS provide functions for legal compliance issues, whereas, the UK database does not explicitly account for functions with legal issues. The category Environmental Impact Assessment shows that it is sometimes necessary to define some special sub-categories, especially if new developments show up like in the case of Carbon Footprint, Carbon Management or Clean Development Mechanisms. Especially these latest trends may have the power to function as entry mechanisms should they be adopted in the marketplace and the scientist wants to bring more CEMIS into practice.

In our survey we put our focus just on the first level, namely the categories. Thus, we cannot emphatically that there is no such system in the database currently. A more detailed analysis on the level of the CEMIS listed in the database would be necessary in order to make more reliable statements here. A more sound approach for such a survey could also highlight the economic issues likely addressed in some of the categories of the Environmental Tools Directory i.e. financial analysis and costing. An assignment of functions or possibilities of integrating accounting instruments to a special category could gain a lot of attention when showing the direct or indirect economic impact of environmental measurements.

5. Conclusion

In our contribution we put focus on three different approaches to summarize the CEMIS tools available on the market and discussed in theoretical discussions of recent years. Our research identifies the need for common definition, understanding and vocabulary when talking about CEMIS categories, although it is not anticipated that hard lines between different systems and different fields of application is practical or necessary. Nevertheless, greater application of CEMIS, together with it the positive effects for more ecological sustainable production patterns, and a clear understanding of terms and conditions, will bring us closer to implementing theory into practice.

The integration of economic key figures related to environmental management is still an open task. Finding ways of assigning possibilities of monetary impact measurement to specific environmental tools may push forward the usage of CEMIS in the daily business. A cross-check of which economic tools may be combined with a specific CEMIS category is anticipated as a next step.
Bibliography


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