

A component based approach for overall Environmental Management Information Systems (EMIS) integration and implementation

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Abstract

The integration of Environmental Management Information Systems (EMIS) into the existing business information systems of an enterprise is still a complex and expensive assignment. By creating a intelligent software system, the integration and implementation of EMIS in existing systems can be simplified. By following a new procedure model and using a framework, individual solutions in integration and implementation of an environmental information management system in the enterprise wide software landscape can be realized, followed by a self-critical survey, allowing a assessment of the effectiveness of the chosen approach for the individual needs.

1. Motivation and Problems to solve

Nowadays, Environmental Management Information Systems (EMIS) still have problems integrating into the existing business information systems of an enterprise. The existing approaches for Environmental management Information Systems often are created out of a individual need and where guided to solve a small amount of well known existing duties and responsibilities. Although many of these duties and responsibilities can be classified or merged to a group of central jobs for environmental management information systems, generalized approaches or frameworks are scarce.

Creating an approach for a holistic and intelligent software system, which can be used for the environmental management in enterprises as well as in government or other sectors, is one possible solution for the integration and implementation of EMIS into the existing systems. For the ease of verbalization the application environment will now be limited to the entrepreneurial sector. The proposed concept of EMIS implementation and integration can be adapted with minor changes to a governmental or private environment as well.

It is of high importance to capture and handle the data of environmentally connected processes, in order to allow the gathering, processing and providing of environmental information, inside of the enterprises as well as outside in exchange with other interest groups like governmental bodies, other enterprises or the public interest. In addition to these interests, national and international obligations and orders as well as a global social change, forces the responsibilities to move environmental aspects into the center of the activities (c.f. [Rautenstrauch 1999]). The needed information for an environmental management information system can be found in different existing systems as well as been created by new, to be developed, systems.

In order to identify the environmental impacts and to develop methods to reduce or avoid these impacts an EMIS needs to support the decision making process with all the necessary information available. With an enterprise-wide EMIS, this support can be provided, as well as an integration of a large amount of methods for controlling, monitoring and reporting environmental issues. To achieve this task, such an enterprise-wide EMIS has to be connected to other areas of management, e.g. the financial controlling, work safety regulations or an overall reporting, therewith connecting to all parts of the enterprise and all parts of the enterprise information systems. Allowing users an improved access on

and rising quality of the data, as well as a minimization in coordination needs, lead to an improvement in overall time use handling environmental issues. In addition, different interest groups can be addressed with the generated sustainability reports, which reach from governmental to stakeholder groups and needed to be supplied with individual generated reports (c.f. [Isenmann, Marx Gómez 2008]).

Using a component based approach for an overall integration and implementation of EMIS in an enterprise will allow customization and adaption on a high degree, hence allowing readjusting to upcoming changes in legal requirements as well as in own interests. While there are several advantages using such an enterprise-wide EMIS, there is no whole approach for a component based integration and implementation for such a system. In this research in progress paper, an approach method for implementing and integrating an enterprise-wide environmental information system is being defined, being the first step in developing a complete framework for this work in progress.

2. Approach

Before developing an implementation and integration method, the current fields of environmental management systems have to be defined. Given in figure 1 (c.f. [Marx Gómez 2009]) there is a small overview of the major fields of these systems. These fields can be separated in two different sectors, the field of sustainable reporting and the field of environmental information management. The to be developed method for implementation and integration of an enterprise-wide environmental management information system as to fulfill the reporting demand as well as the information demand for the management field.

All environmental related Information Systems can be ordered under these two main sectors, giving an impression on the expected functional and organizational extend that has to be covered by an enterprise-wide EMIS. As not every information system listed in this figure may be necessary, a module- or component based approach will allow choosing the needed modules and functions for the exact use case, but also to extend or reduce the developed EMIS if necessary.

In addition to the individual applications of this approach, there are some key-figures, which are always present and define EMIS:

- An EMIS is an organizational technical system for systematic integration, transformation and presentation of environmental related Information of a Enterprise, Public Service or comparable Institutions
- An EMIS is connecting on the field of sustainable development, in form of sustainable reporting, optimization in resource and energy usage and reducing of overall emission.
- An EMIS allows the support of environmental management by registering the environmental load as well as the Planning and Controlling of environmental friendly measures.

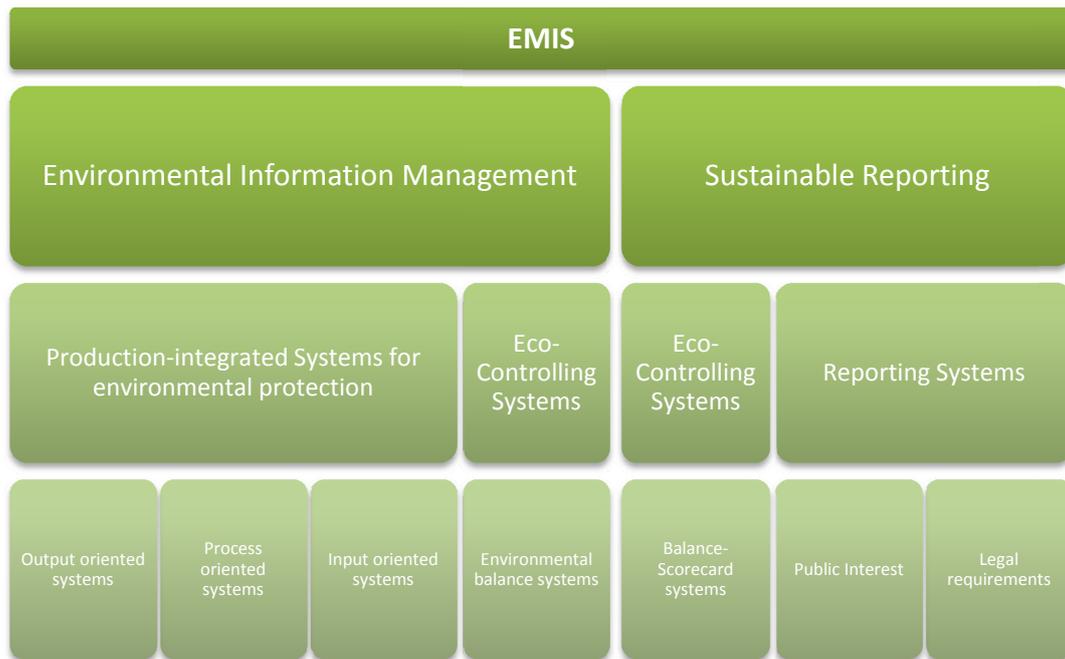


Figure 1: fields of EMIS

These definitions create some components, which will always be present in the created EMIS, independent from the enterprise, size of the EMIS or amount of integrated information systems. These core components are displayed in figure 2. The core components can be divided in groups of connective, administrative and descriptive components, which are needed for operation such an EMIS. The group of connective components provides the connectivity to existing information systems as well as a general option of importing and exporting data to other systems. This allows the import of different type of base data and the export of conditioned data, as needed in a decision support process. The group of administrative components creates a framework for the used components, allows the integration and communication between different modules and provides the user management. By using methods like a Single-Sign On, all user-dependent connectivity will be provided by the user management component. In addition to the user management an extension of the component control and management is also possible.

The third group of components, which will always be present in the created EMIS, is the base set of descriptive components. These components provide basic functions for often needed methods in representation and displaying of information. A basic reporting functionality is as well included as a basic geo-visual information system and a basic decision support system. These components allow using a base functionality of environmental related issues (c.f. [CSR Europe 2000] and [GFEM2006]).

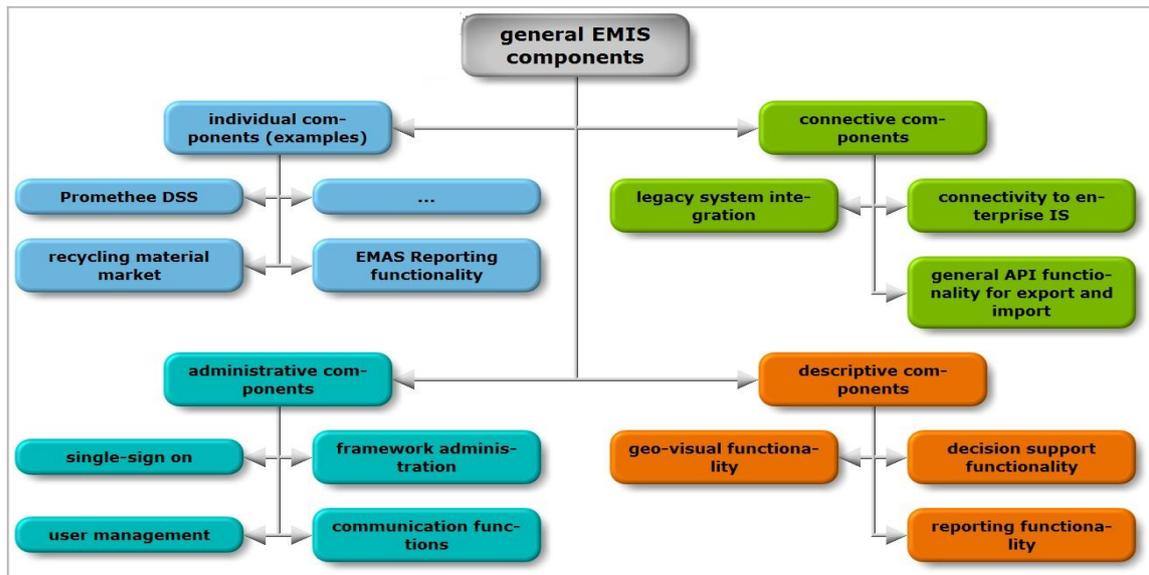


Figure 2: general components of the approach

In addition to these basic components, there are individual information systems to perform their respective duties in the individual EMIS. These could be specialized connection components for external functional systems, extended reporting or decision support components or the integration of complete information systems in the framework of this approach.

The use of the approach is separated in different phases. The first phase is a survey of the currently used environmental related and non-environmental related information systems. All existing information system used for the enterprise-wide information management, the environmental reporting or the impact measuring have to be separated in one of the two categories. Although the decision in separating a information system to environmental related or not may be an easy task on the first view, this phase has to be considered as one of the most important for using this approach to implement and integrate an enterprise-wide environmental management information system to an existing information system structure. To separate, an applicant can choose between the function of the information system as well as the processed information. Not every information needed for an environmental related task is directly seen as useful and important for this issue, and the processing system is not directly seen as an environmental related information system. Sometimes it is even a difficult task to separate environmental from non-environmental related information. In this case, the decision should be affected by the possibility of replacing the functionality in one component of the new EMIS.

After separating all current information systems, the applicant for this approach has to decide what systems to connect, and what functionality to integrate in the to be created EMIS as second phase. For all non-environmental related information systems, a connection to the new system should be considered as best solution. All environmental information systems should either be replaced by a corresponding component or integrated in the new EMIS. Taking into account that all state-of-the-art information systems allow a flexible import and export functionality to a certain degree, a connection to the new system should be possible. Depending on the potential of the new function, a re-engineering of the existing information system in form of a component of the new approach is a medium term decision. The more functionality integrated in the new system, the more benefit will be achieved. For individual cases, a different approach for replacement, integration or connection could be possible.

The third phase is the survey phase, in which the applicant for the approach summarizes to what degree he can replace the given information system landscape with such an environmental management information system. Beside the individual importance of certain information systems for an enterprise, a high amount of adaptable information system could allow switching to an enterprise-wide environmental information system. Using such a system reduces the time and effort needed for certain environmental related tasks, such as reporting or management issues. By migration to an enterprise-wide

EMIS, functionality like sustainable reporting or decision support systems become available for a huge amount of tasks. The survey phase should try to measure the benefit of the new enterprise-wide environmental management information system. This benefit could be determined in the time and effort that is needed to accomplish environmental related tasks as well as the surplus that is given to non-environmental tasks through the system. Beside this directly measurable value, a survey of the user group can also provide reliable information of the benefit of the new EMIS. An evaluation of these information can be used to start over with the first phase, in order to integrate even more systems in the new EMIS or optionally to swap former integrated functions back to an external information system, if necessary and improved to the integrated approach.

By following this cycle in periodical intervals, it should be possibly for a company to achieve an optimum configuration of an enterprise-wide environmental management information system in combination with needed external and separate information systems with an adequate amount of time and effort.

3. Outlook and further work

Beside further developing and researching for the abstract approach, validation of the concept by a first prototype is needed. This could be done by a small framework prototype, testing the theoretical approach in a small environment. In addition to this prototype testing, more input by potential applicants will be needed, to extend the group of pre-defined components for connection, administration and description functions.

The current work is focused on separating the approach from similar techniques, extending the three major phases of analysis, integration and survey to several key sub-phases and develops assisting content to exercise the individual phases of the approach. In addition to this development, a prototype of a web-based decision support system for environmental related projects is being re-engineered (c.f. [SPOINK 2006]). This prototype allows testing the component based approach of an EMIS, focusing on decision support, GIS and reporting functionality. A further component of the system being developed in this prototype is a communication and user management functionality, which can be adapted and used in following projects.

The introduced approach to integrate and implement an overall and enterprise-wide environmental information management system is the first step in creating a combined technical and management method to assist in the task of building up an environmental management information system. The following works will stronger separate the management and technical part of the approach, allowing combining one of the recommended methods with an existing approach. Based on long-term considerations, the method as well could be component based, allowing to use single elements if needed on the one hand, giving a complete aide on the other hand.

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