Environmental Management, Environmental Information Systems, and Knowledge Management

Hans-Knud Arndt

Otto-von-Guericke-Universität Magdeburg

Abstract: Environmental management in organizations is on the one hand a very complex topic area and on the other hand a task done not always with highest priority. Therefore an effective and efficient conception must be developed in particular here. The conception of an environmental information system is based here on the structures of management manuals. Beyond that it is pointed out that environmental information can be seen as knowledge management systems (with focus on the knowledge area of environmental protection).

Keywords: Management Manuals, Knowledge Management, Environmental Management, Environmental Management Systems, Environmental Information Systems

1 Knowledge Management

In today's fast-changing global economy, success is no longer tied to the traditional inputs of labor, land or capital. The new postulated critical resource is knowledge. Today, the knowledge of an organization and the leverage of that knowledge is essential for success. Implementing Knowledge Management (KM) solutions, organizations face similar challenges [Lot01, p. 2]:

- To get a handle on expertise.
- To stop reinventing the wheel.
- To better leverage a multinational engineering staff.
- To improve customer care or capture customer information more effectively.
- To repeat "best practices".

In most organizations, the discussion about vocabulary, concepts, and technologies of KM is more or less present. This discussion focus on some general themes and consistent elements [Lot98, p. 2]:

- *Knowledge*: There is a long-term discussion about the definition of the notion "knowledge" and the question whether knowledge is able to capture and package in reusable and searchable form. Some people are opinion that knowledge only exists inside the head of people. But most people involved in knowledge management are following the idea[1] of the existence of implicit and explicit knowledge. According to the idea of implicit and explicit knowledge, knowledge travels through a process that transforms it from implicit (that is, locked inside information systems and inside the heads of people) to explicit (captured and packaged in reusable and searchable form), and back to implicit, where it is learned and used by others throughout an organization.

- *Commitment of top management*: The success of management techniques especially referring to cross-sectional tasks like KM depends crucial on the commitment of the (top) management.

- *Organizational culture*: In general, the discussion related to the implementation of KM in organizations shows that successful KM is at least depending on as much on the prevailing organizational culture as on the prevailing technology. An organization with a culture that does not foster and reward sharing of knowledge cannot expect that technology solve its knowledge challenges.

- *Document management*: One of the oldest and still common ways to explicit and to record knowledge are to do it document-based. For many organizations the ability to find the right document is seen as one of the most critical KM problem. So many organizations begin to evaluate products such as document management for the discovery of knowledge. Document Management Systems (DMS) bring years of applied experience in managing documents to bear on technology implementations that meet some core challenges of KM.

In the next section we will discuss these four general themes and consistent elements of KM in regard to information systems in the context of environmental management.

2 Information Systems in the Context of Environmental Management

The International Standard 14001 on environmental management systems (specification with guidance for use) specify requirements for an environmental management within an environmental management system (EMS). ISO 14001 is applicable to any organization that wishes to [ISO96]:

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[1]   This idea is based on [Pol74, pp. 69ff] and resumed by [NoTa95, pp. 59ff].

1. Implement, maintain and improve an environmental management system;

2. Ensure its compliance with its stated environmental policy;

3. Demonstrate such compliance to others;

4. Seek certification/registration of its environmental management system by an external organization;

5. Make a determination and declaration of compliance with the standard.

The ISO 14001 standard requires that organizations collect and compile data about environmental aspects and their associated environmental impact. Many organizations react to these insights and developments by building or purchasing specialized information systems. These systems vary from stand-alone programs to systems providing an interface to the existing information infrastructure within the organization.

A core part of management systems in general is the documentation. The purpose of management manuals is to structure and to manage the entire documents of management systems. Management manuals explain the concurrence of single management system elements and describe the entire management system specific controlling instruments and information systems of the respective organization. Therein included is the definite regulation of responsibilities and accountabilities. However, according to ISO 14001 it is not required that the documentation of management systems is to be done with the method management manual. Nevertheless, because of the successfully gained experience in quality management systems management system documentation by manuals is realized as instrument that is to be used for the development and documentation of environmental management systems [But97, p.165].

Hence in the bibliography environmental management manuals are the preferred instruments to implement the environmental management system documentation. Today environmental management manual processing is still dominated by print documentation. Even when environmental management manuals are electronically accessible, they are mostly accessible more or less like paper-based manuals, and thus, do not take advantage of the large number of facilities electronic media provide. But there are approaches of electronic environmental management manuals that support some facilities of electronic media yet. Already the study of these kind of environmental information systems let us draw a parallel to the general themes and consistent elements of KM:

- *Knowledge*: (Environmental) management manuals can be seen as a compilation of continuously updated best practices. Therefore, in ideal case the (environmental) management manual represents the (current) knowledge of the

specific (environmental) management systems. On the other hand the easy access to current and consistent system procedures (provided by management manuals) is an essential requirement for KM.

- *Commitment of top management*: "Environmental safety and environmental management is chief's task." This is claimed, proved and stated in a large number of case studies and publications. Environmental Management and KM are both management techniques that concern the organization in a cross-sectional way. Therefore, the success of both depends crucial on the commitment of top management

- *Organizational culture*: Environmental management is indeed "chief's task" but is not to be remained chief's task in itself. Once an environmental management system is implemented is has to be maintained by the entire organization. The implementation of environmental management systems including the deployment of their specific information systems depends like KM crucial on the organization culture.

- *Document management*: Document-based information systems like Lotus Notes Domino are the leading platform for the advanced implementation of (environmental) management manuals as well as for the implementation of computer-based systems for KM (Knowledge Management Systems (KMS).

In summary we can consider that (environmental) management manuals can be seen as KMS. Among other things it appeared that the company SAP's implementation of KMS with their SAP Knowledge Management Warehouse [SAP00, p. 24]explicitly provides functionality to process management manuals (here in preference to quality manuals according to ISO standard series 9000). Based on the idea that environmental management manuals are an essential information instrument of environmental management and representing a kind of KM we will discuss the design of environmental information systems in the next section.

3   Environmental Information Systems

KM is more than finding the right document. The greater value of KM is in knowing [Lot01, p. 4]:

- Who wrote the document?

- What other expertise that person has?

- What other documents she has created?

The point is that sometimes the expert is needed, not the document.

As we shortly discussed above the definition and understanding of the notion "knowledge" is a wide range. And as we do not want to contribute to this discussion we follow a practical definition and understanding of knowledge [Lot01, p. 4]:

> "Knowledge consists of both content (data and information) and context (a perspective that gives meaning to the content). And a context-creating relationship is required to derive a valuable insight from the content."

Context information is also called meta information (i.e. information about information). Beside the management of material and energy flows the management of meta information one of the substantial requirements to organizational environmental information systems [ArGü97, p. 24].

Document-based content in KMS has to be structured and processed. Therefore, a KMS has to analyze the submitted documents. Depending on the analyzing results the documents are related to certain classes. This procedure is corresponding to the procedure of processing meta information in environmental information systems. Environmental meta information can be related to different meta object classes referring to their content and their recording method [Less+95, pp.394]. Each class is described by specific attributes and groups of attributes.

The SAP Knowledge Management Warehouse approach for example underlines that uniform structure and granularity of document-based knowledge is advantageous for the transformation of knowledge. But one problem is to determine a specific granularity that meet the respective requirements. A too distinguished granularity is probably discouraging knowledge searching people. And a too coarse granularity is probably leading to misunderstanding in the knowledge transfer. Therefore, the proven uniform structure of management manuals is a good basis for structuring environmental management systems.

Based on management manuals we can define a vertical and a horizontal structure of environmental information systems (within the meaning of KMS).

3.1   Vertical Structure of Environmental Information Systems

According to the International Standard 10013[2] "Guidelines for developing quality manuals" environmental information systems should cover the following elements [ISO95]:

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[2]   This meanwhile withdrawn ISO standard is the only international standardization on management manuals to date.

- Introduction (to the concerning organization and the environmental information system itself);

- Label, purpose and scope of the environmental information system;

- Table of contents;

- Nomenclature;

- Environmental policy and objectives of the organization;

- Specific elements of the environmental management system (e.g. material and energy balancing or environmental reporting);

- Guidance of use;

- Appendix of attendant data.

Furthermore, each element except the elements "introduction", "label, purpose and scope", "guidance of use", and "appendix of attendant data" should be structured in following three description level of different granularity:

- *Regulation Level*: Correspond to the level of general management manuals. This level describes the elements of environmental management system in accordance with the stated environmental policy and objectives and the applicable standard.

- *Instruction Level*: Correspond to the level of management system procedures. This level describes the activities of individual functional units needed to implement the environmental management system elements.

- *Application Level*: Correspond to the level of work instructions and related forms, reports, etc. This level consists of detailed work documents. On this level of distinguished granularity the linkage/the transition will be staged between environmental information system and other organizational information systems the usage of which requires (environmental) knowledge or those are able to generate new (environmental) knowledge.

3.2   Horizontal Structure of Environmental Information Systems

On each description level of different granularity environmental information systems should cover the following groups of description information:

- Sort declarations (unique identification, state of modification and distribution list);

- Purpose;

- Scope;

- Responsibilities;

- Instructions;

- References (optional to refer to arbitrary objects - not only to documents).

This proposed concept of environmental systems provides a novel structure for the setup of environmental information systems (within the meaning of KMS) which take into consideration the requirements of a standardized and integrated procedure as well as of adequate flexibility.
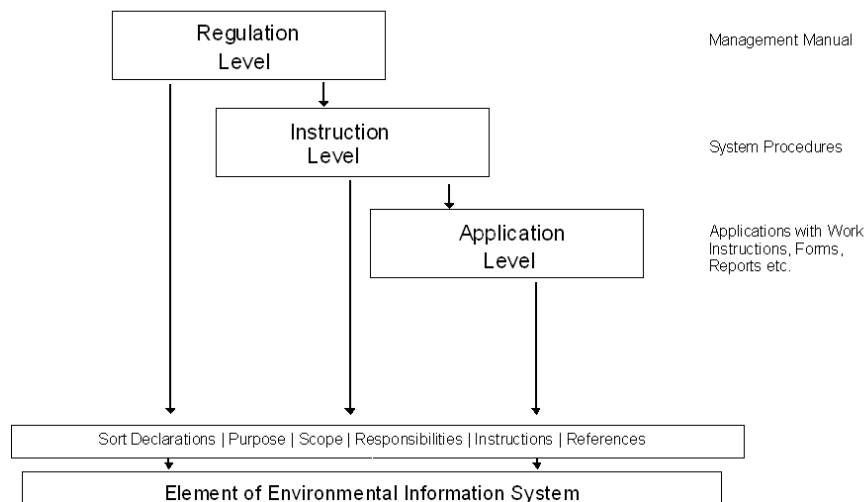

Figure 1: The Structure of Environmental Information System Elements

4. Conclusion

We discussed a new approach to structure environmental information systems that is based on management manuals. The presented approach pointed out on the one hand that an answer can be given to the still open question about how an environmental information system for organizations should look like. On the other hand the knowledge management discussion can substantially profit by the efforts of many years of experience in the area of environmental management (and in the area of quality management as well). In the next future the largest research work

will lie however in a categorization of (environmental) knowledge using semantic nets.

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