

FROM WASTE MANAGEMENT TO KNOWLEDGE MANAGEMENT

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Sustainable materials management requires that industries shift their focus from managing "waste" to managing knowledge of the uses and flows of materials in industrial systems. Failure to do this will place firms in a vulnerable position in the global economy where knowledge management is evolving as a major strategic and competitive advantage. By facilitating the sharing and pooling of knowledge of complex industrial processes and integrating it company-wide, industrial residues can be turned into resources, effectively closing the loop on materials cycles. The best mechanism for pooling and accessing knowledge is a customized software tool that facilitates knowledge sharing.

If we are to build a sustainable society, we must work towards not just reducing waste, but towards eliminating it. We must shift our focus from managing waste, to managing knowledge about materials, their use and their flows. Wherever there is "waste", there is a problem with the management of the materials flow. Materials are wasted due to inadequate product designs and because there is insufficient knowledge of what materials can be used for, where there is a need for them, the value of reusing them, or a combination of these. Opportunities for better use of materials readily emerge from the adoption of knowledge management.

Knowledge management is a popular buzz-word of the nineties, and has served many competitive and organizational benefits to firms such as Hewlett-Packard and Honda. Yet, in a 1997 publication, Royal Bank of Canada published that Canadians

have yet to take full advantage of the opportunities presented by the knowledge-based economy that we live in, and that unless Canadian firms shift their attitudes to reflect the importance of knowledge in the economy, Canadians could pay a high price for their inaction. The rigid forms of decision making and production that served Canadians well as a nation of natural resources and manufacturing are impeding the growth of the Canadian knowledge-based economy. Building a sustainable society requires that we remain competitive in the global market, and therefore, that we shift our thinking from how we manage physical resources to how we manage knowledge.

Knowledge Management

Knowledge management should not be mistaken for information management which is concerned with the interpretation of data. *Knowledge* occurs in the experiences, ideas, values, and expert insights of individuals. Knowledge management effectively leverages the individual knowledge of employees to build organizational knowledge and leads to improvements in business processes that can produce greater quality and less waste.

Managing knowledge can be challenging since it occurs in unpredictable patterns. Knowledge is creative and should be encouraged to develop in unexpected ways. It is not neat or simple, thus, the ability to manage it becomes difficult by the very characteristics that make it so valuable. A company's greatest untapped resource can be the ideas, opinions, experiences and collective knowledge of its staff. Nowhere is

there more valuable knowledge about a company's operations, about what works efficiently in the company and what does not, than in the minds of the people who drive the business every day.

However, Canadian firms have been slow to adapt to the evolution of knowledge management. According to Japanese organizational theorist Ikujiro Nonaka, that is because most Western managers hold a too-narrow view of what knowledge is and what companies must do to exploit it (Nonaka 1998). He points out that they believe the only useful knowledge is 'hard' or quantifiable, and that they see the company as "a kind of machine for information processing". This declares the need for companies to go beyond data and information collection, to tap into the tacit and subjective insights, intuitions and ideals of employees.

Knowledge management and waste management

Waste reduction requires that industries acquire and make use of more knowledge about the flow of materials. They need to achieve a better understanding of the flow of materials and energy in industrial systems and better information on "waste" sources (resources) and uses. Capturing this information and the knowledge of how to use it will allow broader reuse opportunities and greater waste minimization potential to be incorporated into the industrial design process.

The real value of knowledge management emerges when employees share their interpretations and insights about better process and materials management. For example, a middle manager's intuitive sense of market trends becomes the catalyst for important advancements in product stewardship. Similarly, a shop-floor worker draws on years of experience to create a new process innovation that improves quality and reduces waste. In each case, an individual's personal knowledge is transformed into organizational knowledge to the company as a whole (Nonaka 1998).

This building of organizational knowledge can facilitate the redesigning of products and processes that are more efficient. Designers of manufacturing processes are thus enabled to design and produce products and processes in which the control of waste is part of their enterprise, not just an afterthought (Frosch 1995). Production processes can be designed such that byproducts become resources rather than "waste".

Several companies can demonstrate that by paying closer attention to their waste and materials flows, they are able to uncover opportunities to turn their "waste" into resources. DuPont, for example, has begun to manufacture pen and pencil sets out of Corian countertop scrap (Tebo 1997). By turning a byproduct into a feedback loop, DuPont reduced the waste disposal costs from its countertop production operations and created a new product and source of revenue.

Achieving this industrial design framework is in part a technological challenge—clever new technologies that can reduce or recycle wastes will surely play a valuable role. But the answer will depend on fundamental organizational changes that facilitate the sharing of knowledge about materials flows, and complex considerations of design and management which draw from information about a company's products, processes, and waste. In essence, it is critical to recognize the knowledge barrier that separates traditional industrial systems from the efficient materials flows that are possible.

The key to overcoming knowledge barriers is to facilitate and encourage the sharing of success stories and best practices about internal and external operations so that they can be replicated. As well, the sharing and pooling of employee expertise can make that knowledge useful across the company, especially when knowledge from different departments and sites reveals its interrelation. For engineers of production processes and materials flows, this can help to evaluate trade-offs, provide design advice, and capture the accumulated experience of development teams (Fiksel 1996). Part of

sharing these is the process of communicating them amongst interested professionals, and part of it is making the knowledge accessible and retrievable. The best mechanism for pooling and accessing knowledge is a software tool that facilitates knowledge sharing.

Software for environmental knowledge management

A range of software solutions has emerged for managing information about materials and waste, as well as many other environmental aspects of a company. In varying degrees, they are useful for managing inventories of chemicals and other materials, and levels of pollution and other outputs. Many tools also provide checklists for environmental management or to assist in preparing for registration to ISO 14001.

However, what many of these systems fail to do is combine data and information with shared expert opinions, best practices, and other unique knowledge. Therefore, information remains stagnant in the absence of perceptions and innovative discoveries for improvements. Hence, they do not lead to changes in the underlying structure of process and product designs

They are usually not networked, therefore they produce "islands of automation"; hence the information is not highly accessible and is not integrated into everyday business. The key to improving industrial systems through knowledge management is first, the transformation of data into information, but ultimately, the promoting and tracking of knowledge in relation to information. This enables knowledge to be integrated company-wide and can lead to organizational improvements such as more efficient industrial systems.

In order to capture the benefits of knowledge management, the software must suit the culture of the organization and be integrated into everyday business. However, software that is purchased "off the shelf" is generic—it does not "fit" the culture of any one organization.

Business integration

The key to integrating environmental knowledge is a management tool *and a planning process* that are customized for the organization, reflecting the company's traditional nomenclature, workflow, and industrial processes. The customization process must incorporate careful strategic planning to ensure that the design of the environmental knowledge management system reflects the goals of the firm, its corporate culture, and the organizational realities. Users of the system should be involved in the design of applications so that they capture, store, transfer, and display knowledge according to employees' common practices and needs. And since even a sophisticated knowledge management system will fail if nobody uses it, careful planning is essential to ensuring that company employees will adopt the system and use it effectively. People are unlikely to document information, share their knowledge, and reuse the know-how of others unless it is made easy for them (Lotus 1998).

An effective environmental knowledge management system combines the philosophies of both environmental management and knowledge management. It provides all the functions of effective data and information management, but more importantly, it pools valuable knowledge and integrates it company-wide. Thus, it should be designed to foster communication, sharing and teamwork at head office, at remote locations, and across multiple sites. A means for raising questions and also sharing best practices needs to be encouraged and facilitated with tools such as discussion forums and internal inquiry management. In addition, a knowledge index or "corporate yellow pages" can show people in the organization how to find expertise when they need it by tracking employee skills, credentials, specialties and experiences. This sharing and integration of knowledge can lead to profound improvements in business and industrial processes -- an improvement that derives from the knowledge of employees, not the tool itself.

Conclusion

The era of rapid change in what some call the “network society” is occurring simultaneously with the increasing concern for environmental degradation and resource depletion. Thus, industries are under tremendous pressure to adapt both to new technologies as well as public concerns. Companies that choose to overlook the value of knowledge management face competitive risks in the global market. Companies that respond with solutions that incorporate knowledge management will be well positioned to remain competitive. They will be unencumbered by obsolete attitudes and continue to improve the efficiency of their industrial processes. They will effectively use their company knowledge to close the loop on production processes, thereby reducing negative impacts on the environment, and delivering products at a lower cost.

It is necessary to abandon the concept of “waste” as a physical problem, and recognize it as an information problem. Instead of looking at ways to dispose of “waste”, industrial processes must assume the complexity and information flows inherent in natural ecosystems where “waste” transforms into valuable resources. After all, it makes good business sense for a company to manage its limited natural resources with the only resource that does not deplete with use—*knowledge*. Knowledge can provide a sustainable advantage because, unlike materials assets that decrease as they are used, knowledge assets increase with use and add continuous value to an organization. This shift in thinking would effectively preserve the long-term sustainability of resources and advance waste management in the network society.

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