LOOKING FOR EVIDENCE OF ORGANIZATIONAL KNOWLEDGE CREATION IN WATERSHED MANAGEMENT

Nancy Goucher and Sarah Michaels
School of Planning, University of Waterloo

Abstract

To innovatively approach the myriad of ecological challenges facing them, organizations charged with environmental stewardship must create organizational knowledge. Creating organizational knowledge involves producing new knowledge and distributing it throughout the organization in such a way that it is manifested in the operation of the organization. Examples from the Grand River Conservation Authority, an organization noted for its innovative and influential watershed stewardship practices, are used to illustrate three dimensions along which the traditional organizational approach to information processing differs from the conventional approach to creating organizational knowledge. These dimensions are defining the problem, using knowledge in problem solving, and the roles of staff in the problem solving process.

Introduction

Berkes *et al.* (2003) point to the gap that has developed between environmental problems and our lagging ability to solve them. They point to the need to understand the dynamics of the interrelationships between ecological systems and social systems if we are to maintain the capacity of ecological systems, such as watersheds, to support social and economic systems. One way to link the social and ecological systems and bound the inquiry is to focus on creating, accumulating and transmitting ecological knowledge (Berkes and Folke, 2002). Biermann (2002) argues that entities engaged in environmental stewardship must learn to effectively use existing and new knowledge to creatively approach such wide ranging ecological challenges as climate change and loss of biological diversity. To cope dynamically with changing environments requires organizations to create and not merely process knowledge and information (Nonaka and Takeuchi, 1995).

Creating organizational knowledge involves producing new knowledge and distributing it throughout the organization in such a way that it is manifested in the operation of the organization. A knowledge creating organization is defined by its systematic management of the process of creating organizational knowledge (Nonaka and Takeuchi, 1995).

Creating organizational knowledge is essential for Ontario's 36 Conservation Authorities, community-based environmental organizations mandated by the province to conserve, restore, develop and manage natural resources on a watershed basis. From the initiation of the Grand River Conservation Authority's predecessor, the Grand River Conservation Commission as the first organization of its kind in Canada and the third in the world (Boyd *et al.*, 2000), the Grand River Conservation Authority (GRCA) has been considered

a cutting edge, influential conservation authority (Shrubsole, 1992; Shrubsole, 1996). In 2000 it was awarded the international "Thiess Riverprize" for excellence in river management (Mitchell and Shrubsole, 2001). The Authority is charged with managing, protecting and restoring the Grand River's watershed's freshwater resources. The Grand River watershed is located west of Toronto and is one of southern Ontario's largest watersheds being almost 7000 square kilometres in area (Ivey, 2002) (see Figure 1).

Figure 1. The Grand River watershed (Ivey, 2002).
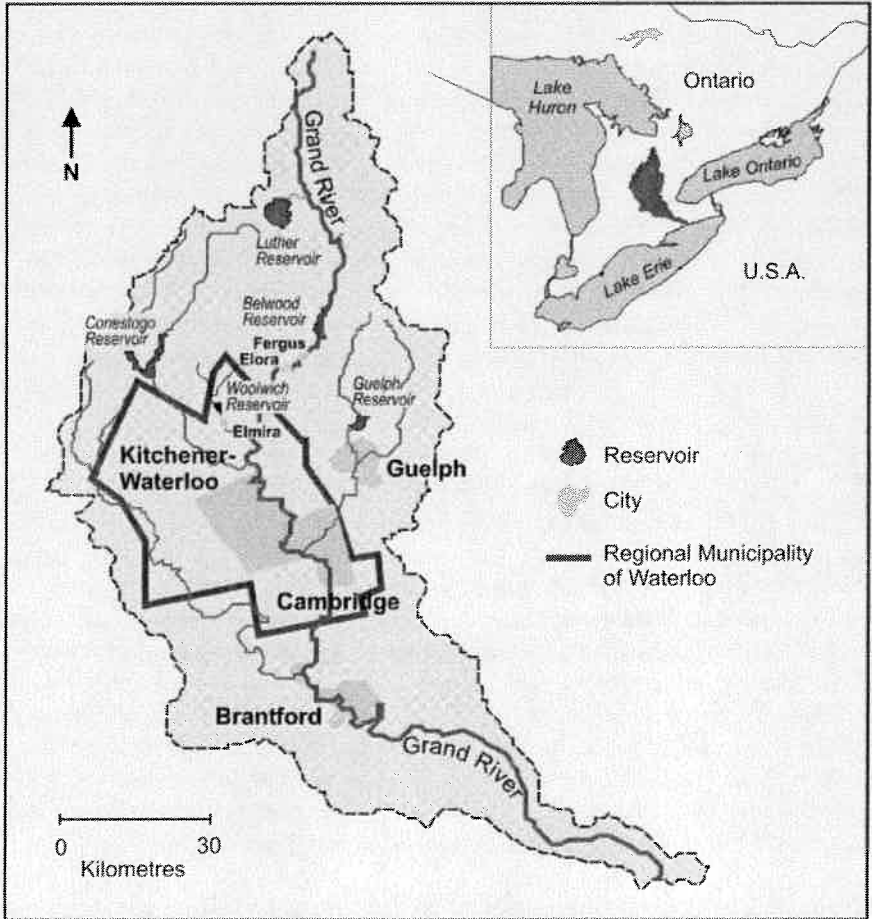
The remainder of the paper uses examples from the GRCA's experience to understand the differences between the traditional approach to information processing and an organizational knowledge creation approach. The discussion, while not comprehensive, does suggest the value to conservation authorities of experimenting with creating organizational knowledge for use in watershed management.

Comparing Information Processing with Creating Organizational Knowledge – Puzzle versus Mural

The tradition of western management from Frederick Taylor to Herbert Simon was to view organizations as machines for processing explicit information. Information was conceptualized as a product and the emphasis was put on how to handle it efficiently. Nonaka and Takeuchi (1995) argue, however, that utilization of information or knowledge is insufficient to drive innovation; to do that requires creating organizational knowledge. A useful way to understand the difference between the traditional organizational approach to information and creating organizational knowledge is to think about the difference between putting together a puzzle and painting a mural. A puzzle approach is about trying to put pieces together in a pre-determined and inflexible fashion. The analogy for creating organizational knowledge is the painting of a mural where the pieces of information should be blended and re-created to contribute to the end product. Painting a mural suggests Choo's (1998) activity view of knowing that contrasts with the traditional treatment of organizational knowledge as an object to be manipulated. Table 1 compares the different implications of the traditional approach to information and the creating organizational knowledge approach for three important dimensions of problem solving within organizations.

Table 1. Comparing the traditional approach to information processing and the organizational knowledge creation approach.

ASPECT OF ORGANIZATIONAL PROBLEM SOLVING PROCESS	TRADITIONAL ORGANIZATIONAL APPROACH TO INFORMATION PROCESSING – *PUTTING TOGETHER A PUZZLE*	ORGANIZATIONAL KNOWLEDGE CREATION APPROACH – *PAINTING A MURAL*
Defining the problem	Problem appears bounded and is narrowly defined	Process is required to identify and bound problem
Use of knowledge in problem solving	Individual pieces of information either fit or do not; a missing piece of information will prevent the completion of the final product	A holistic approach is taken to knowledge; flexibility in process enables problems to be analyzed from different perspectives
Roles of staff	Defined and limited	Multi-faceted based on understanding the big picture

Defining the problem

In the traditional organizational approach to information processing, the problem may be seen as being so obvious that resources are focused on generating a solution through combining pertinent information in a step-by-step procedure (Nonaka and Takeuchi, 1995). This approach consequently characterizes problems as bounded and narrowly defined. For example, to prevent flooding and to augment low summer flows on the Grand River,

the Shand Dam was opened in 1942 creating behind it the Belwood Reservoir (Boyd et al., 2000) (see Figure 1). This structural combination was the first such multi-purpose facility developed in Canada by a watershed based organization (Mitchell and Shrubsole 2001). Well accepted engineering procedures were used to generate the solution – designing and building the dam and creating the reservoir (Templin, 1992).

Creating organizational knowledge, in contrast to the traditional approach, recognizes the importance of defining a problem in terms of the knowledge available and the context at the time the problem emerges (Nonaka and Takeuchi, 1995). The scope and context used in defining the problem shape the approach to the problem and how it is addressed. While the primary function of the Shand Dam remains flood control and flow augmentation (Boyd *et al.*, 2000), the Grand River Conservation Authority has come to recognize and manage for the broadening expectations of river users. Repair work to the dam, initiated in 1997, included installing a pipe to pump additional oxygen into the water with the intent of improving fish habitat (Cork, 1997). When testing the dam's flood gates, the GRCA employees factor in the trout fishery downstream (Hughes, 1999). The GRCA in identifying a problem utilizes a multidisciplinary perspective in sync with a creating organizational knowledge approach. Today when changes need to be made to the water control system on the Grand River, the perspectives of biologists and others concerned with ecological sustainability of the watershed are solicited.

Use of knowledge in problem-solving

In our analogy of the traditional approach to information processing, the puzzle pieces represent bits of information that are used to solve problems. In such a context, if information does not seem immediately relevant, it is discarded. Efficient handling of information, paramount in the assembly line model of information processing, requires manipulating only those pieces obviously applicable to solving the immediate problem. At the same time, if a piece is missing, the picture cannot be completed.

In the creating organizational knowledge approach, there are means to compensate when discrete pieces of information are missing. Knowledge is recognized as being multifaceted and usable in a number of ways. In the mid-1990s the GRCA anticipated the imminent loss of provincially provided knowledge and some of the wherewithal for the GRCA to create its own knowledge. Between 1995 and 1997 Ontario provincial agencies and public organizations, including conservation authorities, had their budgets reduced significantly as a function of the neoconservative philosophy of the then newly elected provincial government. As with the other conservation authorities, the GRCA was confronted with a provincial grants program of support narrowly focused on operating and maintaining flood control structures and flood warning. The provincial government offered no guidance as to how traditional functions such as regulating floodplain land use, recreation and other elements were to be addressed (Mitchell and Shrubsole, 2001). The GRCA did not employ a narrow problem definition - loss of funding, and an equally narrow problem solving approach - trying to replace lost funding dollar-for-dollar. Instead, the GRCA chose to use existing knowledge and to create knowledge so as to define the situation as an opportunity to clarify its mission, to reinforce the valuable functions it provided to the municipalities within its boundaries, to undertake a strategic reorganization and to lay out constructive next steps (GRCA, 1997).

Roles of staff

In the hierarchical model of top-down management, a division of labour is used to process information. Staff members pass up the pyramid simple and selected information to executives who generate plans and orders that are then relayed back to staff to execute (Nonaka and Takeuchi, 1995). Information is handled as if it were an object of production on an assembly line where individuals have discrete, fixed, distinct tasks, dependent upon and separate from others in the chain of production. In such a situation, staff members cannot always see how their individual work relates to the tasks of others, which limits their abilities to creatively go beyond what is required of them.

In our analogy of creating organizational knowledge, staff members are painters of a mural rather than assembly line workers putting together a puzzle. They are responsible for the design and execution of their tasks within a shared understanding of the corporate objective. Staff members are encouraged to constantly look for ways to improve or build upon one another's ideas and questions (Leonard and Sensiper, 2002). Team work is essential if the individual scenes painted are to come together as a mural. The GRCA currently employs a reasonably flat organizational structure that promotes "collegial autonomy" as individuals work toward achieving the organization's mission. A bottom up management approach encourages creating organizational knowledge (Nonaka and Takeuchi, 1995).

Conclusion

While knowledge management is an important factor of innovation in entities involved in environmental stewardship, it is rarely studied in this context (Luen and Al-Hawamdeh, 2000). The contribution of this paper has been to highlight three aspects of the process of organizational problem-solving that demonstrate some of the differences between the traditional organizational approach to information processing and that of an organizational knowledge creation approach. Where possible, the experiences of the Grand River Conservation Authority, an organization actively engaged in watershed management, have been used to illustrate the differences in the two approaches to defining the problem, using knowledge in problem-solving and the roles of staff in the problem-solving process.

The application of knowledge management and specifically of creating organizational knowledge to enhance natural resources stewardship is still in its infancy. It is the prospect of its potential contribution to advancing sustainable conservation practices that will fuel further research into what this application can mean for inducing the innovation necessary to address evolving ecological concerns.

Acknowledgments

References

Berkes, F., J. Colding and C. Folke. 2003. Introduction. Pp. 1-29. In: F. Berkes, J. Coldingand C. Folke. (eds.). *Navigating social-ecological systems.* Cambridge University Press: Cambridge.

Berkes, F. and C. Folke. 2002. Back to the future: ecosystem dynamics and local knowledge. Pp. 121-146. In: L.H. Gunderson and C.S. Holling. (eds.). *Panarchy.* Island Press: Washington, D.C.

Biermann, F. 2002. *Knowledge for the sustainability transition and the challenge for social science.* Berlin Conference Proceedings, December 2002. Available: www.fu-berlin.de/ffu/akumwelt/ bc2002/files/biermann.pdf.

Boyd, D., A.F. Smith and B. Veale. 2000. *Flood Management on the Grand River Basin.* Grand River Conservation Authority: Cambridge, ON. Available: www.grandriver.ca/waterdata/downloads/floodman.pdf.

Choo, C. W. 1998. *The Knowing Organization: How Organizations Use Information to Construct Meaning, Create Knowledge and Make Decisions.* Oxford University Press: New York, NY.

Cork, C. 1997. Shand Dam repairs will benefit fish. *The Record,* June 28, p. B11.

GRCA (Grand River Conservation Authority). *Focus on Watershed Issues 1996-1997.* Grand River Conservation Authority: Cambridge, ON.

Hughes. R. 1999. Grand River, a precious life source. *The Record,* September 25, p. P03. Waterloo, ON.

Ivey, J. 2002. *Grand River Watershed Characteristic Report.* Guelph Water Management Group: University of Guelph. Available: www.uoguelph.ca/gwmg/wcp_home/Pages/G_home.htm.

Leonard, D. and S. Sensiper. 2002. The role of tacit knowledge in group innovation. Pp. 485-499. In: C.W. Choo and N. Bontis (eds.). *The Strategic Management of Intellectual Capital and Organizational Knowledge.* Oxford University Press: New York, NY.

Luen, T. W. and S. Al-Hawamdeh. 2000. Knowledge management in the public sector: Principles and practices in police work. *Journal of Information Science,* 27(5): 311-318.

Mitchell, B. and D. Shrubsole. 2001. Ontario's Conservation Authorities. *Water News,* December 16-21.

Nonaka, I. and H. Takeuchi.1995. *The Knowledge-Creating Company.* Oxford University Press: New York, NY.

Shrubsole, D. 1992. The history of the Grand River Conservation Commission. *The Canadian Geographer,* 36(3): 221-236.

Shrubsole. D. 1996. Ontario conservation authorities: Principles, practice and challenge 50 years later. *Applied Geography,* 16(4): 319-335.

Templin, P. 1992. The Shand Dam: First and largest dam in the Grand River Watershed. *Wellington County History,* 5:30-36.