Tacit Knowledge in Information Systems

Rudy McDaniel
Department of English
University of Central Florida
rudy@mail.ucf.edu

Leonard Pollard
Department of Industrial Engineering
University of Central Florida
lpollard@mail.ucf.edu

Abstract

Knowledge management is now a recognized force in the corporate world. Today's companies grudgingly acknowledge information as a source of capital and realize how important it is to have an established methodology for managing and distributing this information. Proven techniques for knowledge management are still lacking, however. Information systems, or networks of interconnected computers and data storage devices, provide an environment in which information overload is a very real problem and threatens to severely limit the capabilities of information managers. In this type of environment, a means for managing tacit knowledge is critical.
Keywords: Knowledge Management, Tacit Knowledge, Information Management

1. Introduction

The American Productivity and Quality Center (APQC) has studied knowledge management practices intensely since 1996. Partnering with companies such as GE, Motorola, Johnson Controls, and MITRE, and sponsored by Intel, the Social Security Agency, Xerox, and many U.S. agencies including the Department of Agriculture, Transportation, Veterans Affairs, and the U.S. Navy Chief Information Office, the APQC reports on the knowledge management practices of some of the largest and most diversified U.S. corporations and agencies. A recent best-practice report outlines the problems involved in searching, sharing, revising, creating, and managing information and tacit knowledge. The report introduces the idea of content management to be "the system to provide meaningful and timely information to end users by creating processes that identify, collect, categorize, and refresh content using a common taxonomy across the organization" [1]. Whether you call it content management, knowledge management, or information systems management, it is clear that the process by which information is moved throughout an organization is critical to the success and prosperity of that organization. To have a common mechanism for distributing important information is undeniably valuable. Of their partners the APQC reports that sixty percent of these organizations have an established knowledge management strategy in place; eighty-two percent of their sponsors use a knowledge-management system.

2. Knowledge, Information and Data

Before attempting to further explain techniques for managing different types of information, it is necessary to differentiate what is meant by the terms data, information, and knowledge.

2.1. Data

While various researchers and industry-specific experts have attempted to make this distinction, Thomas Davenport's discussion of the three terms is perhaps the most elegant. Davenport defines data as "observations of states of the world" [2]. This definition is especially nice because it communicates the same general idea to different types of professionals who each have a different idea of what "data" happens to be for their given occupation. For example, a computer programmer used to thinking in an object-oriented manner may attribute this idea to an object model and its various states of existence. Thus there might be data that does not exist yet (potential data), data that is currently being manipulated (active data), and data that is essential for some later use and is currently stored away until it is needed (foundation data). Someone such as a lower-level hardware or compiler programmer may consider data to be a less abstract part of that computer program, such as the strings of bits making up the programming language itself. A technical writer, on the other hand, would have other experiences and ideas

that influence their own observations about the world. To a technical writer the number of customers who completed a survey about a given program feature could be considered data. A manager would have yet another paradigm through which data could be observed, which might be the various costs and numbers associated with each project. This subjective definition of data is key to formulating a plan for knowledge management. In essence, it means that our vision of data is specifically related to the way in which we see the world. Data observation is therefore a social process.

2.2. Information

Information is a subset of data which is "endowed with relevance and purpose" [2]. Its most critical purpose is obviously to inform. One's expertise or knowledge of a given subject will influence the level of abstraction needed to transform data into information for one's own purposes. A computer, which is the most powerful data processor we have (but which still needs a skilled human operator in order to produce useful information), can read data at the hardware level and scan millions of binary digits in a matter of seconds. So, to a computer these bitstreams are information. To a hardware programmer writing in assembly language, the information is codified in a more human-readable form which becomes information for these programmers but is still cryptic for those programming in higher-level languages. For a technical writer, the functional data that a programmer views as informational may not address the needs of end users and therefore is considered to be non-information by the writer. Obviously, the definition of what is purposeful and relevant can be the cause of some disagreement amongst different professions or even within the different divisions of the same organization. Thus information is much harder to transfer from one unit to another "with absolute fidelity" [2].

The availability, reliability, and dissemination of information all influence how that information is perceived within an organization. Consider the health care industry as an example. Here we have massive amounts of data available (hopefully only to those with the appropriate security clearances) on everything from a patient's allergic reactions to the last time they received a flu shot. What transforms that data into information, though, is finding something purposeful within that information for a given department. For the billing department, the insurance number might be information. For the clinician, a general medical history would be more informative. For the anesthesiologist, allergies are key pieces of information. It is the task of the information manager or knowledge manager to filter irrelevant data from useful information for these various departments and make sure the correct people receive the correct information.

Reliability is another issue we must consider. The Internet Age places us in a somewhat uncomfortable position. Now we can find people so passionate about all areas of life that it is sometimes difficult to discount even the most ludicrous ideas we read about on the Internet. Reverting back to our health care example, a search on "headache remedies" returns suggestions from the reasonable (lie down in a quiet room, drink some caffeine, etc.) to the downright strange (one website listed in the top ten results instructed the visitor to lie down in a bathtub and pour a mixture of honey, warm water, and pepper over their bodies until the headache subsided). Reliability is certainly a factor that must be considered in all areas of information gathering, but the Internet is an excellent example of information overload in action. In order to perceive information as being truly useful and valuable, there must be some sort of indicator vouching for the reliability of the purposeful facts about the world that we have gathered.

Finally, the dissemination of information contributes to the perception of information in an organizational system. Rare or esoteric information is highly prized and valued, and as a result someone possessing such information is tempted to keep that information to themselves and secure a stronghold on that particular topic. In healthcare especially, this type of thinking can be dangerous. It is important to facilitate information transfer throughout the organization and eliminate these types of bottleneck scenarios in which certain chunks of information must be queued up behind one overbooked specialist.

2.3. Knowledge

Knowledge is an even more useful form of information. If you consider data, information, and knowledge to lie along a continuum, as Davenport does, then knowledge would be the end-of-the-road marker for that continuum. In other words, knowledge is what one ends up with when trying to do something useful with their world observations. It is more valuable than simple data or even information because "someone has given the information context, meaning, a particular interpretation; someone has reflected on the knowledge, added their own wisdom to it, and considered its larger implications" [2]. As such, if we can develop a strategy to manage knowledge efficiently then by default we gain mastery over the more elementary forms of facts and observations such as data and information. Davenport coins the term "information ecology" to describe the science of managing and manipulating the whole environment of information [2].

3. Knowledge Types

Since Davenport's idea of knowledge involves the incorporation of personal wisdom, it is often quite challenging to decide upon efficient ways to formulate, organize, share, and retrieve this knowledge within a team or distributed unit. Even more frustrating is the fact that some types of knowledge are simply harder to codify than other types. Researchers generally distinguish between explicit knowledge (sometimes referred to as hard knowledge) and tacit knowledge (soft knowledge). Explicit knowledge is knowledge that can be written down or codified rather easily while tacit knowledge is more intuitive and therefore more difficult to formulate and explain.

3.1 Managing Knowledge

Over the years there have been significant advances in fields such as artificial intelligence, psychology, and engineering that have produced expert systems capable of doing an acceptable job of managing explicit knowledge for specialized fields. Specific systems for hospitals, financial firms, and insurance companies can now bring up the necessary pieces of information needed to gather knowledge about a disease, stock, or claim based on a few preliminary queries used to narrow down the search field.

While managing explicit knowledge can be tricky, even for expert systems, the real interesting problem is attempting to manage tacit knowledge. What makes tacit knowledge so interesting is the fact that you never know exactly where the knowledge is coming from. Because of this, even the most vicious manager cannot force an employee to write down his or her tacit knowledge in anticipation of that employee losing their job in the next month or so. Downsizing, outsourcing, and globalization are thus powerful enemies to an established source of tacit information. Finding a way to control and manage this information is the critical problem.

Tacit knowledge is knowledge that cannot be explicitly explained through a set of precise steps. It is a more subjective type of knowledge in which the knower has a general idea or intuitive feeling about how to complete a certain task or troubleshoot a particular problem. Tacit knowledge is a vague type of knowledge that is no less valuable than the explicit knowledge which can be transmitted wholly from sender to receiver using chunks of information or by sending a precise series of oral or written steps that detail how to accomplish something. In fact, since it is so hard to manage and distribute, tacit knowledge is often the more valuable type of knowledge within information systems.

When you consider the idea of tacit knowledge, it seems to be rather non-logical and un-scientific at first. After all, any problem that has a rational solution seems like it would offer a solution in a format that could be described in a linear sequence of steps. But the problem is that the expert may not know exactly what they are doing in the first place, but instead they know of a general approach they can use to try and hammer at a problem until it fits together. Perhaps this could be described as tacit-explicit knowledge, or knowledge that has the potential to be described clearly if only the describer knew what they were talking about.

For example, we can again consider the computer programmer. In programming a computer to solve a particular problem, a programmer has several options for designing their application. They may decide to plan their project in detail and define all of their data structures and information transitions using flowcharts or UML diagrams. Or, they may choose to immediately start writing source code which allows them to bypass the planning phase and jump directly to what they find as the more interesting work in this particular project. When a problem is encountered, the code is simply modified to take into account the new problem. What is eventually hacked together is a product that works without bugs but still rests on a shaky foundation. In the former case, where the programmer has invested some time and effort in planning, the information is laid out in a manner that facilitates the sharing of explicit knowledge. In the latter, where the planning stage is bypassed, the haphazard way of construction makes it much more difficult for the programmer to explain exactly what they have done to a colleague.

Of course the problem with this is that to those untrained in planning strategies more planning time can often mean a longer project time. This means more money is needed for the project which can then lead to corporate downsizing. So the programmer is stuck deciding between two non-optimal solutions, and in this scenario hoarding tacit knowledge can become a defense mechanism and an agent for job security.

Several innovative strategies have been hypothesized and/or tested as useful tools for tacit knowledge management. For example, one of the more interesting techniques considered for sharing this type of knowledge is to use a narrative approach [3]. By using stories to convey knowledge, we can capitalize on the very social nature of the knowledge-building process. This allows different users with similar types of explicit knowledge to build stories which can then be read by others and hopefully internalized into their own tacit knowledge-centered stories. What massive databases and lists did for explicit knowledge-management expert systems stories and narratives now have the potential to do for tacit knowledge-management systems. Roger Schank calls the

process of making internalized collections between stories indexing, and it is a task he believes is critical to both knowledge and intelligence [3]. Interestingly enough, research in knowledge management has shown stories to be one of the only proven ways to share tacit knowledge (the swapping of technological stories between grizzled IT veterans), and yet story-based approaches are not yet widely used as tools for knowledge management [4].

The advantages of narrative techniques such as storytelling and storyboarding have been noted in several research studies [3,4,5]. In one such study, Xerox repair technicians were monitored by anthropologist Julian Orr in order to see how closely their jobs were related to their job descriptions as described on paper. What Orr found was that a critical activity in relaying and assimilating tacit knowledge was the breakfast and coffee-time discussions that the technicians would participate in and share their various "war stories" with one another [5]. In a related study, Hildreth, Wright, and Kimble found similar connections and a strong need for face-to-face contact in managing tacit knowledge by carrying out two case studies observing the knowledge management practices of Watson Wyatt, an international actuarial organization [4].

If we extend Davenport's metaphor of knowledge management as information ecology, then we can equate narrative knowledge management as recycling our ecosystem's resources. By telling stories and relating experiences amongst a group, a team can analyze their failures, reinforce their own ideas and workarounds, and better understand why a given solution works even though it is not written down on tangible documentation anywhere. Thus the same knowledge is recycled from one team member to the next, and the tacit ideas remain whole even if the specific details surrounding these ideas are somewhat different from one person to the next.

Mastering the intricacies between data, information, and knowledge will not secure the success of an individual, group, or organization. Finding a way to move knowledge between these groups, however, will do much to better communication and reduce unnecessary strain on both employees and teams. When an individual feels that much better about the document she or he is creating because they know it is unique and therefore useful, or when a manager can quickly find the information they need without sorting through blocks of irrelevant data, or when the client and support staff are reading the same version of the same documentation, then one can rest assured that implementing their knowledge management strategy has been worthwhile.

[1] Odem, Peggy et al. "Knowledge Management Consortium Benchmarking Study". American Productivity and Quality Center, 1999.

[2] Davenport, Thomas H. *Information Ecology*. Oxford University Press, New York, 1997.

[3] Schank, Roger C. *Tell Me A Story*. Northwestern University Press, Illinois, 1998.

[4] Hildreth, Paul, Wright, Peter and Kimble, Chris. "Knowledge Management: Are We Missing Something?" In Brooks, L. and Kimble C. *Information Systems – The Next Generation*. Proceedings of the 4th UKAIS Conference, York, UK: 347-356, 1999.

[5] Brown, J. S., P. Duguid, et al. *The Social Life of Information*. Harvard Business School Press, Boston, 2000.

About the Authors

Rudy McDaniel received a B.S. in Psychology and an M.A. in Technical Writing from the University of Central Florida. He is currently pursuing his Ph.D. in Texts and Technology at UCF along with a B.S. degree in Computer Science. His research interests include artificial intelligence and knowledge management. He is a member of the Society for Technical Communication and the STC AccessAbility Special Interest Group. Rudy's email address is rudy@mail.ucf.edu.

Leonard Pollard received a B.S. in Industrial Engineering and an M.S. in Engineering Management from the University of Central Florida. Currently, he is an Industrial Engineering Ph.D. student at UCF. His research includes applications of Industrial Engineering in Health Care and Knowledge Management. He is a member of Institute of Industrial Engineers, the Society for Health Systems (SHS) and the Health Information and Management Systems Society (HIMSS). Leonard's email address is lpollard@mail.ucf.edu.