The Hybrid Design: Integrating the Human and Technical Components of Just-In-Time Knowledge Management Systems

Nabie Y. CONTEH, Ph.D.
Harry F. Byrd Jr. School of Business, Shenandoah University
Winchester, VA 22601, USA

ABSTRACT

This paper explores the right balance of human and technical resources in the design of Just-in-Time knowledge delivery. It also examines and analyzes the case study: "Teltech: The business of Knowledge Management" by Davenport. It further attempts to depict the characteristics of the hybrid. The paper describes how the hybrid can be applied to Just-In-Time knowledge delivery. It also seeks to analyze and explore its interplay with knowledge splits with a view to designing Just-In-Time Knowledge Management. These include: "tacit versus explicit knowledge", "in-process" versus "after action" documentation, "process-centered versus product-centered approach", "knowledge versus information" and the "culture of sharing versus hoarding."

Keywords: Hybridization, JIT knowledge management, Knowledge analysts, hierarchical knowledge structure, thesaurus-based knowledge structure, knowledge engineers.

1. INTRODUCTION

The widespread use of the electronic media and the Internet has facilitated the exchange of information and in consequence brought about a tremendous increase in the volume of information. This has in turn, resulted in a situation otherwise known as the "information overload". Sorting through this vast pool of resources to extricate the right piece of information is not only tedious but intractable.

The idea behind "Just-in-Time knowledge delivery" is being able to furnish this information in the right form, just when it is required. The implementation of this concept plays a vital role in minimizing the time spent in retrieving the needed piece of information or expertise.

In the software engineering industry, for example, there are tasks or operations that are time-critical such as programming and code reuse. Usually the problem to be resolved is directly linked to a long trail of related and successive tasks. This means that, a problem with one of these tasks will result in a standstill of the entire production process. The delay in waiting for a resolution of the problem consequently translates to a loss of huge amounts of money. Sometimes, companies have to resort to outsourcing, which further lengthens the delay. "Just-In-Time knowledge Management" is a concept whose design and implementation is geared towards addressing these problems.

This paper attempts to explore the design of "Just-In-Time knowledge Management". It will further explore the combined role of humans and technology in the Just-In-Time knowledge delivery systems. It will as a matter of core significance explain what a hybrid of these components should look like, its characteristics, environment, conditions and its right balance. Finally, the paper will explain the hybrid's implication to information systems.

In order to be able to address the design phase, it is necessary to first and foremost understand the problems that this situation poses. Thereafter, issues of design and implementation can adequately be addressed.

The Choice of Teltech as Test Bed

In order to better illustrate the problems to be addressed, the case study, "Teltech" was chosen as an example. Teltech is a company that specializes in knowledge management. It has been successful in utilizing the hybrid method in Just-In-Time knowledge management (Davenport, 2002).

The choice of Teltech, as a basis, for the assessment of the right balance of knowledge delivery is based on the following: (1) Teltech is an information service providing company. (2) It utilizes the hybrid components of people and technology. (3) Teltech has a successful track record in rendering information services. Given the enumerated reasons, Teltech therefore serves as a logically ideal ground for such discourse.

2. "TELTECH: THE BUSINESS OF KM" CASE REVIEW

Teltech provides external technical expertise and information to companies that wish to better manage their knowledge and information assets. Teltech is a hybrid environment of people and technology-based services. It maps, structures and categorizes knowledge obtained from information sources and customer behavior. Teltech offers four basic services: (1) The Expert Network (2) Assisted Database Searches (3) Vendor Service and (4) Technical Alert service.

3. WHY THE CHOICE OF "HYBRID SEARCH" METHOD A PREFERRED OPTION AT TELTECH

From experience at Teltech, it was found that most people choose the option of employing the services of knowledge analysts as guides in their search for knowledge and information rather than embarking upon the search themselves.

The clients' need for assistance from knowledge analyst during any given information search is demonstrated when clients call up. Often times, they don't know the search term and search criteria to use. In certain cases, they don't know the database in which to search from. The end users of the information services of Teltech not only require the guidance of the knowledge analysts, but also need the confidence of their expertise. That is, it makes the clients feel that the information they are getting from the knowledge analysts is the right one and that this has been proven true and valid over time with past cases.

Teltech pays very well and therefore through rigorous screening gets the best people for hiring. In addition, these recruits undergo a substantial amount of training. These aforementioned reasons account for why these knowledge analysts are considered by clients to be capable information providers. They therefore have won the trust of their clients.

A key method that Teltech uses to accomplish knowledge management is by storing the names and locations of experts in databases and then referring clients to them. The filtering enhances the search process and provides richer knowledge as this is more than a telephone book. The fact that people help in the search combines the use of both people and technology. One big advantage this has on the quality of service is that the waiting time for callers is drastically reduced. This as a result, minimizes the number of knowledge analysts needed to render services to clients. In the final analysis this translates to reduced spending in training needs as well as in salaries.

One major problem that stands in the way of Teltech is integrating the databases of literature, of vendors and of experts. This view of source information, known at Teltech as, "Integrated source map", allows the clients who seek information directly from the system or through knowledge analysts to gain access to the sought after information. Someone seeking information on specific software, for example, will be furnished with such information as the number of experts available who could be consulted on the use of software. The number of patents on the software, alternatives available, the number of articles so far published on the software, within the past three years, the upcoming conferences, the federal and state codes and regulations governing its use. All this information will be presented in a "natural language" interface which is a project that was being worked on. This comprehensive information on products and services makes the Teltech a one-stop resource for information needs.

Another aspect of Teltech's knowledge management is its online search and retrieval mechanisms, the "knowledgeScope". This includes a thesaurus of over 30,000 technical terms maintained by several fulltime "knowledge engineers". They add 500 to 1200 new concepts per month to the database and remove outdated ones.

Many of the unsuccessful searches including misspellings are added to the database. Before the introduction of the thesaurus, a hierarchical knowledge structuring, known as "Tech Tree", was in use. This had proved difficult to navigate as new terms were added at inappropriate levels of the tree. The thesaurus knowledge structure is based on categorizing knowledge before it can be captured and leveraged. In practice, the thesaurus knowledge structure proved to be more flexibly navigable and easy to search.

From the foregoing, it is apparent that Teltech practices the concepts of knowledge management, "the learning organization," and intellectual capital. Teltech as a company is therefore setting the pace and trend in knowledge management practices for other companies to emulate.

Lessons Learnt From Teltech

From the Teltech case study, it is evident that humans and technology compliment each other. This conclusion was reached owing to the following reasons:

Teltech was formed with the express and sole purpose of providing access to a network of technical experts. From research conducted, however, it was discovered that customers were interested in gaining access to online databases. "Technical experts" in this case, refers to humans, while the "online databases" make a direct reference to technology. Teltech has created the right mix of humans and technology in meeting customer information needs. Teltech has further increased more services both human and technology-related.

Moreover, "knowledge analysts" being humans can not store all the names and addresses of the experts and their areas of expertise in their heads. Experts vary from case to case and the knowledge Analysts invariably have to use the database to help them in their search. These databases also help them when referring their clients to experts.

This goes to signify how the hybrid use of humans and technology can prove to be very efficient in the provision of the client's information needs. The clients call the "knowledge Analysts" by phone to help them do an interactive search on the databases in the computers.

One important way that Teltech uses to inform or make known all the significant technical developments made by researchers in the world is through "Technical Alert Service". This is an ideal way of networking expertise, products, services and technology around the world. This is an indication of the collaborative workings of technology and humans in rendering information services.

From the aforementioned, it is clear that the human factor is a vital and crucial component of the hybrid, without which, the search process becomes very difficult if not completely impossible. Knowledge management is implemented to a large extent by people and for the information needs of people.

Technology must be considered as a conduit for enhancing the capture, retrieval and transmission of information. Before embarking upon the purchase of a portal and the installation of a costly technical infrastructure, one must logically ask the question whether they are necessary at all. If deemed necessary, the next logical question to ask is are they going to be used by the employees? Further more, will the returns achieved through their

use justify the costs? A major hurdle that inhibits the use of the technology components is the ability and willingness of the employees to take advantage of them. The challenge here is the creation of incentives to motivate workers to utilize them. There is therefore a place here for influencing organizational behavior. The trick is to spend more on motivating and urging workers to cultivate a culture of sharing their expertise. This leads to the dimensions of the design space.

4. DIMENSIONS OF THE DESIGN SPACE

Knowledge Versus Information

Knowledge is neither data nor information though it is related to both.
Data is a set of discrete objective facts about events (Davenport and Prusak, 1998).

There is no inherent meaning in data. Data neither provides interpretation nor judgment. It serves as raw material for the creation of information. According to Drucker, Information is data endowed with relevance. Information is believed to shape the receiver's insight or outlook.
According to the Western Rationalist and Empiricist traditions, knowledge is argued to be a "set of justified beliefs". Information on the other hand is the meaning that humans assign to incoming data.
Gregory Bateson states: "those differences that make a difference" (Marshall et al, 1997).

Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of the knower. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms. (Davenport &Prusak, 1998:5

While it is generally believed that information is found in messages: oral, written, graphic, gestural, knowledge on the contrary resides in the heads of people and when it leaves these heads it becomes information. Knowledge is affected by information in that it helps in restructuring it. What both knowledge and information have in common is a comprehension of a sense of their social settings from which they originate and their embedded messages or assumptions and therefore their significance and limitations.

Knowledge creation is, in fact, a process of value addition to previous knowledge through innovation (Duffy, 1999; Narayanan, 2001). In other words, knowledge is defined as what we know.

Process-centered Versus Product-centered Approach

The process-centered approach also known as knowledge flow focuses on knowledge management as a social communication process and it is enabled by groupware support; whereas the product-centered approach also known as knowledge stock focuses on knowledge assets, their creation, storage and reuse.

Information technology is the backbone that supports the exchange of this explicit knowledge. This is frequently based on document management systems. The archiving of lessons-learned, best-practice databases, distributed technologies, such as collaboration tools and groupware, innovative techniques for communication and cooperation like e-mail, real-time chats, videoconferencing, workflow tools, aid in the capture of expertise. This in turn helps in the solving of problems. These, are but a few instances of how and what tools are being developed and used for the purpose of knowledge exchange or knowledge sharing.

The product aspect of knowledge management is therefore closely linked with the content management. It is the information being contained and transferred in these tools. This information is then stored for subsequent reuse. The process centric aspect on the other hand is concerned with context management. This entails the creation and enhancement of the environment. It is also concerned with setting up of the required tools and with a view to facilitating the exchange of information.

The objective for the utilization of such tools and techniques in the product-centered approach is for the retrieval of documents. The aim here is that of furnishing the information needs which are geared towards user query specific needs or the use of static information filter. The retrieval of documents can be done from a document repository. This is usually indexed in a logical and coherent order of document structures. They as well come from external sources like Internet information brokers, commercial databases, or web sites.

Knowledge, however, can not be captured, stored, transmitted and reused. Unlike information, it resides in the minds of people. Knowledge therefore is a product of the processed information that people or individuals receive by way of messages, social interaction, or in stored in repositories. This means the process of knowing can be enhanced through social communication. This process of knowing can also be enhanced by technology such as through the infrastructure of groupware, e-mail, fax, and electronic media. This information in turn has to be exploited, organized, standardized, codified, and contextualized. This processing of information makes it reusable. Thereafter, the strategy proceeds further towards connecting people with a heavy IT focus. This entails the development of a document management system. The end product in this case is a knowledge object. This is created and maintained by knowledge management processes. It is at the same time used as a means of searching, retrieving and disseminating knowledge content. It therefore serves as a fusing point and unifying factor for both the product and process centric approaches (Knownet, 2002).

Tacit Versus Explicit Knowledge

Tacit knowledge is knowledge that is complex, developed and internalized by the knower over a long period of time. It is near impossibility to reproduce it in a document (Davenport & Prusak, 1998).

Explicit knowledge is that which one can express in a written or verbal form. The problem with tacit knowledge is that it is difficult to transmit or transfer. Explicit knowledge on the other hand, can be documented or easily passed on to others, either by verbal or written means.

We can know more than we can tell. That is to say, often times, we know the physiognomy of a physical entity say a face, and distinguish it from many others but lack the capacity to communicate its precise description to others. We can only do so if we are provided with a reasonable means of expressing ourselves. For example by furnishing us with samples of features, for example, noses, mouths, we would be able to come close to what we would like to describe.

Another way of adequately expressing ourselves is by pointing to the object itself. This is otherwise known as "naming-cum-pointing". This is "an ostensive definition". This means, we need to rely on the capacity of the recipient to understand the missing part of our description. "Tacit Knowing" has two aspects:"knowing what" and "knowing how" and neither is ever present without the other. Austin Farrar described the functional relation of the two terms of tacit knowing as *disattending from certain things for attending to others.* These two correspond to the *proximal* and *distal respectively (Polanyi, 1997).*

The phenomenal structure on the other hand, refers to the appearance of the object. The *semantic* aspect of tacit knowing is an interpretive effort at transposing meaningless feelings into meaningful one. In other words, these meanings have a tendency to be displaced away from ourselves. Beside the three aspects outlined above: *functional*, *phenomenal* and *semantic,* a fourth aspect can be deduced, which is the *ontological* aspect. This tells us what tacit knowing is made up of – an understanding of the comprehensive entity that jointly constitutes the two terms (proximal and distal). Experiments have been performed to transpose perceptions from subception to subliminal. The capacity to see external objects that help us become aware of the subliminal processes inside our body.

The German thinkers, Dilthey and Lipps postulated indwelling or empathy as the proper means of knowing man and humanities. This means the mind can be understood by reliving its workings. *Interiorizaton:* To interiorize is to identify ourselves with the teaching in question by making them function as the proximal term of a tacit moral knowledge. Understanding the joint meaning of things comes about not by looking at them but by dwelling in them.

Plato in *Meno* states that it is absurd to search for the solution to a problem as you either know what you are looking for, and then there is no problem or you do not know what you are looking for and therefore do not expect to find anything. The paradox here is that in reality, there is discovery which, entails the intimation of hidden things and in consequence know things that we can not tell. Knowing represents a) Valid knowledge of a problem b) the ability to pursue it with a clear insight of approaching the solution and c) an anticipation of the implication of the finding *(Polanyi, 1997).*

Culture of Sharing versus Culture of Hoarding

One of greatest challenges of Knowledge Management has always been the task of sharing knowledge. This stems from the polarity of the two types of knowledge: tacit and explicit knowledge. In the industry, for example, it has always been difficult to encourage stellar employees to share their hard earned knowledge with their less talented peers. The reasons for this tendency are the desire to enjoy monopoly of knowledge, especially in the cut throat competition of the present day job market. Moreover, time is very limited. The fear of the employer on the other is that of losing workers with tacit knowledge.

Furthermore, workers have little or no extra out of job time to document their knowledge. Due to the lack of documentation of knowledge, many organizations have to rely heavily on storing the knowledge in peoples' heads. This leads to chaos due to errors and as a result, inevitably leads to setbacks in the competitiveness of an organization. That is why documentation and knowledge sharing are major prerequisites to the implementation of JITKM.

Companies, business institutions and organizations lose a lot tacit assets on a daily basis due to the fact that experts or skilled employees who get fired, retire, leave for greener pastures elsewhere. They take with them, the tacit knowledge assets they acquired over the years. One of the biggest challenges of companies is to capture, document and most importantly share this tacit knowledge with new and less skilled workers. The difficulty here is the ability to transfer tacit knowledge. Another challenge is the creation of common searchable repositories organization-wide.

Sharing of tacit knowledge is best articulated by the phrase: "Knowing who knows what" within the organization. The next big question to ask is: Are they willing to share what they know at the expense of their precious time? The obvious answer is no. Though a good number of strides have been made in the form of incentives towards promoting knowledge sharing, relatively little success has been achieved in that direction. The IT emphasis has been the development of a knowledge network management system with the aim of encouraging exchange of ideas among knowledge experts.

In a study conducted on groupware implementation (specifically lotus notes), two organizational elements are relevant in influencing the effective utilization of groupware: people's *cognition* or mental models about technology and their work, and the structural properties of the organization, such as policies, norms and reward systems. Sharing of cognition is facilitated by common educational and professional backgrounds, work experiences, and regular interaction. How users change their technological frames in response to a new technology is influenced by (1) the kind and amount of product information communicated to them and (11) the nature and form of training they receive on the product. The structural properties of the organization entail the reward systems, policies, work practices and norms that shape and are shaped by the everyday activities of the members of the organization (Orlikowski, 1992).

Reward Systems*:* As mentioned earlier, there should always be organizational incentives to motivate employees to effectively document and share knowledge. Employees studiously avoid "non-billable hours".

Policies and procedures*:* Security, data quality, confidentiality and access control are major concerns for many employees in the deployment of new technology or groupware in organizations. Employees are worried about who is seeing the data while managers and senior consultants are anxious about personal liability and embarrassment.

Firm culture and work norms: Many organizations cultivate an individualistic and competitive culture which makes collaboration and knowledge sharing among peers problematic.

Traditional After-action reports Versus In-process KM reports embedded in workflow systems: The traditional After-Action explicit knowledge capture is a structured review process that allows training of employees or training on the job participants to find out for themselves what happened, why it happened, and how it can be done better with the aim of documenting them in repositories. This approach has it disadvantages. Firstly, it is not a good way of eliciting tacit knowledge. Tacit knowledge is mostly gained from experience

and or doing. It resides in the heads of people. This knowledge is not easily transmitted through writing. In-process, on the hand is knowledge that is embedded in workflow. It is mostly captured during the workflow processes or gained through experience.

The concept of furnishing or making accessible the right information at any given point in time, when it is needed, and in the right amount and form is known as Just-In-Time Knowledge Management (JITKM). Just-In-Time knowledge delivery in principle is a marriage between Knowledge Management and Workflow Management and their joint implementation. Given the above definition, it is quite apparent therefore that the in-process is a better approach for Just-in-time knowledge delivery. Besides the better capture of tacit knowledge, there is an excellent preservation of context, exposure of inefficiencies, richer "post mortem" details and above all a workflow with artifact characteristics of value, authority and believability.
The ideal method of knowledge delivery would therefore be a hybrid or a mix between the in-process and after-action approaches.

5. CONCLUSION

From the foregoing, it is evident that knowledge management has come of age. This has been facilitated by the advancement in information technology, the widespread use of the Internet. Companies like Teltech have perfected the art and practice of leveraging the right knowledge in the needed form and amount and on time to the end users.
Teltech has most importantly utilized the hybrid method of blending knowledge analysts, experts, technology (knowledge repositories and interactive databases) not only to furnish individual users but a variety of industries with vital information in a timely manner to facilitate their work processes.

This paper represents an attempt at exploring the various options of knowledge delivery. It highlights the activities at Teltech as a case study with the aim of shedding light on their advantages, limitations and their implementation.

Looking at the concepts and knowledge splits analyzed in the preceding pages, it is quite apparent that a holistic hybrid approach that unifies the explored options of knowledge delivery is most appropriate for "Just-In-Time Knowledge Management".

6. REFERENCES

[1] T. Davenport, & L. Prusak. Working Knowledge: How Organizations Manage What They Know. Harvard Business School Press, 1998.

[2] Prusak et al, Knowledge in Organizations Butterworth Heinemann. 1997

[3] I. Nonaka, & H. Takeuchi, The knowledge creating company: how Japanese companies create the dynasties of innovation. Oxford: Oxford University Press. 1995

[4] T.D. Wilson, "The nonsense of 'knowledge management'" Information Research, 8(1) 2002, [Available at http://InformationR.net/ir/8-1/paper144.html]

[5] S. Al-Hawamdeh, "Knowledge management: re-thinking information management and facing the challenge of managing tacit knowledge" Information Research, 2002 8(1) [Available at http://InformationR.net/ir/8-1/paper143.html]

[6] S. Benett,. "Just-In-Time Scholarly Monographs". Accessed 10th January 2002. Available from: http://www.press.umich.edu/jep/04-01/benattach.html

[7] M. Butler, "Workflow Beyond the Enterprise". Available from eAI Journal: http://www.eaijournal.com/ArticlePrint.asp?ArticleID=19 Accessed 30th October 2000.

[8] T Leahy, "Extracting Diamonds in the Rough". Accessed 14th May 2002. Available from: http://www.best-in-class.com/expertise/knowledge_managment.asp

[9] I. Rus, et al. Knowledge Management in Software Engineering. A State of the Art DACS Report. 2002

[10] U. Karmarkar, Getting Control of Just-in-Time. Harvard Business Review.

[11] "KnowNet". Accessed 14th November, 2002. Available from: http://www.knownet.org/

[12] KM and e-learning: a growing partnership". Accessed 30th January 2001. Available from http://www.kmworld.com/publications/magazine/index

[13] T. Davenport, et al. Knowledge Management at Andersen Consulting. Harvard Business School, 1999 9-499-032.

[14] S. Sensiper, et al. American Management Systems: The Knowledge Centers. Harvard Business School, 1998 9-697-068.

[15] W.E Fulmer, Buckman Laboratories. Harvard Business School,1998 9-800-160.

[16] M. Alavi, KPMG Peat Marwick U.S.: One Giant Brain. Harvard Business School, 1997 9-397-108.

[17] T. Dingsøyr, Knowledge Management in Medium Sized Software Consulting Companies. Tapir Trykkeri, Trondheim.iii. Ph.D. Dissertation.

[18] U. Karmarkar, Getting Control of Just-in-Time, Harvard Business Review, 1998.

[19] "Knowledge Management World". Accessed 20th January 2002. Available from: http://www.kmworld.com/

[20] "e-workflow: the workflow portal" Accessed 25th January 2002. Available from: http://www.e-workflow.org/

[21] "The Workflow Management Coalition". Accessed 10th December 2001. Available from: http://www.wfmc.org/

[22] "KM and e-learning: a growing partnership" Accessed 30th January 2001. Available from: http://www.kmworld.com/publications/magazine/index

[23] W.J. Orlikowski, Learning from notes: Organizational issues in groupware implementation, Sloan School of Management. CSCW 92 ACM Proceedings, November 1992.