Introducing a JAIST-COE Project: Knowledge Management for Creation of Scientific Technology in Academic Laboratories

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In the last decade, there has been increasing pressure on academic laboratories to produce practical results. The last ten years also have seen a growing interest in knowledge management, a management discipline believed to enhance organizations' innovative capability by the sharing and creation of knowledge. While most cases on knowledge management refer to the business setting; we believe that the introduction of knowledge management practices can also enhance knowledge creation and knowledge sharing within and between research units.

This research project is being conducted at a Japanese public graduate university – The Japan Advanced Institute of Science and Technology (JAIST) – under a Center of Excellence (COE) program aiming at bringing the performance of research laboratory up to a world class level in productivity using Knowledge Science tools.

This study represents a cooperative effort between the School of Knowledge Science, doing research on knowledge management and systems, and two research laboratories operating jointly in the School of Materials Science, doing basic and applied research on materials science. The goal of this study is to enhance materials science students' capabilities so that they become successful creators of new scientific and technological knowledge.
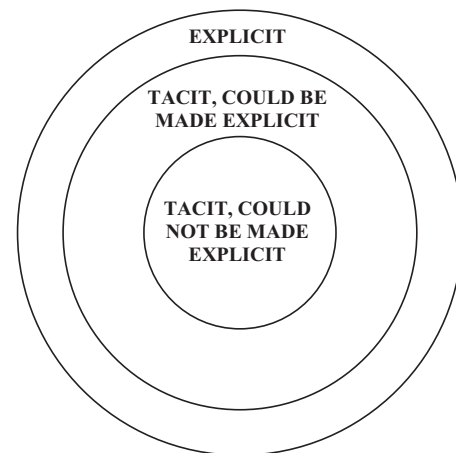
Guest Column: Knowledge Management Systems and Business Processes

Professor John S. Edwards (j.s.edwards@aston.ac.uk), Aston Business School, Aston University United Kingdom

Both academic and practical interest in knowledge management (KM) has continued to increase throughout the last decade. The activities involved in knowledge management include creating, sharing, retaining, refining, and using knowledge.

The distinction between tacit and explicit knowledge is widely acknowledged. However, it is most important to realize that tacit and explicit knowledge are not mutually exclusive concepts. Rather, any "piece" of knowledge has both tacit and explicit elements. Some of the tacit knowledge may be made explicit, but some cannot be. A common example of the latter is the most important part of the knowledge required to ride a bicycle. The relationship between these categories is shown in Fig.1.

EXPLICIT

TACIT, COULD BE MADE EXPLICIT

TACIT, COULD NOT BE MADE EXPLICIT

Figure 1 : The relationship between tacit and explicit knowledge

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Winter, 2004

Introducing a JAIST-COE Project (con't)

A group of seven graduate students volunteered for the project. As one of the steps taken so far, we introduced a formal and periodic written reporting system that motivates students to think strategically about their experiments, helps them to improve their communications skills, and enables students to self-evaluate their skills and supervisors to evaluate the students' skills as well as monitor their progress and developments in a formalized way.

Since the project is relatively young, started only several months ago, the preliminary results are associated with a generalized awareness and participation of the students in the project. However, we are expecting to obtain more concrete results, i.e., quantifiable improvements of scientific production, in the near future. The results will be reported later. The goals and objectives of this project are shown in Figure 1.
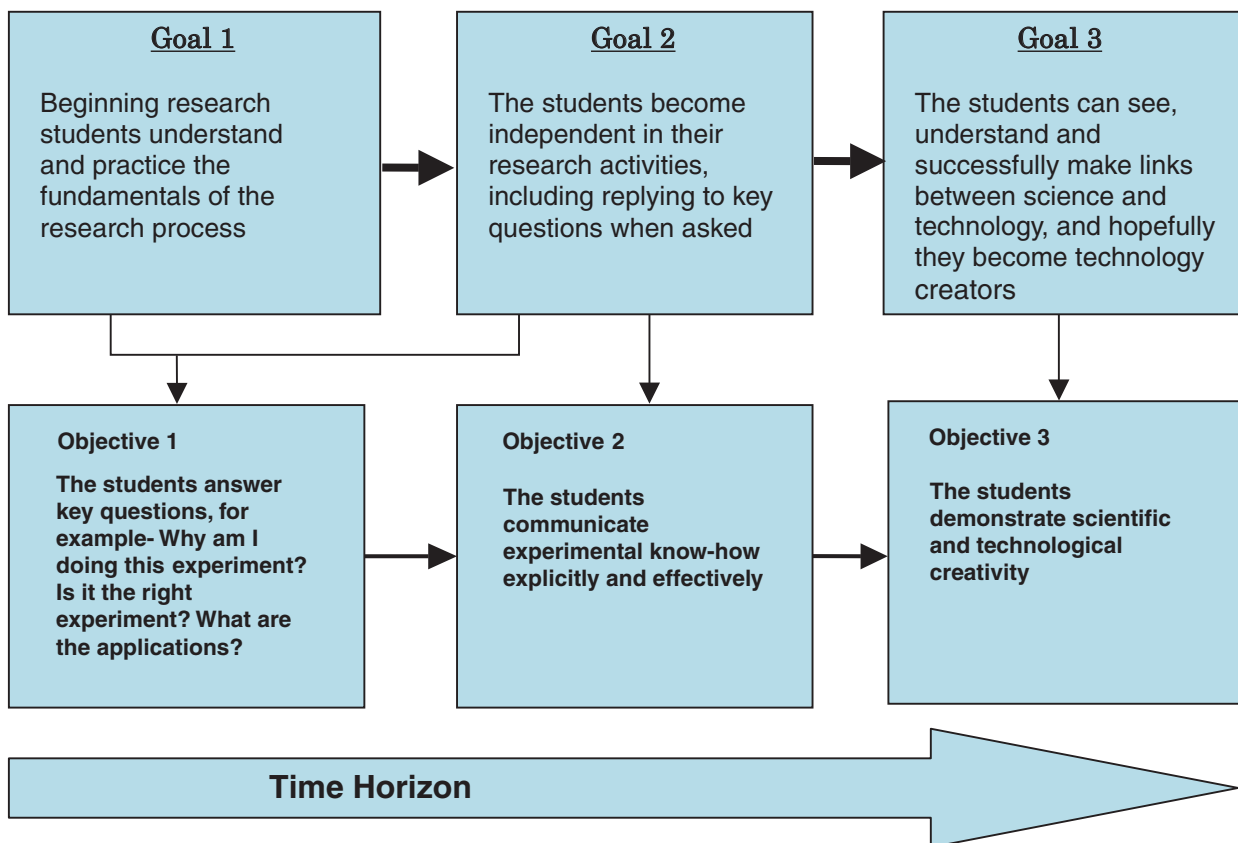

Goal 1	Goal 2	Goal 3
Beginning research students understand and practice the fundamentals of the research process	The students become independent in their research activities, including replying to key questions when asked	The students can see, understand and successfully make links between science and technology, and hopefully they become technology creators

Objective 1	Objective 2	Objective 3
The students answer key questions, for example- Why am I doing this experiment? Is it the right experiment? What are the applications?	The students communicate experimental know-how explicitly and effectively	The students demonstrate scientific and technological creativity

Time Horizon

Figure1. The Project –Knowledge Management for Creation of Scientific Technology in Academic Lab–Goal and Objective.

Guest Column (con't)

Effective knowledge management in an organization needs to consider both tacit and explicit knowledge, and therefore a knowledge management system (a deliberate, conscious attempt to manage knowledge, usually in the context of a particular organization) needs to encompass people, processes, technology and (potentially) structure.

This seems easy enough on paper, but the challenge for managers is to translate the increasing body of theory

on knowledge management into practical, implementable reality. We have identified four stages in an organization's KM life cycle:

Stage 0   Unaware of the need for KM
Stage 1   Aware of the need for KM but not actively doing it. May confuse KM with information management
Stage 2   Doing some KM but not strategically across the whole organization
Stage 3   Doing KM strategically and reviewing it

Guest Column (con't)

Our own current research suggests that far fewer organizations, at least in the United Kingdom, are at stage 3 than might be supposed from the literature. We are revisiting organizations that we studied previously, and several of those who were at Stage 1 have not progressed beyond it in the two or three years since our previous visits.

We advocate a view of the organization in terms of its business processes as the best way to do this. Note that we have found that non-profit making organizations, even police forces or hospitals, are happy to use the term *business* process, even though in strict terms they are not "businesses". This view gives a *demand-side* view of knowledge, which is complementary to the more common supply-side view of knowledge that stems, for example, from the school of definitions based on data leading to information leading to knowledge.
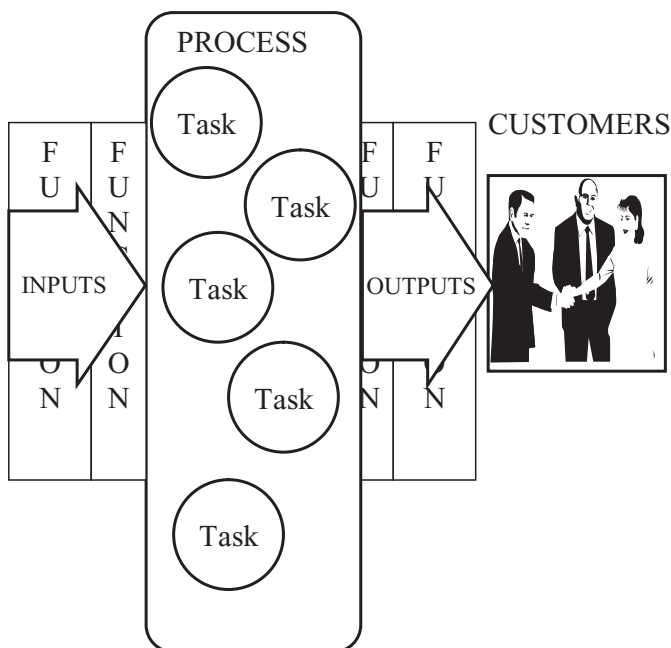

Figure 2: Business process view

We have identified five reasons for thinking of KM in terms of business processes:

- Business processes have identifiable customers, whether internal or external. Knowledge is of little relevance unless put to use for a customer of some kind.
- Business processes cut across organizational boundaries. Knowledge does not need to, and in fact does not, respect the artificial boundaries within an organization.
- Business processes consist of a structured set of tasks or activities. Choosing the appropriate way to structure these tasks or activities is an important part of the knowledge.

- Business processes need to be measured. Without some form of measurement as a comparison, knowledge cannot be validated.
- While the parts of a business process are important, the overriding requirement is that the overall process works. True knowledge of the organization must take an holistic view.

These relationships are outlined in Figure 2.

Innovation adds an extra challenge, because it involves trying to create new knowledge where none exists before. Although we advocate an emphasis on business processes, we certainly do not agree with the position often found in the business process re-engineering literature that all processes need radical change. We do, nevertheless, agree that the *possibility* of change needs to be considered in all processes.

However, an organization must be careful not to lose the good elements of the old ways when introducing new systems or ways of working. The need is to combine the best of the old with the best of the new.

To sum up, we do not wish to propose a single way in which to implement a KM system, because it must be context dependent. We would, however, respectfully suggest the following elements.

- Take note of the context.
- Use business processes as an anchor for your thinking.
- Use KM systems as appropriate.
- Bring the people along together with your plans. "Quick wins" may help, but not if they compromise the longer-term objectives.
- Manage the implementation to yield the benefits that are anticipated – do not simply assume they will happen; but also, watch out for any unanticipated benefits, especially if the change has been radical. The process itself may turn out to have been more important than the outcome.

Finally, be open to ideas, whatever their source, but combine the best of the new with the best of the old.

(Dr. John S. Edwards is Professor of Operational Research and Systems. He has been at Aston since 1978 and is active in research and lecturing in the Business School. He is currently Convener of the Operational and Information Management Group, and Chair of the Business School's Technology Strategy Group. His research interest is in how people use models and systems to help them do things).

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COE-Strategic Center Activities Highlights

November 10-12, 2004: **The Sixth JAIST International Forum on Technology Creation Based on Knowledge Science: Theory and Practice and KSS 2004** was held at Ishikawa High-Tech. Conference Center, Tatsunokuchi, and Kanazawa Art Hall, Kanazawa, Japan, organized by the JAIST COE Program-Technology Creation Based on Knowledge Science. The COE Program Leader Professor Yoshiteru Nakamori introduced the whole program. Two papers were presented on Knowledge Management for Science and Technology: "Research and Development in Academic Laboratories," and "Creative Space and Creative Environments" by Research Professor Quamrul Hasan and Research Professor Andrzej P. Wierzbicki respectively.

November 24, 2004: **A COE seminar** was held at JAIST on "A Vision of New Era of Knowledge Civilization," co-presented by Research Professor Andrzej P. Wierzbicki and Professor Akio Kameoka, Vice President of JAIST.

December 13-15, 2004: A paper was presented in the **First iKMS (International Conference on Knowledge Management), Singapore** on "Improving University-Industry Knowledge Partnerships for Scientific Research and Development Projects" by Research Professor Quamrul Hasan.

December 18, 2004: A lecture (chaired by Professor Eiichi Tamiya from School of Materials Science, JAIST) at the **MOT School in Kanazawa** was given on "A Successful R&D Example and Personal Experience: An Innovative Technology/Product for a Global Market" by Research Professor Quamrul Hasan.

January 3-6, 2005: A paper was presented at the **Hawaii International Conference on System Sciences** on "Knowledge Creation and Integration: Creative Space and Creative Environments" by Research Professor Andrzej P. Wierzbicki (co-author Professor Yoshiteru Nakamori).

January 17-18: A paper was presented in the **International Workshop – The Grammar of Technology Development**, University of Tsukuba, Tokyo Campus on "Informed Systems Approach, Decision and Creativity Support" by Research Professor Andrzej P. Wierzbicki.

Weekly-Monthly: Project meetings or Colloquia, depending on the project, at JAIST.

Upcoming Event

November 14-17, 2005: **The First World Congress of the International Federation of Systems Research** to be held at Kobe International Conference Center, Kobe, Japan, co-sponsored and organized by JAIST COE Program-Technology Creation Based on Knowledge Science

COE-Strategic Center News

Research Professor Andrzej P. Wierzbicki and Professor Yoshiteru Nakamori obtained Best Paper Award for their paper "Knowledge Creation and Integration: Creative Space and Creative Environments" in the Decision Technologies for Management Track, Hawaii International Conference on System Sciences, January 3-6, 2005.