

Crossing the research fields

Part Two

Steven MacGregor, Design, Manufacture & Engineering Management, University of Strathclyde, provides a joint perspectives approach to literature reviews.

In Part 1 he discussed Computer Supported Co-operative Work. Here, he concludes with a look at knowledge management.

In the last issue...

In the first part of this article (published in *Engineering Designer*, January/February, page 29) I discussed the value of investigating Computer Supported Co-operative Work (CSCW) and knowledge management (KM) for a study in distributed engineering design. The article focused on the use of CSCW concepts for engineering, design and distribution. Here, a brief discussion on the use of KM is followed by a summary of both fields, their main research streams, and overall implications for distributed design.

Knowledge management

KM has been the focus of much research and hype over the last few years with much of that research regarding how best to leverage knowledge within organisations. Making the best use of knowledge is far from new, but organisations have only recently spent a great deal of time and effort putting in place knowledge specific strategies and initiatives. KM is essentially the capture and re-use of organisational knowledge.

As with CSCW, KM can be split into behavioural and technological aspects. Sveiby⁶ describes KM along two tracks:

- ◆ The management of information where knowledge equals objects;
- ◆ The management of people where knowledge equals processes, both individual and organisational.

People in the *Knowledge = Object* domain tend to rely on concepts from information theory in their understanding of knowledge. Those in the *Knowledge = Process* domain tend to take their concepts from philosophy, psychology, or sociology.

Sveiby also discusses the phases that KM has gone through since 1992 (widely regarded as the birth date of KM) to the present, and looks to the future of the field. See Figure 1.

KM initiatives and challenges are also noted. Challenges include creating a culture of knowledge sharing within an organisation, ensuring the quality, utility and currency of information and deploying systems and technology for KM. Company initiatives include the emphasis of tacit knowledge transfer (making local knowledge and practices globally practiced) through an integrated communication network. Sveiby summarises KM strategies and initiatives into three main areas, each with their own approaches:

	Philosophy	Manifestation
Phase 1:	Inward looking, focusing on productivity issues;	Lotus Notes installations, best practice databases;
Phase 2:	As above but with more of a customer focus;	Data Warehousing;
Phase 3: (present day)	Initiatives at the interface of company (<i>present day</i>) and customer;	Interactive web pages, e-commerce;
Phase 4: (future phase)	Key to unlocking the value of (<i>future phase</i>) knowledge is people.	–

Figure 1

External structure initiatives

- ◆ Gain information and knowledge from customers.
- ◆ Offer customers additional knowledge.

Internal structure initiatives

- ◆ Build knowledge sharing culture.
- ◆ Capture, store and spread individuals' tacit knowledge.

Competence initiatives

- ◆ Create careers based on KM.
- ◆ Create micro environments for tacit knowledge transfer.

Over 40 major companies worldwide are shown to use the above initiatives to become more knowledge focused. Schwartz⁷ prescribes an approach to KM, specifically within the context of internet collaboration. Their manipulation of knowledge is based on the AOD model (Acquire, Organise, Distribute). Within each of these stages, further actions are prescribed in order to best leverage knowledge:

- ◆ **Acquire** – GIVE (Gather, Inquire, Validate/Verify, Encode);
- ◆ **Organise** – PARC (Profile, Associate, Rank, Classify);
- ◆ **Distribute** – AID (Awareness, Identification, Delivery).

Use for distributed engineering design

Knowledge based initiatives within the design community include the development of ontologies, best practice databases and support for communities of practice with such research collaborations often taking place between engineering designers and computer scientists.

Prusak⁸ states that globalisation has been the prime mover in driving the development and interest in KM. He states that the needs of global reach and speed compels organisations to ask themselves, 'What do we know? Who knows it? What do we not know that we should know?' Significantly, Prusak further states that in an environment where access to information is ever expanding the value of knowledge components that cannot be digitised, such as judgement, design, leadership and innovation, increases with KM practice potentially able to provide necessary support. This is in contrast to the 'tendency... to reductively define [KM] as moving

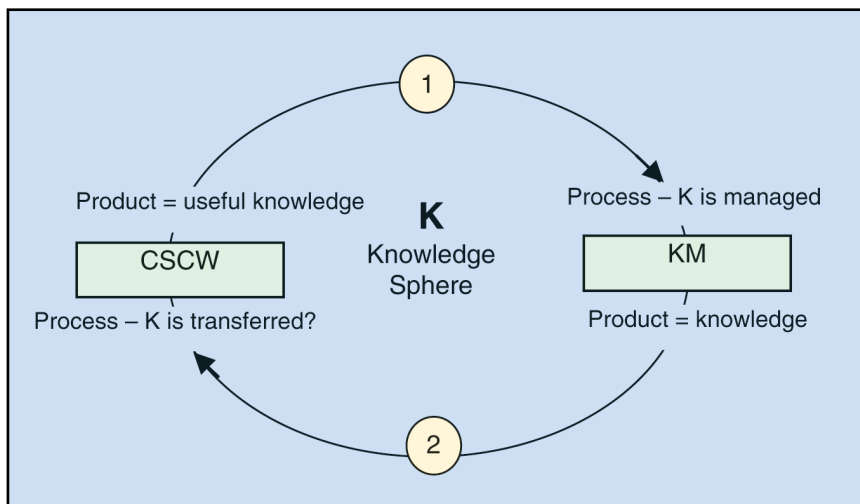


Figure 2: CSCW and knowledge management relationship.

data and documents around.'

The integration and transfer of knowledge for distributed design is key. The amount of sub-supplier involvement in the engineering process leads to islands of knowledge and information. This dispersion of knowledge is something which could give rise to problems in the design process as distributed engineers may be collaborating, each with a grasp of different parts – not the whole, of the design knowledge base. The efficient delivery of knowledge is therefore critical to the function of distributed teams. Knowledge transfer will directly affect the communication process and therefore success of distributed teams. Most of the informal transfer of knowledge which occurs in collocated design will be lost. However, it is important not to over-compensate, which may result in 'knowledge swamp', too much information and knowledge without any of it being useful.

So, what type of KM initiatives, if any, can support distributed design? Sveiby believes that the people track offers most promise for future development with a key question being: How do we create innovation enhancing environments? This fits well within the overall aims of design with Sveiby further detailing that anyone can buy new KM software, but very few have the ability to create sustainable creative organisations. Prusak states that most practitioners believe that knowledge exists and grows mainly in sociological structures, with the study of networks and communities the most productive units of analysis

for doing knowledge work. He suggests that the criteria for future success may be that KM, like the quality movement, becomes so embedded within everyday thinking, it becomes invisible.

Summary – CSCW and KM

Figure 2 shows the main research areas within the fields of CSCW and KM.

◆ CSCW technological

Technical aspects of CSCW including tools, architectures and frameworks. Much work is based within computer science.

◆ CSCW behavioural

Includes the primary behavioural aspects of CSCW such as discourse and trust. Much is based on psychology and results in an understanding of human needs before and after the introduction of technology.

◆ CSCW mechanics

Examines the environment in which CSCW aims to be applied and focuses on teams, projects and case studies. It involves much of the behavioural issues but applies them in context along with practical and logistical issues.

◆ KM tools

Development of tools to leverage the usefulness of knowledge within an organisation such as ontologies, best practice databases and 'who knows what' directories.

◆ KM people

Development of people centric support, such as processes and training, to leverage the usefulness of knowledge within an organisation.

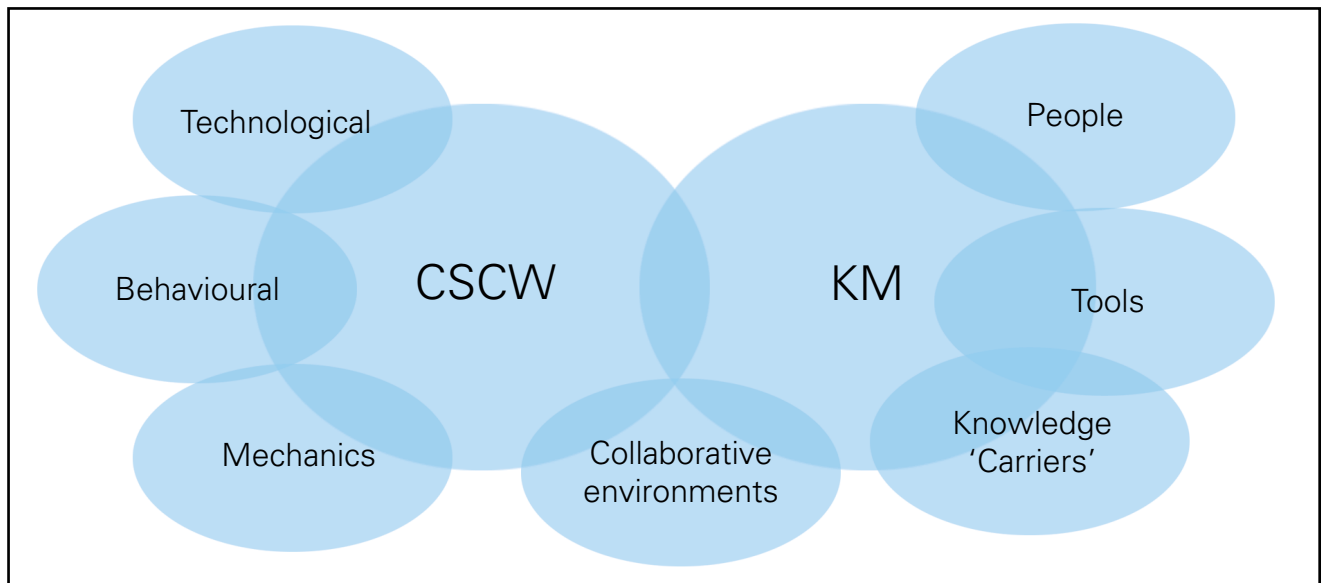


Figure 4: Summary of CSCW and knowledge management research streams.

◆ Knowledge 'carriers'

Focuses on the concept of knowledge and investigates ways of representing and manipulating it. Much within engineering design and artificial intelligence context, overlaps with tools.

◆ Collaborative environments

Production of support (such as the virtual design studio) for engineering design through the influence of research from both CSCW and KM.

Implications for distributed design

It is clear that similar patterns exist in both KM and CSCW with the focus on both tools and people, while IT has facilitated more interest in the tools track in recent years. Of particular interest to the design field and a study of distributed design, is the collaborative environments stream as this develops support for design work. However, if distributed

This is the second in a series of three short papers examining industrial case studies in distributed design and the wider approach adopted to tackle identified problems. A short review of distributed design within a manufacturing led adaptive and variant design environment was published in *Engineering Designer*, July/August 2001. A further review within a marketing led original design environment is forthcoming.

design has not reached its full potential and the focus within each of the constituent fields has been on technology and tools should other areas then be developed?

Specifically, the study of CSCW has produced a type of 'requirements specification' for supporting group communication. Further, an understanding of human needs and what currently does and does not work will narrow the design solution space and progress the research. However, the social-technical gap tells us that even though a thorough understanding of social needs can be developed, catering for those needs is a far more difficult proposition.

The study of KM informs on the key challenges of augmenting design work and communication through the use of knowledge. In particular, the human track is relevant to a study of design by taking a process-centric view to knowledge work.

About the author

Steven MacGregor has just completed his PhD in the CAD Centre, Design, Manufacture and Engineering Management at the University of Strathclyde studying distributed design.

You can email him at: steven@spmacg.com or view the project website at www.spmacg.com. His thesis on process support structures for distributed design and development will be published later in the year.

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