Socio-Technical Systems for Knowledge Mobilisation in Communities

Helen Hasan
Kathryn Crawford
School of Economics and Information Systems
University of Wollongong
Wollongong, NSW
e-mail: hasan@uow.edu.au

Abstract

The most challenging, and potentially rewarding, aspect of knowledge management, and systems to support knowledge creation and innovation, is that of collective knowledge in a group or community. In this paper the term “mobilisation” is preferred to that of “management” as it is more closely related to creative activity. Technology used for knowledge mobilisation should be developed, not on its own, but as a component of a broad socio-technical system. This paper will present the results and implications of collaborative research into the development and evaluation of socio-technical systems designed to mobilise knowledge in communities.

Keywords

Knowledge Management, Socio-Technical Systems, Communities of Practice, Activity Theory

INTRODUCTION

The Australian Interim Standard defines Knowledge Management (KM) as “a multi-disciplined approach to achieving organizational objectives by making best use of knowledge. It involves the design, review and implementation of both social and technological processes to improve the application of knowledge, in the collective interest of stakeholders.” It is clear however that the field of knowledge management itself has a knowledge management problem. According to Masterton and Watt (2000), “there is a lot of expertise out there, spread out through people’s experience, with many different systems”. Davenport and Prusak (2000), in their preface to the paperback edition of their popular text on Working Knowledge, expressed surprise at how far the KM movement had come, both in academia and in practice, in the two years since their original publication in 1998. However, three more years have now gone by since 2000 and the field is far from mature, in part due to the continuing debate on the nature of knowledge in the current context.

To avoid an unproductive continuance of that debate, it is useful to adopt the pragmatic approach of Davenport and Prusak (ibid) who begin their book by observing that “knowledge is not neat or simple”. “It originates, and is applied, in the minds of knowers” and “in organisations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices and norms.” This would indicate that part of the debate over the interpretation of the term “knowledge management” stems from the dichotomy between the individual character of “knowledge” and the formal organisational focus implied by the concept of “management”. As to the latter, Benson and Standing (2001) have concluded that most management engage in harmful knowledge practices, adopting reward structures that encourage workers to be selfish and competitive in nature. It is not in a worker’s interest to be altruistic and share knowledge within organisations and this represents a loss to the organisation.

There is a growing body of literature (Boland & Tenkasi 1995, Engestrom 1999, Toulmin 1999, Wenger et al 2002), which promotes a view of socially-constructed, collective knowledge as the predominant source of learning, creativity and innovation. Moreover this focus promotes knowing as an activity by specific people in specific circumstances for a specific purpose. Such desirable outcomes are commonly achieved, not at the organisational or individual level, but at the group level in work units, cross-functional teams or informal groups of people who have come together with a common interest. It is not surprising then that the expressions “community of interest”, “community of learning” and, most significantly, “community of practice” have captured the attention of many in the area of KM. Communities are collections of people that engage in activities that encompass a common interest and ongoing learning through practice, not in their leisure time, but also as part of their work as employees of organisations. There is a business imperative for intellectual capital creation which is a socially constructed dynamic process of situated collective knowing that is capable of being leveraged into economic and social value (O’Donnell et al 2003).

This paper will report on the findings, after a period of three years, of work undertaken as part of a collaborative research endeavour in the field of knowledge management, focussing on the development of systems, which
support knowledge creation in learning communities. Recognising the association of knowledge with activity, one of the current aims of the project is to discover how to build knowledge management systems that genuinely create knowledge by increasing an individual, or group’s, capacity to take effective action. Progress to date has been substantial and will be reported here together with descriptions of the following principles, which have emerged from the findings of the research. Firstly that, in this creative area, the term knowledge management is misleading and a preference would be to let KM stand for something more closely related to activity, such as Knowledge Mobilisation. (Retaining the KM acronym would reduce confusion while allowing business and government organisations to focus on mobilising knowledge to improve performance through collective learning for innovation). Secondly, that the most exciting level of KM on which to focus and develop systems to support knowledge creation and innovation, is the level of the group or community. Thirdly that any technology used for knowledge mobilisation should be developed, not on its own, but as a component in a broad socio-technical system. Some background to the notions of community and socio-technical systems in the KM context will be offered before presenting the methodology, results and implications of research into the development and evaluation of the socio-technical systems designed to support KM in communities.

COMMUNITY, ACTIVITY AND KM

In this research the concept of community is used, without qualification, in recognition of the fact that there are many different creative collections of people: teams, groups, work units, clubs, professional societies, as well as communities of interest, practice and learning. Some are co-located and some meet predominantly online. They may vary in size, length of existence and degree of formality, but each has its own common history, culture, knowledge and purpose. While the differences between them are not trivialised, this paper will focus more on characteristics and challenges that are found in most communities with respect to KM. We believe that all communities are formed around a common interest and engage in activities that involve both learning and doing. Communities of practice are everywhere and most of us are familiar with the experience of belonging to one although our participation may take different forms, from core membership to that on the periphery. As groups of people who come together to share and learn from one another face-to-face and virtually, communities of practice are held together by a common interest in a body of knowledge and are driven by a desire and need to share problems, experiences, insights, templates, tools, and best practices. A CoP therefore implies a shared practice and shared knowledge and are boundary-spanning units in organisations. A CoP is fundamentally a self-organizing system embodying the key elements of communities, namely practice and identity.

To be able to analyse complex interactions and relationships, Engestrom (1987) proposes a new unit of analysis in the concept of object-oriented, collective, tool mediated, and culturally mediated, human activity system, where “activity” is interpreted from the theory of Leontiev (1981) which is, in turn, based on the psychology of Vygotski (1978). Engestrom acknowledges that the internal tensions and contradictions of such an activity system, which includes both historical continuity and local situated contingency, are the motive for change and development. In a similar fashion to the SECI spiral of KM, dynamics and phases of cycles of expansive learning are of crucial importance to the historical understanding of activity systems. These cycles combine the process of internalisation and externalisation where internalisation is the reproduction of culture by socialising and training individuals to be members of the activity system, and creative externalisation is the creation of new artefacts through innovations.

In our focus on communities as a locus of activities of creative knowledge generation we are encouraged by other Australian researchers (Linger & Warne 2001; Cecez-Kecmanovic & Jerram 2002) who distinguish this intermediate level, between individual and organisation, as important to increasing the understanding of KM in its broadest sense.
SOcio-technical Systems for KM

Just as there is controversy surrounding the appropriateness of the term “knowledge management”, so there is with the concept of a knowledge management systems (KMS). Maier (2001) states that KMS neither contain knowledge, nor do they manage it, but that there is justification for the term as it has been a strong metaphor or vision for the development of a new breed of ICT systems. Markus et al (2002) have proposed a new IS design theory for such new ICT systems required to support organisational activity patterns which they call Emergent Knowledge Processes (EKP). EKP are described as exhibiting the following characteristics in combination: no best sequence or structure; requirements for knowledge that are complex, distributed across people and evolving dynamically, and an actor set that is unpredictable.

In a well-known KM text, Davenport and Prusak (2000) acknowledge that most firms make their first move with KM in the domain of technology, and, although they cautioned against a technology-centred KM approach, they state that a technology infrastructure is a necessary ingredient for successful knowledge projects. They also warn that knowledge behaviours sought from users of knowledge systems may be slow to emerge.

It is our contention that a focus on KM technologies, without consideration of the social processes that surround them is a recipe for failure. There must be an increasing awareness of the importance of the social aspects of KMS, which should be viewed as socio-technical systems. However, bringing together the social and technical demands of systems is not easy. As observed by Benson and Standing (2001), staff will develop and information systems in a purposeful way but the social system, which underpins most of the day-to-day operations, develops in an ad hoc fashion.

KMS are inevitably groupware systems, which either connect people to people directly or indirectly, through sharing knowledge. KMS routinely adopt different social roles within an organisation and these roles have a major influence on a system’s acceptability. (Masterton & Watt 2000).

In our research we assume that the ability of IT to provide support for KMS are best understood as the interrelationship of organisational, cultural and technical elements. (Boland & Tenkasi 1995). What is more, we distinguish between KMS as artefacts (an end product or outcome of a development activity) and as an evolving tool that mediates, and is mediated by, the activity for which it is used. A significant aspect of our work is concerned with the social and organisational factors that may underpin successful KMS development and we believe that investigation of these issues necessitates a sound understanding of culture and relationships, human social interactions, and communication.

Research Approach and Methods

In searching for research methods appropriate to the study of dynamic, self-organising and diverse communities through the development of complex and evolving socio-technical systems, we are in accord with the notion of a “New Scholarship” (McNiff 2000) where there is a new way of knowing that meets the everyday needs of people working in real-life situations. Real-life practices are messy, uncontrolled and unpredictable and are seriously separated from the sanitised world of abstract theorising. McNiff (ibid) proposes that learning from experience, although not highly valued by the academy, can be reinforced through intellectual study and contrasts this to traditional forms of scholarship, which values facts and information and is generated by conventional kinds of research which tests knowledge against standardised criteria of hard scientific analysis and techniques.

We have therefore adopted an approach to our research rooted in reflection-in-action, which implies that the research will be participatory, evolutionary, contextual, holistic and developmental. The developmental research method is disciplined investigation conducted in the context of the creation and implementation of a product or program, in our case a socio-technical system and model, for the purpose of improving either the thing being developed or developer. It is holistic, contextual and evolutionary, where a prototype model is constructed, used with the target group, which is analysed through participatory observation before the prototype (both technology and social system) is revised.

This approach is influenced by the expanding spiral of learning in the developmental work research (DWR) approach (Engestrom 1987), where communities of learning and practice are viewed as activity systems (Virkkunen & Kuutti 2000). DWR provides a dynamic framework that can accommodate a multifaceted analysis of the community members, their motives and purpose for belonging, their relationships within the community and the tools that mediate community activity. In our research the tools include technology together with social and learning processes. Discipline is imposed on our investigation by the analysis of each case as an activity system, in the tradition of the Cultural-Historical Activity Theory so that an activity system the unit of analysis is the work activity itself, which is culturally and historically located. The work/learning activity system is comprised of the following components:
the purpose to which members of the community direct their activity
individual workers/learners, their colleagues and co-workers/learners
the conceptual models, tools and equipment they use, and
the rules, culture and context that govern how they work, and learn through their work

The evolution of each community is studied with this as a framework for evaluation by the participant observers who become significant members of the community.

EVOLUTION DEVELOPMENT OF THE RESEARCH

Background Research

The original aim of this project was to investigate the capacity of IT to support knowledge creation for innovation in modern organisations. The plan was to iteratively develop prototypes of flexible computer-based systems and evaluated their usability and suitability for the support of knowledge workers. An interpretive study would determine how the systems contributed to organisational learning, performance, and responsiveness to change. The initial emphasis on technological systems reflected the background of the investigators in Information Systems.

The cross-institutional team of researchers conducting the project quickly came to the realisation that they were themselves a small community concerned with knowledge creation and were managing their own knowledge with a mixture of face-to-face meetings and online communications. This realisation, together with the results of extensive preliminary research, summarised below, has determined the importance to KM of

- the nexus between learning and practice, (and similarly between knowledge and activity),
- the frequent location of knowledge creation activities in communities as distinct from individuals or formal organisations, and
- the establishment of a viable social-technical model for systems to support communities, particularly those who predominantly communicate online.

A summary of the preliminary research for this project, built on the diverse skills, experience and recent research activities of the members of the research team, includes:

- ethnographic studies of social learning in command and control in strategic and tactical settings of the Australian Defence Organisation (ADO) investigating issues inherent in building learning, adaptive and sustainable organisations. (Warne et al 2002a)
- investigation of the relationships between organisational structures and the use of IT in corporate and public sector organizations, with an awareness of its role in strategic decision-making (Hasan & Gould 2001).
- expertise in the fields of ICT and organisational learning, information systems development and usability issues in human computer interaction
- experience in running online community learning projects
- knowledge and experience in the application of the Cultural-Historical Activity Theory to IS and HCI (Hasan et al 2001)

This team then came together to discover how to build socio-technical management systems that genuinely support the creation of knowledge in communities through a nexus of learning and practice.

The First Phase of Completed Work

Over the duration of the project three activities have been running in parallel.

In the first activity the social learning in the ADO work brought an understanding of information architectures that could support the development of systems to enhance organisational learning and facilitate KM. (Warne et al 2002b). These architectures have been evaluated in workshops to inform the systems design and development processes of the other two activities. (HICSS36 2003)

In the second activity, an activity-based model of knowledge processes was created using “activity” as the unit of analysis and a knowledge repository, using the model, has been evaluated for its suitability and effectiveness (Hasan 2003). The elements of the activity-model are:

- Activities: who is doing what, for what purpose
Components of each activity: subject, object, tools, outcomes,
Relationships between those activities.
Actions and Operations by which Activities are carried out
An historical record of the above elements

This model has been implemented as a prototype (see Figure 1) in currently available technology and is being evaluated as part of an ongoing evolutionary development process. Two non-technical issues that have been identified as critical to the success of such innovative knowledge repositories are:

- the motivation of people to continue to enter content throughout the life of the system and
- the meaningfulness of information and knowledge that can be extracted from the contents of the system

![Figure 1 The UniStore Knowledge Repository, with an Activity-based Architecture.](image)

A third related activity has been a developmental approach to the social and technical support for work and learning in diverse online communities. The first stage of this work has been reported elsewhere (Hasan & Crawford 2003) and a summary appears below, before the latest developments, stage 2, are presented as new outcomes for this paper.

**Research into Systems for Online Learning Communities: Summary of Stage 1**

This third research activity was inspired by an exercise in experiential, team-based learning that had been successful in creating awareness of the new science of Photonics amongst communities of high school students and teachers in a large city. In the initial Photonics project, scientists, business developers, teachers, technologists and business people contributed to:

- Intensive workshops with input from all participants and including community-building exercises and heterogeneous project team formation. Their project was to create a website that could be used to inform other students about Photonics.
- An online period of sustained creative activity as new materials are assembled and knowledge is exchanged by the teams online. A proprietary web-based message, discussion and document storage system was used for this.
- Community celebrations where young people show their creative work and explain their new learning and interest to members of the community including politicians, local government officials and the media.

This experience was encapsulated in a socio-technical model for online communities, which begins with a face-to-face workshop followed by a period online where learners, experts and instructors are linked by a special-purpose, Internet-based communication and group-support package. During this period the community of
learners undertake a team-based, problem-solving project where experiential learning takes place through the generation of skills, ideas and solutions.

A development research investigation was conducted using this model in two regionally based communities. The aim of this research was to evaluate the contributions to the achievements of the community of a socio-technical model of conduct. A single day workshop was held to establish and build the community and to determine what would be achieved and how. The prototype of an online support system was constructed modelled on the proprietary one used in the previous Photonics project. Teams were established to work together in an extended online period on appropriate project designed to facilitate the desired learning the result of which were presented at a concluding half-day celebratory meeting.

The first of these new communities was set up to promote Photonics awareness in a regional high school so that, although the object of the activity was the same as that of the previous city communities, the site of the activity had moved into the rural setting with the community based in a single small town. Several of the team projects were successful, and made a profound impression on teachers, parents and local dignitaries who attended their celebratory final session. However, despite initial interest from teachers and parents, it was most the students in the community who kept the work going. Online communication was used mainly between the students and the coordinators at Photonics as the students, being in the same school could meet face-to-face. Use of the online system was further restricted by the poor facilities available to the regional participants and some shortcomings in the software.

In the second of the communities, the activity was expanded to incorporate a different purpose: an introductory course in Information Systems. This was also conducted through experiential learning but with a more geographically and demographically distributed community membership involving high school students, teachers, and community seniors in several disparate regional towns. More use was made of online communication, as most members were separated by some distance and could not meet. Although some participants left the community, several teams worked together well and produced good learning outcomes.

Although the communities were set up particularly for the research project, they were each a response to a real need in a rural setting and were an adaptation of the model used on similar projects in an urban environment. There was reason to conclude that new information and communication technologies were the catalyst to form and sustain these heterogeneous communities where it is imperative to share knowledge and skills. In a review of the projects at this stage of the research, it was determined that improvements were needed with the software prototype, the procedures for team-building and some more work was needed to find ways of sustaining interest in the community. These recommendations were incorporated in the next stage of the project as will now be described.

![Figure 2 - A Poll of the CTC Community in UniLinks](image)

Hasan, Crawford (Paper #169)  
14th Australasian Conference on Information Systems  
26-28 November 2003, Perth, Western Australia
Research into Systems for Online Learning Communities: Developments in Stage 2

In stage two the research expanded in scope to study existing distributed communities with a need to use advanced technological communications to work and learn together effectively. The knowledge gained from stage one led to more sophisticated requirements for an online support tool appropriate for a wide range of such communities in a variety of settings, many with very low bandwidth access to the Internet.

To this end a new UniLinks software prototype (Figure 2), incorporating enhanced features for usability, security and, performance, was built. A more skilful development team than the previous one was engaged, with a leader who could continue with the evolutionary development of the system during the remainder of the research. The software package at this stage provides 4 levels of participation from super-user to guests and enables the establishment of many communities within which there can be many projects and within those teams. Each community or project can have its own functions of News, Forum for discussion, Storage of documents and Polling. There is a messaging system and most parts of the system are customisable. Anyone can register into the system but must be assigned to communities, projects and teams by a super-user. The system will continue to evolve as we observe and learn from its use.

This stage of the research involved an existing community, a group of regional coordinators of CTCs (Communities Technology Centres). The CTCs are a government-funded initiative to provide IT services and training in small towns. This group, many of whom did not know one another, met at a two-day workshop (Figure 3) where the researchers introduced the notion that they were a community with common interests, problems and goals and that they could build a community of support, which could continue online, using the UniLinks software.

![Figure 3 – The workshop which initiated the CTC coordinators community.](image)

Members of this community were highly motivated to cooperate with one another by their feeling of isolation and a recognition of how they could help one another by maintaining contact online. In this reasonably homogeneous community there was no attempt to set up a specific experiential learning project, although they have already created some projects of their own in the three weeks since the workshop. They have thereby increased the viability of their Centres by working together. At the initial workshop it was obvious that there was no competition between the members and that they could all see the benefits of a collaborative environment. They were all excited by the UniLinks package and were quick to see how it could be used to sustain the community.

This ongoing study has enabled us to identify five concepts important to the socio-technical model when applied to genuine disparate communities of people with common interests and goals in the non-commercial arena.

- Being clear about the purpose of community, including what can it achieve.
- Recognising the importance of diversity in the community and how different members are encouraged and their contribution valued.
- Encouraging a mix of work and learning and how learning occurs in team-based, project-oriented, activity.
- Taking into account how trust is developed, how teambuilding occurs and the contribution of different aspects mixed mode interaction, in particular face-to-face, video-conferencing and online.
- Noting how different characteristics and capabilities of the people and technology affect the viability of the community, identifying the functions of technology and skills of people to be enhanced.

This contrasts with, but is in incompatible with, the following seven principles for online community coordination in a business: setting determined by a recent report from Arthur Anderson (AA1999)
Invest in the means not the end (Communities require a significant investment of time and resources to maintain but are worth it).
Focus on the needs of members, not sponsors
Resist the temptation to control free wheeling
Don’t assume that the community will become self sustaining
Consider environmental factors
Extend community-building beyond the discussion space
Seek out and support members who take on informal roles

It seems that, in both business and non-business settings, socio-technical systems can enable organisational learning from cycles of past experience so that innovation can be supported in the face of changing circumstances and opportunities. Using a developmental research approach we are learning how community flourish with the help of Internet enabled support so that we can improve the sustainability of different communities with each iteration of the project.

Issues now emerging from this stage of the project, and which will be fed into the next evolution of the socio-technical system, are

- the suitability of a separate, closed system for community support, where users must go to the effort of a login to participate, compared with more open environments such their normal email system through which they communicate to everyone else.
- how much intervention should be made by the community sponsor or leader to sustain initial enthusiasm, promote activity or control inappropriate behaviour
- what user skills and experience are essential and desirable
- how can community value be established in order to justify costs
- Is there a need to classify different types of communities?
- Are online communities that much different from traditional ones?
- Can, and should, the UniStore repository be integrated into UniLinks?

DISCUSSION AND FUTURE RESEARCH

This paper reports on developmental research into distributed communities, framing them as phases of an activity system in expansive learning cycles in the context of a program of innovative learning. This research demonstrates that such communities are viable, with a wide range of benefits, economically and socially. In the electronic age, locally-driven regeneration of the concept of community can be enabled by a flexible, multifaceted model where new information and communication technologies are the catalyst but social demands must be addressed.

It is clear that technology, no matter how advanced, is far from providing the complete answer to the KM needs of communities and it is essential to take an integrated socio-technical approach to this issue. In this research, innovative ICT and social systems have been used to support new forms of activity that meet several real needs in the community at once and represent an emerging solution of benefit to each of the active stakeholders.

Our technological prototypes, UniLinks and UniStore have evolved throughout this process to the stage where they are now a useful and usable technical systems. However they can only grow if the developers are aware that they are only components of a holistic social-technical system supporting activities of knowing and doing in collaborative, innovative communities. Such communities develop around things that matter to people. As a result, their practices reflect the members' own understanding of what is important.

It is encouraging to know that this is not the only research, which is pointing to the fact that communities are good government and business investments, even if their value cannot be measured or even anticipated when they are formed. New forms of KM are challenging the current focus of management on profitability and shareholder values, and may be seen as leading to long term sustainability.

To this end, McNiff (2000 P68) links the nature of organisational learning to the idea of good societal values such as the care of others, equality and mutual entitlement, so that organisations serve wider purposes than the fulfilment of pragmatic, economic goals. Working for IBM, Snowden (2002) also believes that organisations will be more successful if they are more organic then mechanistic. He claims that we are now entering a third generation of KM in which the orthodoxy of scientific management will be challenged, superseding the second KM generation dominated by the tacit-explicit conversion in the SECI spiral of Nonaka. He uses complex,
adaptive systems theory to create a sense-making KM model that utilises the self-organising capabilities of informal communities along axes of learning/teaching and low/high abstraction. Rather than implying that chaos is the natural outcome of such systems, he has faith in the human capability to create order and predictability though collective and individual acts of freewill.

A comprehensive industry study (AA 1999) into the significance and adoption of on-line communities (OLC) in business, reports that the expectations of sponsored OLC are that “they provide faster more efficient communications, higher levels of innovation and collaborative creation of new products or processes”. The study shows that OLC coordinators are thinking about how the value generated by an OLC can be measured and what kind of knowledge tools and relationships they require. They observe that elements of community are at odds with the standards and practices of a traditional business enterprise, but that attempts to control OLCs can kill them or drive them underground. Their advice to those who want communities that are focused and appropriate for a business, is to lighten up and stop trying so hard. Managers should trust that members of communities are professionals and adults who are aware of the main purpose of the OLC to attain business goals and consciously allow social interaction and non-business exchanges, as these may be the glue that holds the community together.

The fact that communities are being recognised as a source of business value indicates that research into the role of socio-technical models of communities in general is warranted. It appears that such communities have similar behaviours and concerns to those in the regional centres of our study. Self-sustaining communities require systems that support genuine knowledge creation and innovation by increasing an individual, or group’s, capacity to take effective action. The message for Information Systems is that any technology used for activities of knowledge mobilisation at the level of the group or community should be developed, not on its own, but as a component of a broad socio-technical system.

REFERENCES


ACKNOWLEDGEMENTS
This work is supported by Discovery Grant, DP0211336, from the Australian Research Council.

COPYRIGHT
Helen Hasan and Kathryn Crawford © 2003. The authors assign to ACIS and educational and non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to ACIS to publish this document in full in the Conference Papers and Proceedings. Those documents may be published on the World Wide Web, CD-ROM, in printed form, and on mirror sites on the World Wide Web. Any other usage is prohibited without the express permission of the authors.