

[Will Venters](#), [Mike Cushman](#) and [Tony Cornford](#)

Inter-organisational motility of construction knowledge practices

Conference paper

Original citation:

Originally presented at e-sm@rt 2002: towards a European knowledge economy in the construction and related sectors, 19-21 November 2002, University of Salford.

This version available at: <http://eprints.lse.ac.uk/24256/>

Available in LSE Research Online: June 2009

© 2002 Will Venters, Mike Cushman and Tony Cornford

LSE has developed LSE Research Online so that users may access research output of the School. Copyright © and Moral Rights for the papers on this site are retained by the individual authors and/or other copyright owners. Users may download and/or print one copy of any article(s) in LSE Research Online to facilitate their private study or for non-commercial research. You may not engage in further distribution of the material or use it for any profit-making activities or any commercial gain. You may freely distribute the URL (<http://eprints.lse.ac.uk>) of the LSE Research Online website.

INTER-ORGANISATIONAL MOTILITY OF CONSTRUCTION KNOWLEDGE PRACTICES

Will Venters, Mike Cushman, Tony Cornford

London School of Economics and Political Sciences
Houghton Street, London, WC2A 2AE, W.Venters@lse.ac.uk

ABSTRACT: *This paper presents a new model of intra-organisational knowledge management in terms of motility of knowledge practices. While existing conceptualisations of knowledge, such as tacit and explicit have proved a valuable lens for focusing on knowledge practices within organisations and in relatively well understood or stable contexts, this paper argues that their use may be less effective in considering knowledge practices shared and communicated between organisations and when knowledge needs are still being negotiated. Based on research into the construction industry's approach to the issue of sustainability and the knowledge challenges it poses, this paper introduces the concept of motile knowledge practices as an alternative lens through which to make sense of, and improve, the industry's ability to support innovation for sustainability. The notion of motile knowledge helps us to focus on the fundamental property of knowledge practices as they move, mutate and decay. Seeing knowledge as essentially motile it is possible to question the application of existing approaches to knowledge management within inter-organisational domains. The paper concludes with a discussion of the implications for practice made apparent by the lens of knowledge motility.*

1. INTRODUCTION

Inter-enterprise knowledge management poses new and intriguing problems which the mainstream knowledge management literature has largely overlooked. This paper seeks to make a contribution to this neglected topic, drawing on work undertaken in the C-SanD Project¹. The C-SanD research focuses in particular upon the issues of knowledge and knowledge management posed as the UK construction industry confronts questions of sustainability within construction activities and seeks to develop its own sustainable practices and processes. Sustainable construction can be broadly described as construction practices that minimise waste, environmental impact and energy consumption from a whole-life perspective and that are intended to ensure a better quality of life for everyone, now and for generations to come (DETR 2000, Sage 1998). The research has explored the attitude and approach of various players to meeting this key cross-organisational knowledge development issue.

Based on this work and the various interviews undertaken with industry participants and clients exploring their approach to managing knowledge in general, and to addressing the new knowledge issues posed by the contemporary sustainability agenda, our research has developed an alternative lens for conceptualising knowledge in terms of motile knowledge practices. Our work suggests in particular that this alternative lens may be more appropriate to situations of emergent knowledge needs in the context of inter-organisational projects, and thus to the UK construction industry, than conventional models within the

¹ The C-SanD project: Creating, Sustaining and Disseminating Knowledge for Sustainable Construction: Tools Methods and Architectures is supported by the UK EPSRC Grant no:R20564/01. The project includes partners from Loughborough University, LSE and Salford University. Further details are available at www.c-sand.org.uk.

knowledge management field. We see the knowledge needs associated with sustainable construction as emergent in the sense that this topic and the agendas for innovation that it brings are only now starting to become a substantial and higher profile issue for the industry (see CIRIA 2002). As a consequence individual actors within the industry, and the industry's clients, are now having to work to make sense of the concept, evaluate evidence about aspects of sustainable construction and its desirability or necessity, and integrate such understanding into their individual working practices and into their negotiated relationships with other industry actors. Respondents in our field research have described how they engage in learning about sustainability from individual motivations and as a response or reaction to external pressure and to institutional pressure both within and outside their own organisation's boundary or the construction industry. They also describe how they then negotiate their learning within their work environment; as one interviewee put it *"if the client says they want something suddenly to look a bit different, or to be sustainable, we will find a way of trying to articulate ... what they mean by that, in a way that we can respond to it"*. Interviewees have also been candid in expressing their uncertainty as to what sustainable construction is, or how they might pursue it; *"Those of us ... who've thought about sustainability, are beginning to kind of, you know, pay lip service to ... sustainable construction; whatever we might take that to mean"*.

Our research also reveals an understanding that achieving sustainable construction means change for the industry, and that such a process of change is intimately bound up with the ability of multiple actors and organisations (collectively and individually) to manage and work with some new knowledge. However, given the fragmentary and tentative understanding of sustainability, and its essentially inter-organisational manifestation, this does not appear to lend itself to conventional intra-organisational models for knowledge management as found in the literature of the field – identifying the knowledgeable, extracting what they know and codifying it in a way which allows storage, transmission and sharing within the organisation in pursuit of competitive advantage. Rather, in our research context we see a situation in which many fragments of knowledge and knowledgeable practice are available, but are made significant only as they are contested and debated across organisational boundaries. Indeed, in the broad and multi-organisational context addressed in this research (including construction professionals of many types, interested external parties including government and civil society organisations, as well as construction clients) such knowledge only becomes of relevance or utility in so far as it *can* cross organisational boundaries; the most knowledgeable sustainable construction consultant can only use their knowledge if there are other parties, for example construction companies or construction clients, who can appreciate and work with their insights. In our field research we have found such an understanding in many of those we have interviewed, with respondents seeing their ability to practice or promote sustainable construction as only able to be enacted (put to use) through a developed dialogue or interchange of understanding with other parties. They also often report how frustratingly difficult it is to achieve such a dialogue.

2. INTER-ORGANISATIONAL KNOWLEDGE PRACTICES

In this research we have attempted to address the situation sketched above, and to understand how fragments of such knowledgeable practices might (or might not) come to coalesce into new sustainable construction processes. The distinction made here between practices and processes is significant. The C-SanD field research has revealed a patchwork of practices and interested actors that can be seen as offering elements of sustainability, for example in energy efficiency of buildings, in waste management on sites, or in models for whole-life costing. However, at the current state of the industry, such practices are more or less free floating, moving through the industry and eliciting some attention from individual actors and occasionally being integrated into isolated projects. We do not see, to the same degree, a developing sustainable construction process, although work on this is a part of the C-SanD project but not reported in this paper.

Given the existence of such knowledge practices, and our research interest in tracing how and through what modalities they may become embedded in construction processes, we have developed the model of motility of knowledge practices presented here. This model is intended to provide a lens through which to view the dynamics of such knowledge practices as they move through the industry and find some resonance with particular groups of actors. The motility model extends and critiques both the socially

mediated and the objectified notions of knowledge prevalent in much work on knowledge management (Schultze 1998). The model in particular addresses the mobility of knowledge but conceptualised not in objectified terms as disembodied and codified knowledge, but as knowledge practices: the knowledgeable activities that people engage in during their work through reflecting upon their experiences, appropriating the experiences of others, and applying the fruits of such reflection and appropriation to their activities and to the organisational and social context in which such activities are situated. In particular the model addresses how such knowledge practices can or might move on, and become available to others (as discussed below, we refer to this as their motility). This approach is aimed at supporting and enabling purposive and strategic activity in the construction industry, in pursuit of sustainable goals, that recognises and utilises the potentialities of diverse knowledge practices to reshape or reform the industry's modes of operation. The work is intended to contribute to the construction industry's ability to understand the ways in which knowledge about sustainability and sustainable construction may (or may not) be created, applied and disseminated. More generally, through a focus on the specific issue of sustainability, this research aims to provide a wider understanding of the ways in which innovation can be supported in such multi-organisational, project centred settings.

3. CHALLENGE OF SUSTAINABILITY TO KNOWLEDGE MANAGEMENT

The C-SanD research project was established to explore knowledge management issues in the context of sustainability and the dialogue associated with sustainability within the UK construction industry. The industry's own discourse concerning sustainability emphasises the need to adapt present practice (e.g. designing and building for ease of demolition as well as ease of construction) as well as the creation and application of new knowledge within new practices (e.g. the adoption of new concepts such as whole-life costing) (Egan 1998, Movement for Innovation 2001). But in the industry sustainability is still seen as a novel and contestable concept with no settled definition or operationalisation and no settled body of existing practice embedded in industry wide processes. It is, at this time, as much an emerging philosophy of construction as a prescribed and integrated method. This emergent and negotiated status of sustainability has great significance in evaluating knowledge management opportunities and seems to indicate that conventional knowledge management tools and methodologies may be premature at best.

For example, Nonaka and Takeuchi's (1995) model of knowledge creation, based on a cyclical conversion of tacit and explicit knowledge has been widely employed as the basis of much knowledge management research and equally as the basis for practice. In suggesting that knowledge exists in two forms (tacit and explicit), and that tacit knowledge can be "converted" into explicit knowledge through various social processes, many practitioners have concluded that knowledge management is essentially concerned with making tacit knowledge explicit, and thereby available to all employees within an organisation. At a recent conference concerning knowledge management within the construction industry such approaches were clearly evident with a focus on the intra-organisational context (BRE 2002). For example a representative of a large construction company defined knowledge management as "*the way companies generate, communicate and leverage their intellectual assets.*" Another company presentation highlighted the need to focus systematically on the value of knowledge; employing knowledge management "*to establish a systematic approach to sharing technical excellence and best practice to demonstrate added value and create differentiating to our business.*" (BRE 2002). Such approaches are usually supported by technological solutions based upon similar objectivist notions of knowledge; a recent influential review of technology for knowledge management provided a definition of such knowledge management solutions as "IT systems developed to support and enhance the organisational processes of knowledge creation, storage/retrieval, transfer and application" (Alavi and Leidner 2001).

However our research suggests that such approaches and technologies, while informationally beneficial, may prove an ineffective approach in the context of the contested concerns of sustainability and given the inter-organisational nature of the problem domain. Rather we see a situation in which the industry has broadly identified the need to jointly develop new understandings, definitions, practices and processes; these are to be achieved through attention to, and appreciation of, innovation and through dialogue. The question at issue is not then how to disembodify some knowledge that is deemed relevant and make it more

broadly available to an eager audience, but to create conditions in which people can take their own local concerns and interests and see them translated through new sustainable construction practices. At present this often takes the form of attempts to generate such learning through pilot (often high profile or prestige) sustainable construction projects, and thereby to move such ideas into the realm of general construction activity. The particular nature of such pilot projects, with ample funding and explicit goals of innovation, do indeed generate what we would see as relevant knowledge practices, but this does not often directly lead to new sustainable processes for wider uptake. We thus see in such cases exactly the situation described in the introduction; fragments of potential for sustainable construction circulating (we would say motile), but needing to become embedded in new locales. If the construction industry is to seek an effective route to address these issues then we suggest the need for a richer conception of the nature of knowledge practices around such issues and how they might be made to move more effectively into and through the construction domain. This is the problématique that we seek to address through our model of knowledge motility.

4. A CONCEPT OF KNOWLEDGE MOTILITY

Motility is a zoological term referring to a capability for motion {OED} and concerns the ability of a cell or primitive organism to move spontaneously in a rationalistic way. The concept is most commonly associated with the movement of spermatozoon (sperm) cells within reproduction. Such cells are by their very nature mobile, consisting of a head containing biological information (knowing) and a tail which enables the cell to move (providing the spontaneous action). The motile cell's movement is rationalistic in that it serves the purpose of the cell as it pursues its goal. Our adoption of this term in the context of mobility of knowledge is intended to express the view that, rather than knowledge moving through external action, be it a communicational act or the technical apparatus of a formal knowledge management system, it moves (or fails to move) in its act of being. This view suggests that all knowledge practices have as a fundamental property such an ability to move. At one level this is a fairly unremarkable statement. Most people would appreciate that for something to be understood as a knowledgeable practice there must be some potential for it to be communicated or shared. However traditional views of knowledge within the knowledge management field have tended to overlook or assume such a property, and more particularly to make it manifest through some external agency or intervention, be it technical or social.

Thus objectivist accounts view knowledge as “a separate entity, static property, or stable disposition embedded in practice” (Orlikowski 2002). In seeking an alternative other literature has employed subjectivity in focusing upon knowledge as a disposition, a view of organisational knowledge as processual, dispersed and ‘inherently indeterminate.’ (Davenport and Prusak 1998, Tsoukas 1996). The motility model presented here is intended to be complementary to both objectivist and subjectivist approaches, and highlights aspects of knowledge which are overlooked by both perspectives yet particularly relevant to inter-organisational knowledge domains and project based industries.

In related work on knowledge management by Orlikowski (2002) a somewhat similar account is given, seeing knowledge as essentially found in practices, “emerging from the ongoing and situated actions of organisational members as they engage in the world” (p. 249). She suggests that knowledge is enacted, every day and over time, in people's practices, suggesting that discussion of knowledge must be intrinsically linked to practice. In her work the emphasis on practice indicates that knowledge is seen as “at any given time, what the practice has made it” (p. 250), with knowledge and practice seen as mutually constitutive. Her work, however, is focused on intra-organisational settings, albeit geographically dispersed, but her critique of existing approaches to knowledge managements is certainly relevant to this study. She writes that

A view of knowing as enacted in practice does not view competence as something to be ‘transferred’, and suggests that the very notion of ‘best practice’ is problematic. When practices are defined as the situated and recurrent activities of human agents, they cannot simply be spread around as if they were fixed and static objects. Rather, competence generation may be seen to be a process of developing people's capacity to enact what we may term ‘useful practices’ – with usefulness seen to be a necessarily contextual and provisional aspect of situated organizational activity. (p.253)

Building on this understanding of knowledge as embedded in recurrent human practices, the motile model suggests that the movement of such knowledge from one locale to another is not simply associated with some external acts, apparatus or intervening actors, but is associated fundamentally with knowledge practice itself (what Orlikowski calls enacting useful practice). Motility describes knowledge as not just (potentially) mobile when expressed, codified or commoditised, but as itself potent and with its own propensity to move. Indeed, we suggest that without such movement knowledge is merely information, symbolism or individual memory. Of course free floating and mobile knowledge practices are not of much use unless they can find some responsive locale to become embedded in as part of a sustained and organisationally embedded activity. But we do not suggest that motile knowledge practices represent directly such processes (business processes or, in another common term, best practice), but need to be appropriated and tailored into any specific context, and which will mutate the knowledge practice and render it again motile.

In this approach we see motile knowledge as not just an output or consequence of purposeful action, rather it is accomplished in action, simultaneously being input into action and mutated by action. To take a very simple example of using a hammer: in engaging the hammer one is both making motile one's previous knowledge of hammering, and mutating this knowledge through the present experience of hammering. If previous experience is challenged by this present experience then the motile knowledge may mutate – hitting one's thumb may lead a person to challenge their learnt behaviour concerning safety, or discuss the experience with others (potentially leading them to learn). Such motile knowledge is sterile without a destination, either individualistic in an individual's altered action or communicative. Yet such destinations for knowledge cannot be seen as just passive or pre-planned receivers of codified knowledge, rather they must be resonant to receiving such motile knowledge through an appreciation of the action. We use the term resonance to refer to the propensity or ability of a receiver (person, system or process) to appreciate and apply such knowledge to their context of knowing and in their own activity. We suggest also that without some resonance, perhaps a strong resonance, knowledge practices will quickly decay. Their ability to travel or move is thus dependent on their ability to resonate with other actors.

We can illustrate these concepts with an example: An experienced engineer may introduce an existing approach to connecting glass-panels (a knowledge practice) to the new practice of connecting a new form of lightweight, low-energy plastic panel. If such an approach appears to work, the knowledge may be reproduced among others observing such activity or facing similar requirements. In particular other engineers who observe the practice and have previously experienced the problems of connecting glass may be particularly interested in the activity – they may resonate to the motile knowledge of how to connect such panels. But if this approach were to fail, perhaps the new plastic panels are too brittle to withstand the fixings used for glass, the innovating engineer may then be forced to re-think her approach and new approaches may be improvised through reflection on, and discussion about, the difference between glass panels and the new plastic panels. This may lead to an innovative approach, and in particular may lead to mutated motile knowledge concerning glass, plastic and fixings in various combinations. In time engineers resonant to the problem of panel fixing may develop new approaches by reflecting upon their own experiences and the observed and discussed approach. If the resultant mutated knowledge of fixings, developed as a result of experience of the new plastic panels, proves more effective with glass panels, then other engineers are likely to apply the practice when fixing glass. The knowledge of previous approaches will in time cease to be realised in practice, and the motile knowledge concerning these methods may decay as it is undiscussed, unrealised, unobserved and eventually forgotten.

5. DISCUSSION

In this work we have introduced the concept of the motility of knowledge in response to field work within the UK construction industry which explored, through interviews with various actors, the industry's developing perspective on the potential to incorporate a concern for sustainability into its practices and processes. The presented motile model helps us to see knowledge practices relevant to sustainability, as inherently mobile within the industry structures, but as requiring that other actors are able to resonate with

such practices, and thereby to incorporate them in some form into their own practice. Over time, and as such practices are replicated, mutated and further distributed, some version of a sustainable construction practice can emerge. Achieving sustainability goals for construction, with all the consequent changes in behaviours, organisational relationships and work activities, is thus seen as achievable only if the need for motility of knowledge practices is appreciated and fostered. Such a perspective suggests a number of relevant insights into the way that the industry and individual organisations within it develop their knowledge management strategies and techniques; we outline some such implications here.

The motile account of knowledge practices emphasises the need for knowledge to be enacted and re-enacted as a means to sustain it and to allow it to be shared and taken up by others in some form or other. This challenges the notion of protecting knowledge within an organisation as a means to achieve competitive advantage. Motile knowledge is essentially linked to *multiple* and *diverse* occasions for individual action well beyond those afforded by any one organisation. A knowledge practice is of value when there is a resonance which allows it to become embedded in some new locale and in a multi-organisational and project based environment this will generally be beyond any one organisation's boundary. This is indeed the common understanding expressed by many participants in our study, and often they describe how they wish to be able to take their knowledge of some aspect of sustainable construction (their knowledge practice) and influence the behaviour of others in other organisations.

But of course we also have to acknowledge that knowledge practices are bounded by organisations to some degree, through shared culture and experience, and taking knowledge across such boundaries is less easy to the extent that there is some lack of shared understanding. However participation in projects, the dominant form of work within this industry, does mean that when knowledge is enacted in practice it is available to be observed and shared with others outside an organisational boundary. Thus the motile view of knowledge as accomplished in action, suggests that knowledge should not, and perhaps cannot, be protected within the organisational boundary since action external to this boundary is essential to how the industry operates. As others observe the knowledgeable action, which may resonate with their context or experience, it will engender their gaining knowledge that they can embed within their own practice. For example, a site manager may observe an innovative approach to managing waste on site, appreciate the problem its instigators were trying to solve, and then innovate a new solution for a new context based on the insight. Taking this perspective, the challenge is then not to manage the knowledge of an organisation behind boundaries in order to gain competitive advantage, but rather to focus upon creating an environment in which knowledge is engendered as motile and mutable across any such boundary. The benefits flow from seeing the organisation's own knowledge practices influencing the activity of others, as well as in being able to absorb or enact the knowledge practices of others with which they resonate.

Such an inter-organisational domain requires a significant shift from much accepted knowledge management practice. This is not to suggest organisations lay themselves open to a wholesale theft of their corporate knowledge advantage, but that the industry is presented with a challenge to collectively learn and change if it is to respond effectively to the sustainability agenda. Each individual company may continue to protect and enhance its informational environment, providing intranets, electronic document management systems and other forms of informational technology to develop an infrastructure through which knowledge practices may be made motile. These technologies provide the requisite variety (Espejo 1993) necessary for mutation and motility of knowledge, but from this perspective they do not contain knowledge themselves.

Focusing on supporting the motility of knowledge requires an attention to people and their practices. However, the motile model suggests that, in considering approaches to knowledge management, people alone should not be considered as intrinsically holders of knowledge, for their knowledge is only realised in action – one can best realise (and make motile) the ability to ride a bicycle (a knowledge practice) by actually riding a bicycle. As we have suggested, the greatest propensity for knowledge motility and mutation is through action and experience or observation of action. This suggests that activities which lead individuals to reflect in the context of practice upon action, information and experience are more likely to lead to reappraisal, innovation and change. Such a perspective calls into question some of the existent approaches adopted towards knowledge creation within construction practice. For example, post-hoc evaluations of projects, while potentially providing useful information, present poor opportunities to

promote the motility of knowledge. Such evaluations are unlikely to make knowledge motile among people who consider a project's action complete (or approaching completion). When evaluations occur towards the end of a project the number of salient problems, questions or demands for innovation are diminished as is the volume of knowledge presently motile within the environment (e.g. the ongoing discussion of the project). This leads to reduced potential for resonance to motile knowledge.

The motile model would suggest that evaluation practices could be improved if they can coexist with the ongoing action of a project. For example, by regularly undertaking reviews throughout a project's life individuals are able to reflect-in-action upon the experience of working within a project, with such reflection making knowledge motile through salient (and thus resonant) activity. Such discussion requires participants to constantly interpret and renegotiate meanings and so knowledge mutates as it is found useful by other parties in their own contexts. We see such mutation not as a sign of some failure in a transmission media, but rather as positive and indeed inherent to such motile knowledge. For example, while a factual report may capture the action and process of a project, it is the stories and discussions exchanged around such reports that infuse them with meaning and allow them to enable some change or altered behaviour in some other place (Gabriel 2000).

Such processes of mutation are particularly relevant within a project based industry where interaction with other organisations and with a variety of professionally legitimated roles is part of daily practice, and in which contexts change from project to project in significant ways. This character of the industry presents a significant opportunity for fostering the motility of knowledge as people continually face slightly different versions of the same situation; however present practice seldom seems to achieve this. For example, project meetings often act as merely information exchanges in which individuals wait until issues pertinent to their interests are raised. While such approaches are effective within an established process they do not promote knowledge motility (and thus innovation). Within such meetings descriptions of practices are seldom inscribed with sufficient meaning and narrative that they be made resonant to others present. Thus, within the C-SanD project as new technologies are considered to support the knowledge needs identified to develop a sustainable construction process, their role is considered in terms of engendering knowledge as motile as well as to support informational activity. Such technology must improve the "knowledge environment" in which knowledge is rendered motile and act as a conversational device (Deetz 1992) supporting the continual revisiting and renegotiation of meaning (mutation), rather than simply as tools for the capture, storage and transmission of information.

6. CONCLUSIONS

The model presented here has emerged out of analysis of fieldwork data from the C-SanD project and other construction industry research, and from a feeling of unease as established knowledge management models are applied in this industry. The particular situation that has been revealed by our study of sustainability, and our interest in how the fragments of knowledge practice that we have found might come to be bound into a more established industry process for sustainability, has lead us to start to develop the motile model presented here.

Our aim in this has been to be able to appreciate aspects of the development of knowledgeable practice (rather than abstract and a-contextual knowledge) across an inter-organisational domain, and in a situation in which the aims towards which people are directing their innovative energy are themselves vague and contested. Our concern from the start has been to understand both how such practices are developed and shared within this community, as well as the barriers or inhibitors to such sharing. The motile model as presented here is the result but it is not complete. We see this as work in progress, and this paper has provided only an initial attempt to describe the motile perspective. The work of the C-SanD project is also still in progress, and our continuing research agenda requires us to not only present such theorising but to develop this into useful technologies that can themselves become embedded in other people's practices.

7. REFERENCES

- Alavi, M. and D. Leidner (2001) "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues", *MIS Quarterly*, **25 (1)**, pp. 107-136.
- BRE, Buildings Research Establishment. (2002) conference; *Knowledge Management - Learning from the Leaders*, BRE, Watford UK.
- CIRIA,. (2002) *Debate: "the Business Case for Sustainable Construction Is Not Convincing"* (Personal communication).
- Davenport, T. and L. Prusak (1998) *Working Knowledge: How Organisations Manage What They Know*, Harvard Business School Press, Boston.
- Deetz, S. (1992) *Democracy in an Age of Corporate Colonization: Developments in Communication and the Politics of Everyday Life*, State University of New York Press, Albany, NY.
- DETR, (2000) "Sustainable Development: What It Is and What You Can Do" DETR London.
- Egan, J. (1998) "Re-Thinking Construction: Report of the Construction Industry Task Force" DETR London.
- Espejo, R. (1993) "Giving Requisite Variety to Strategy and Information Systems" in *Systems Science* (ed. Stowell,FA et al) Plenum Press.
- Gabriel, Y. (2000) *Storytelling in Organisations*, Oxford University Press, Oxford.
- Movement for Innovation (2001) "Environmental Performance Indicators for Sustainable Construction" *Movement for Innovation*
- Orlikowski, W. J. (2002) "Knowing in Practice: Enacting a Collective Capability in Distributed Organizing", *Organization Science*, **13 (3)**, pp. 249-273.
- Sage, A. (1998) "Risk Management for Sustainable Development". in *IEEE International Conference on Systems, Man and Cybernetics*, pp. 4815-4819,
- Schultze, U. (1998) "Investigating the Contradictions in Knowledge Management". in *IFIP WG8.2 & WG8.6 Joint Working Conference on Information Systems: Current Issues and Future Changes*, Helsinki, Finland, p. 155, Omnipress, Wisconsin, USA..
- Tsoukas, H. (1996) "The First as a Distributed Knowledge System: A Constructionist Approach." *Strategic Management Journal*, **17 (Winter Special)**, pp. 11-25.