Learning from Products in Service: A Socio-Political Framework

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Abstract

The paper develops a socio-political framework for analysing how companies can learn from products in service. The framework employs perspectives of time, space and power to analyse how four manufacturing organizations attempt to learn from their products in use. Vignettes from interviews with expert engineers in these companies are used to illustrate the problems encountered and the range of solutions adopted, and this leads to evaluation of the efficacy of the model.

The paper demonstrates the value of the framework for analysing problems of knowledge management specifically in the context of learning from products in service, and critically evaluates its strengths, weaknesses and generalizability to other contexts. It concludes that it has value in understanding the nature of classic problems of knowledge management, and the limitations of some solutions adopted by companies.

Keywords: learning from use; knowledge management; organizational learning; time; space; power.

1. Introduction

The development of product-service systems in the engineering industry has thrown the spotlight onto a long-standing issue: how organizations that provide after-sales service can learn effectively from their products in use (Johnstone, Dainty, & Wilkinson, 2009; Wilkinson, Dainty, & Neely, 2009) In these cases companies need to retain information about product use, evolution and service history, and to be able to sustain relations with customers over long periods of time. For engineering companies that have traditionally focussed simply on manufacturing and selling products, it is a relatively new challenge. But it also provides new opportunities both in terms of business models and though the potential to learn from long lasting interactions with customers and the products-in-use (Koners & Goffin, 2007; Morris, Bessant, & Barnes, 2006).

The aim of this paper is to build on recent work, by refining and developing understanding of the learning challenges and opportunities for companies managing knowledge within the product-service environment. In particular we draw on ideas from the organizational learning literature because it provides insights into processes that are complex and flexible and has been applied to areas such as new product development (Koners & Goffin, 2007). In particular we suggest a socio-political perspective on organizational learning, which pays attention to the dimensions of space, time and politics. We provide examples from four companies where we have researched over the last three years to show how both problems and opportunities can be configured using this framework. We then discuss the interrelationships between these three concepts and review the relevance of the socio-political perspective in relation to the more conventional perspectives on learning and knowledge management within organizations.

2. Theoretical Framework

2.1 Contributions from Organizational Learning

Although the literature on organizational learning is very extensive and diverse (Easterby-Smith, 1997), the bulk of the literature can be grouped into two main categories, the cognitive and social perspectives. The cognitive view assumes that individuals learn through absorbing, remembering and recalling information, and that organizational learning equates to the sum of individual learning. It therefore focuses on the ability of organizations to collate and remember individual knowledge through storage, dissemination and retrieval (Huber, 1991; Simon, 1991; Walsh & Ungson, 1991).

The contrasting view is that the most significant learning in organizations takes place in the social interaction between people which then becomes embedded in the routines (Feldman, 2000; Nicolini & Meznar, 1995), culture (Cook & Yanow, 1993) and practices (Gherardi, 2004; Lave & Wenger, 1991; Roberts, 2006) of the organization. There is also a growing interest in the politics of learning, which recognises that learning results both from individual agency and from systematic processes at an organizational level (Lawrence, Mauws, Dyck, & Kleysen, 2005). The political perspective also emphasises how cultures and rituals change over time, often as a result of contestation (Vince, 2001).

There is an important parallel between the knowledge management and organizational learning literatures. Since its inception in the early 1990s, knowledge management has been driven by the ICT agenda which has concentrated on technical solutions to the distribution of knowledge around and between organizations (Hayes & Walsham, 2005). Hansen et al. (1999) provided an early reminder that 'personalised' knowledge was also important, and this line was extended through the work of Brown and Duguid (2000) and others (Marshall & Brady, 2001) in developing the social perspective, which emphasised that human interactions were also very important in the creation and dissemination of knowledge. Similarly, within the organizational learning literature, the socio-political perspective has developed in contrast to the more established cognitive views (Lawrence et al., 2005). We see these contrasting views as being complementary. But in view of the consistent dominance of the codified and cognitive views we wish to redress the balance here by bringing the personalised and socio-political view to the foreground.

2.2 Towards a Socio-Political View

What are the main features of the socio-political view? For a start, it is closely linked to the ideas of Lave and Wenger (1991) about situated learning which implies that knowledge and learning are located in both *time* and *space*. Within their formulation, learning takes place over time as the newcomer interacts with the experts; and as the newcomer develops expertise he or she moves closer towards the centre of the community of practice. Similarly, Amin and Cohendet (2004) argue that space and time should be central to any theorisation of knowledge formation, and as we explain below, both concepts are important when organizations are learning from customers, and about their products. The third feature in the socio-political perspective is the element of *power*, which is intricately linked to both knowledge and learning (Lawrence et al., 2005; Marshall & Rollinson, 2004; Yanow, 2004). Furthermore, Vince (2001) argues that learning results from a close interaction between politics and emotions within organizations.

These three elements – time, space and power - form the core of our socio-political perspective. We have deliberately kept the literature review brief here, but in the main part of the paper we extend each of these concepts with reference to the relevant literature. We then illustrate each one with examples from four major engineering companies with which we have been working over the last four years. We would emphasise that we see it operating not as a mechanistic framework, but as a way of throwing light on key facets of learning from use.

3. Applying the Socio-Political Perspective

Our research investigated the learning from products in use within four high technology European companies. Two are leading European aerospace companies (Aero A and Aero B), and two are multinationals working in the fields of power conversion and automation (Power A and Power B). Aero A and Power A are large multinational with over 40,000 employees each; Aero B and Power B are smaller multinationals with approximately 5,000 employees each.

In these four companies we conducted over 100 interviews and observation sessions with knowledge management experts, service engineers and other technical specialists in these companies during a period of 3 years. As explained above, our main interest started with issues of learning from products in use, but then extended back into the ways that companies incorporated knowledge and information into their internal processes. Most of the interviews and observations were recorded, and all of these were transcribed and then subsequently coded in N-vivo. This has functioned as a data bank from which we have drawn examples and quotations which provide good illustrations of the theoretical points we are making.

In this section we develop the socio-political perspective, focussing on ideas of time, space, and power. In each case we start by summarising what literature from the socio-political perspective can say about this topic, we then apply the framework to the companies covered in our study, considering both typical problems that they encountered and some of the solutions they adopted.

3.1 Time

Theory. Researchers have identified three distinct ways in which time can effect organizational learning and knowledge management. First is the view that it takes time for individuals to learn things, whether this be academic knowledge, life skills, or job-related knowledge. As managers or engineers gain experience their capabilities increase through reflecting on the consequences of their past actions (Davies & Easterby-Smith, 1984). It is also recognised that organizations can potentially learn over time. In the case of manufacturing organizations, for example, it has been demonstrated that the unit costs of making products reduce as the cumulative output increases, and this is taken as evidence of a so-called ‘learning curve’ (Argote & Epple, 1990). Organizations may seek to learn from trial and error (Argyris & Schön, 1978) by capitalising on their experiences, although this can be difficult in practice especially if there is a suggestion of failure (Arino & de la Torre, 1998; Provera, Canato, & Montefusco, 2005).

Second, there are differences in the experience of time. It may be linear or cyclical (Crossan, Cunha, Vera, & Cunha, 2005), where the former implies that events take place in sequence, sometimes faster and sometimes slower. Where there are differences in the pace of events, this can lead to difficulties of communication within and between organizational units. Differences in time horizons can lead to conflicts, for example where one unit needs some design information to solve an urgent problem, but those working in the design unit are focussed on long term projects and do not have the time to help with short term problems. Yet although the pressures on the service engineers may be very immediate, they will be operating within service contracts that cover very long time periods (Wilkinson et al., 2009). In contrast, cyclical time refers to routines and recurrent patterns which have predictable consequences, such as the financial year-end, reporting of monthly sales figures, or end-of-project reviews. Where different time cycles coexist, and when people are driven by different linear time horizons, tensions can arise. These disjunctures in time are sometimes referred to as 'entrainment' (Ancona & Chong, 1996; Lervik, Fahy, & Easterby-Smith, 2010).

Finally, there is the view that knowledge decays over time: people and organizations forget, records are misplaced or deleted, and technologies develop so that old records are no longer accessible with modern digital systems (Blackler, Crump, & McDonald, 1999; De Holan & Phillips, 2003). Consequently organizations need to develop ways of retaining knowledge that may be useful in the future. Although it was once believed that digital technology alone would solve the knowledge retention problem, it is now recognised that social systems are also very important. The dilemma is about getting the right balance between technical and social systems (Brown & Duguid, 2000).

Application. Our research has identified a range of mechanisms for *learning from experience* adopted by companies, some of which rely more on technical procedures, and others more on social processes. We will start with the technical procedures. The key idea here is to capture knowledge and information from the past so that it can be used in the future. This includes developing databases and other knowledge curation systems which allow both secure storage and easy retrieval knowledge from the past. Many companies use 'lessons learned' systems that require project teams to review the successes and failures of each project, and to enter these points into a searchable database.

In each of our companies the 'lessons learned' systems had achieved mixed results. Our fieldwork suggests that there are always problems in making these systems work effectively. There is uncertainty around deciding and ensuring that relevant information should be entered into the database: should all projects be included, or just the more interesting ones? There is often a lack of time and resources at the end of one project to carry out a systematic review and recording of lessons before the next project starts; and some people feel that there is also a stigma about providing inputs to lessons learned systems because it can imply some failure in the past from which 'lessons have to be learnt'. Nevertheless, our informants suggested that although effort was made to input lessons learned, levels of reuse were disappointing. From the user end, there is often a lack of confidence that the database will be populated with material of relevance to current needs, and when they are used by design engineers, for example, this tends to be at the early stages of a new project where it is important to check that they are not simply 'reinventing the wheel'. The following comment expresses some of the doubts from a 'user' perspective:

> We've had to produce lessons learned outputs from some of the CAT team work we've had to do. Where they went, I don't know… the circulation was only within the project. Perhaps it's our shortfall rather than somebody else's, I don't know, but we didn't have access to any lessons learned early in the CAT programme. The pull-through was all through talking to

> individual people or through some of these experts who came and joined us for a while. [Aero B, M21: 189, 193]

This engineer highlights the importance of social processes which transfer personal knowledge and experience directly, without necessarily having to record it all digitally. There are always problems when project teams break up, or when skilled individuals leave the company. In the former case, lessons learned systems and project reviews dominate, but as Koners and Goffin (2007) demonstrate, the individuals who take part in the reviews often act as a more powerful source of dissemination than the public records generated. In the latter case various knowledge transfer procedures are utilised. In Aero A, for example, a knowledge transfer process is normally initiated six months before key employees are due to retire. This is conducted by dedicated staff who interview the retiree on a number of occasions and also seek to transfer as much of their knowledge as possible to colleagues through further interviews and joint meetings.

However, this still assumes that knowledge can be codified, and requires an explicit negotiation between what needs to be heard and what needs to be said (Collison & Parcell, 2004). To deal with the tacit information Power B is piloting an 'apprentice' scheme where mid-career engineers are linked to acknowledged experts in their fields and effectively act as gatekeepers, dealing with technical queries on behalf of their mentors. Since they frequently need to consult the expert when dealing with queries, this enables knowledge transfer at the level of practice, or knowing. The alternative to transfer of knowledge and practice is to use contractual arrangements which seek to retain retired employees on a consultative basis, and this parallels structural procedures in the industry where considerable use is made of outsourcing work to former employees on a full-time basis.

The second aspect is the *slippage* between timescales. This is most easily illustrated by the contrasting timescales of projects at the design or service ends of the process -- where design team members might be assigned to projects that run for 15 or 20 years; whereas the service engineer on a callout contract for a piece of industrial machinery might be expected to arrive on site within four hours, and to have completed the repair within eight hours. Thus the design and service engineers are likely to be operating to very different mental timescales in the way they organise and produce their work. The time pressure under which service engineers operate was summarised by their manager as follows:

> We've got about 500 service contracts and the basis of those service contracts is a callout system, which means that a customer if he's got a breakdown on a … most of the customers work a 24/7, 365 days a year with a couple of weeks off, so it's a continual process. If a plant goes down, obviously it costs a lot of money and they want to get somebody to site as soon as possible to fix it. [Power B, C7: 21]

This is significant because, despite the rhetorical value of learning from use, we encountered very few examples of any direct feedback from service experience which was incorporated into future designs. We will return to this issue when looking at political aspects. For the time being we can note that part of the problem arises from the fact designers concentrate on the next generation of products and will see little need to attend to in-service problems from earlier generations of products.

Thirdly is *knowledge retention*. Many products, such as aircraft, ships and buildings are designed with an assumed life span of 30-40 years. With complex systems there may be a design phase of 5-10 years making an elapsed time of up to 50 years. With the development of product-service systems in engineering and the construction industry, the manufacturer or builder is now responsible for maintaining the equipment or structure throughout its operating life – which is around twice the average working life of employees. The manufacturer needs to retain knowledge of the design and the rationales behind the original design, and the history of the product including maintenance, parts replaced, and upgrades of materials and technologies.

In the case of Aero A for example, design modifications have to be introduced as the functions and roles of their aircraft evolve over time. Thus the aircraft may start life being operated by a national scheduled airline, then move to a budget operator, then to a charter operator, and then to a freight operator. Changing use requires modifications both to the internal layout of the aircraft and also to other characteristics such as loading (which affects the landing gear) or the required range (which affects fuel tanks), and all of these modifications need to be added into the overall life history of the aircraft. This requires detailed service records to be maintained for hundreds of aircraft located in any part of the globe; it also means that expertise has to be retained in order to know how to fix customer problems as they arise, especially if they have implications for safety. This latter expertise is often highly personal to the individual who may be able to remember similar cases from the past, and who may be able to solve novel problems by combining different past solutions.

> And also, what you tend to find is when we originally designed the original landing gear, what we discovered was that the way the airlines were actually using the aircraft was quite different. You know, for instance, … one of the things that actually drives the design of the landing gear is not the landing of the aircraft, it's actually the manoeuvring on the ground. … And actually when you're manoeuvring the aircraft around, you get very high top loads going up through the landing gear. And so actually, the fact that the aircraft were doing a lot of sort of taxiing manoeuvres on the ground and very sort of tight turns, … the fatigue loads were much sort of worse than we thought they were. [Aero A, B14: 86]

In the case of codified knowledge there is now a dilemma about whether to store design and service records in physical or digital form. As digital technology evolves many databases and systems become obsolete a long time before their associated products complete their useful lives. In the case of personalised knowledge there is the problem of human frailty: people forget things, individuals move roles and jobs, they retire and die; and teams get formed, re-formed, and dissolved. So how can this tacit knowledge be retained and transferred when the individuals who originally owned it are no longer there? There are also dilemmas about what to store when we cannot be sure what questions future generations of engineers will need to answer. Information and knowledge need to be stored so that it can be retrieved at whatever point in the future it is needed, and this assumes that those looking for it are aware of what is available and of how it might be relevant to their particular problems.

Reflections

Our analysis above of the temporal dimensions of knowledge management and learning suggests that organizations put a lot of effort into learning from experience and dealing with knowledge retention. In practice, however, there seemed to be less success in the former than the latter. There was less effort put into dealing with entrainment issues, which suggests either that they are not important, or that they are not understood sufficiently well by companies. This aspect, coupled with the difficulties in learning from experience may also be linked to political issues, which we will discuss later in the paper.

One consistent observation from our examples above is that social processes are at least as important as codified documents. It is therefore not surprising that recent work has attempted to combine personal and codified knowledge. One example is the Design Rationale editor (DRed) which is used by Rolls-Royce to capture the rationale behind engineering decisions with a particular emphasis on articulating the reasons why different options were chosen or not chosen (Bracewell, Wallace, Moss, & Knott, 2009). This methodology creates a tree diagram which records the sequence of thoughts, ideas, and rationale is which led to a particular design solution being adopted. It is likely that more such hybrids will be developed in the future.

3.2 Space

Theory. The idea of space is relevant to organizational learning and knowledge management in several ways. It is widely accepted that learning is *situational,* in the sense that understanding, memories, and capabilities are linked to the social and physical contexts in which they are acquired. This is a key aspect of the idea of developing capabilities through apprenticeships, and of acquiring tacit skills within groups and professions (Lave & Wenger, 1991); context is important both for individual learners, and to provide support for communities of practice (Handley, Sturdy, Fincham, & Clark, 2006).

The physical *proximity* of individuals, teams and companies is generally assumed to enhance knowledge transfer and innovation (Amin & Cohendet, 2004). Proximity is important if individuals are to share ideas, and it is widely accepted that the co-location of team members, or the clustering of related teams, is important for fostering innovation (Kirat & Lung, 1999). Similarly, the development of networks (Collins, Dunne, & O'Keefe, 2002), and the clustering of related firms has been shown to be a major contributor to the success of industries, such as the electronics industries in Silicon Valley (Inkpen & Tsang, 2005; Saxenian, 1994). Moreover, distance can be problematic, especially when dealing with machinery and equipment. As Von Hippel and Tyre (1995) found, when designers are unaware of the precise circumstances in which manufacturing equipment will be used two things often happen. Either the designers will make incorrect assumptions about the context of its use, or the users will do things to and with the machinery which were not anticipated by the designers. But this is less likely to be the case when dealing with virtual material as in the global software development project studied by Kotlarsky & Oshri (2005).

A third aspect of spatial configurations is the impact on knowledge flows of *boundaries*, which exist between groups, departments and organizations. Carlile (2004) shows that some forms of knowledge are more difficult than others to move across departmental and boundaries. Thus 'syntactic' knowledge only requires common definitions of terms and codes to enable transfer; and 'semantic' knowledge requires similar meanings and interpretations to exist on opposite sides of boundaries, and hence some form of the translation is required. Transfers of pragmatic knowledge are most difficult because in order for knowledge to be usable by the recipients it needs to be transformed so that it fits with their own systems.

Other authors have investigated different features of the boundaries. Thus Scarbrough et al (2004) have investigated the problems of moving knowledge between different project groups, and Hong et al (2009) have looked at the flow of information across organizational boundaries within the supply chain of a Japanese multinational. There are also paradoxes. The co-location of members of research and development teams creates a concentration of high-level skills, fostering informal interaction and the confidence that comes through the identification with other elite members. Similarly Koners and Goffin (2007) recommend the co-location of senior and junior employees to encourage knowledge transfer and the evolution of natural mentoring relationships. The downside of this arrangement, of course, is that these groups become exclusive, resisting penetration and knowledge transfer to other groups. This demonstrates the positive and negative effects of boundaries, which can exist within multinationals between departments, disciplines and national borders.

Application. In the case in high-technology companies, we were surprised how often the specialist engineers were physically removed from the equipment and products for which they are responsible. For example, a senior Aero A engineer commented in response to a question about whether his own colleagues had much contact with customers:

> Very, very seldom they do. The guys in the Structures repair area, they tend to go out to operators when … say if there's an aircraft gone off the runway and they have to repair it. They'll ask for one of our guys to go and actually survey the aircraft… If an airline has got a particular problem and they can't resolve the troubleshooting of that aircraft, they can then ask for our guys to go out and do some specialist troubleshooting. But normally, we don't have that regular contact with the airlines. [Aero A, B9: 186-7]

Thus they have to develop communication procedures with the locally based engineers to give them the confidence in the decisions they are taking. This requires multiple sources of information including the descriptions, technical data from local tests, drawings and photographs. This is also apparent in our own observations of service engineers working for companies such as Power A and Power B. But the language used by service technicians on site can be quite different from that of the technical expert working at a distance in the head office, and who therefore has to translate reports of system malfunction into mathematical language or software code. This is an example of semantic knowledge transfer in Carlile's terms. In order to make this translation the engineer often has to draw on contextual information acquired over many years of dealing with similar problems.

Nevertheless it was the *boundary* element which dominated accounts of knowledge management issues that we collected from companies, reflecting both the perception of problems and the range of efforts that were established to overcome these problems. The experience of boundaries was neatly captured in the common expression used by engineers passing information to other departments or units as 'chucking it over the wall', and when they pass information on, they assume that the specifications coded in these information documents will be self-evident to others. In other words they cannot see (and perhaps do not care) whom it goes to, and what use is made of it.

There are also *disciplinary boundaries* particularly in knowledge-intensive organisations, where different groups draw from, and create, their own technical and operational languages. Amongst service technicians this development of private language was highlighted by Orr (1996) in his study of photocopier service technicians working for Xerox, who used 'war stories' to communicate with each other about typical problems in the maintenance of their photocopiers.

There are inevitable boundaries *between* organisations, which become problematic when they need to collaborate within alliances and joint ventures, and along supply-chains. Although partners may be concerned about possible 'leakage' of IPR to other partners (Collinson, 2007), they also need to ensure that information relevant to the success of the joint enterprise can be transferred. Occasionally knowledge transfer is possible between direct competitors, as when Power A linked up with one of its main competitors (Siemens) to solve a joint problem:

> There's been … particularly in South America, … some severe technical problems with copper sulphide in … transformers. … we got together with Siemens and a couple of the others because actually at one stage you know, it was almost like an Aids epidemic for transformers… Because it wasn't one manufacturer's problem, … they all got together and pooled their research on it as well… And that was a fascinating story, it turned out to be something to do with the oil which is used to fill the transformers. [Power A: A21: 33]

On the other hand, within the European defence industry national security considerations overlay organisational interests to the extent that within the same company some forms of information are restricted by law to nationals of each individual country.

There are many approaches used by companies to deal with space and boundary problems. As indicated above, much reliance is made on technical systems and physical objects, such as databases, plans and drawings, which act either to transfer codified information from one group to another, or act as background facilitation for discussions between the parties involved. The latter are referred to by Star and Greisemer (1989) as ‘boundary objects’ because they can facilitate communication and conversation -- in the same way that a friendly dog on a lead can assist communication by allowing a perfect stranger to start talking to the owner of the dog.

Some companies have policies for moving people between projects and groups to act as ‘boundary spanners’ (Jones, 2006), and this may take the form either of short visits/exchanges or longer secondments from one team to another. Short visits which may take the form of ‘shadowing’, tend to work better when the two groups are physically located close to each other and yet there are clear differences in the context of work in each case; longer secondments tend to work better when the groups are located a long way apart, perhaps in different countries, but where the nature of the work is relatively similar and therefore it becomes easier for the secondee to make a real contribution to some ongoing project.

‘Communities of practice’ can also be established to bridge across different kinds of boundaries. In Power A, for example, service engineers who cover different physical territories around the UK meet together on a monthly basis to share ongoing problems and to identify new business opportunities. Although these communities were initially formed and chaired by senior managers, reviews of the process have led to coordination and knowledge capture tools being designed and managed by members of the community itself.

> [We had] these participation cards. It was a fantastic idea and management loved it. They could easily access this database…it would give them all sorts of lovely reports, in a lovely format and they could pick and choose…from lists. As far as engineers filling it in were concerned they just… weren’t interested and consequently the participation cards…dying a slow death. It was just a matter of somebody actually standing up and saying that in a meeting, which we did… we decided to kill that off. And we’ve resorted to … a simple spread sheet…and in the month that it has been up and running the number of bits of information collected is probably twice what the total community collected in the last 12 months in the old system. [Power A: A17: 39.50]

This moved them from a management initiated community, which is often problematic (Swan, Scarbrough, & Robertson, 2002), and more towards the original conception of a community (Lave & Wenger, 1991) as a naturally forming group of peers with similar interests and concerns. Other companies use electronic ‘virtual’ communities of practice when there are only a few experts in a particular area and they are distributed around the world in different countries. Shell Oil is noted for its ability to harness distributed knowledge through global ‘expertise networks’, both in technical and human areas of expertise (Sparrow, Brewster, & Harris, 2004).

Reflections. In this section we have used theoretical perspectives about the spatial aspects of learning and knowledge management to throw light on practical problems, and potential solutions, which largely involve semantic communication. There is the issue of ‘*distance’* between technical experts and the equipment for which they are responsible, but this is dealt with through a range of media including emails phone calls and photographs.

From our cases the *boundary* issues predominate, especially between disciplines and departments in the same organization. Inter-organizational boundary problems are less common if only because companies put less effort into these transfers for reasons of competition and national legislation. Methods for dealing with boundary problems also include frequent use of boundary objects, and the establishment of various social approaches to stimulating communication between people, including community of practice that combine both social and technical forms of knowledge management.

3.3 Power

Theory. There are many perspectives on the relationship between power and knowledge. While most observers recognise that power is a necessary part of organizational life, it is important to understand how it may help or hinder knowledge flow within organizations. Lawrence et al. (2005) analyse the impact of power on individual, group and organizational levels. They suggest that individuals' judgements about new ideas are influenced by the costs and benefits that they personally associate with the new idea, that at group levels people will use position power to control agendas and to restrict alternatives, and that the ability of organizations to take on new ideas depends very much on architectures of physical layout, information systems and rewards. Overall they see power and politics as positive because they 'provide the social energy which transforms the insights of individuals and groups into the institutions of an organization' (p. 188).

Lawrence et al. (2005) also draw on the ideas of Foucault in making a distinction between systemic and episodic power, referring respectively to the impersonal structures and routines of an organization, and to the actions and tactics of individuals seeking to influence others and the wider organizational environment. *Episodic* power may be reflected in the motivation of individuals to share, or withhold, information from others. They will be less likely to share when there is a fear of losing personal power (Szulanski, 1996), or authority (Darrah, 1995); conversely they are more likely to share where there is common identity and trust (Szulanski, Cappetta, & Jensen, 2004). In addition, Vince (2001) argues that learning is an emotional process, and that sharing processes between individuals and departments will be affected by emotional states; essentially power, learning and emotion are closely intertwined.

The *systemic* view suggests that power is reflected in reward systems and organizational structure. A key structure, which affects knowledge flows, is organizational hierarchy. In formal hierarchies, which provide authority and legitimacy, it is noted how information flows quite easily 'down' the hierarchy, but with the utmost difficulty upwards (Yanow, 2004). Within knowledge-intensive firms, such as engineering companies, an additional hierarchy operates, one of technical expertise. Some forms of expertise are valued more than others: for example, in technology-intensive companies design expertise may be valued more than the practical expertise in manufacturing, the commercial expertise in sales, or the operational expertise of service activities.

Internal *competition* for resources and rewards constrain communication between individuals and organizational units (Marshall & Rollinson, 2004). At an organizational level, there is an interesting example of sharing and collaboration between business units being linked directly to rewards. In BP John Browne established 'peer groups' comprising chief executives of distinct business units, and established reward mechanisms for each CEO based on the performance of the *weakest* business in the group. This acted as a very powerful incentive for managers to share with, and assist, colleagues running businesses which might otherwise be competing for resources (Goold, 2005).

Application. Issues of power and politics were manifest in all four companies. In several cases, the individual motivation to share with others was tackled by introducing questions into the annual performance appraisal about the willingness to share knowledge. But issues of resource competition and various forms of hierarchy were most common. When an organisation is seeking to learn from products in use, people in high status jobs may be less willing to listen to the service engineers who are in lower status jobs. As one of our informants commented:

> I think time and time again we have new projects coming along and it's always at the last minute that Customer Services are consulted, involved or their voices heard. My feeling is that the Customer Services guys are always the last people invited to the party. At the end of the day, they've got to look after the aircraft for the best part of 40 years and the people who design it look after it from you know, conception to entry into service, which would be about what, four or five years. [Aero A, B9: 277]

Moreover, when people with different forms of expertise are required to work together, the individuals concerned need to find common ground, and to both confirm and challenge the legitimacy of different experts. This often requires them to be able to be confident of their own expertise, yet recognise their relative ignorance in the other's field of expertise (Mengis, Nicolini, & Swan, 2009).

Competition for resources and conflicting objectives between departments and units was also apparent:

> (The problem we have with) Products Units, is that Service and Product business … have different views on how things should be achieved. I mean obviously Service is looking for lifecycle of the product, Sales is: 'I want to sell it now, I'm going to keep on selling your products'. [Power A, A5: 90].

> You know, the Chief Engineer wants things done and he thinks … his requests are the most important. And then Customer Services get … complaints from airlines and they want something fixed. And then Procurement … might say 'well we want some cost reductions, we want some modifications to reduce the cost of the product'. [Aero A, B19: 158]

Not only does this show that departments are in competition for resources, but also the fundamental differences in the objectives of different functions means that tensions will develop between departments, because they are being driven by wider systemic requirements.

Various tactics are employed in order to deal with the problems of power in the context of learning from products. Most common are mechanisms for reducing the effect of competing objectives such as the establishment of multifunctional teams which comprise members from different functions and departments.

> I am a firm believer of good launch meetings. [The] chief engineers and all the relevant different functions are needed to be there. Because when you start launching it we're going to discuss what the issue is, who is impacted, who is involved, and who is not involved. The launch meeting would be like representatives from say the Chief Engineer's Office, Program, Engineering. From Engineering, … for instance, there could be somebody from static, fatigue, design and you could maybe have material processes in there, if you might be needing to do non-destructive testing, all sorts of things. [Aero A: B18, 115-123]

Another tactic relies more on influencing the culture and processes of the organisation. Senior managers and engineers can play direct roles in facilitating the upward flow of information, particularly through establishing regular review mechanisms within projects. These review processes are very important in the development of complex products. The role of the senior manager is important because it ensures that people from different disciplines and functions are prepared to talk to each other, and it reduces the tendency of people from particular areas to place blame upon people from other areas. In the aerospace company Aero B, there is a defined group of senior managers who share these review processes, and who in turn are both trained for this role and engage in exchanges about important findings that they identify.

> We have regular design reviews where the panel will include … fairly senior people that will look at these … issues … and they can make recommendations on where we should be going in terms of what we do on the project. And we also have a director-level group which meets once a month in theory, it's often hard to get them together, and that is to make sure that all the different departments are actually functioning together properly and that they haven't got … overriding issues. [Aero B, M21: 79]

The issue of hierarchy between levels of expertise, especially between service and design functions, was not being tackled directly by any of our companies. However it is reported that this is happening in a number of companies such as Rolls-Royce where the technical sophistication of products requires very high levels of technical expertise from the people at the service end of the chain, and hence the educational level of people in service roles is becoming similar to that of people in the design areas.

Reflections. The implications from this perspective are that political processes cannot, and should not, be eliminated: they are central to the functioning of any organization. However, the design of the organization needs to acknowledge political processes so that people are encouraged to collaborate and share their expertise. In our case studies, the emphasis was on the adoption of systemic processes aimed at influencing individual behaviour, for example through amending appraisal systems and reward mechanisms for senior managers.

There were also systematic approaches to dealing with hierarchical and competitive issues. These included frequent use of multifunctional teams, and in some cases demonstrated a degree of circularity - where senior managers would use their power to reduce the impact of political tensions and divergent objectives between departments. But other aspects of hierarchy proved to be intractable, and this was manifest, for example in the career strategies of individual engineers who preferred to be assigned to work on new technologies rather maintaining established technologies.

4. Conclusions

We have concentrated in the paper on the social and political aspects of learning and knowledge management, although we recognise that more technical aspects are also important. The socio-political view adds value in several ways. First, it provides an explicit counterpoint to the technical view, and hence as a reminder that socio-political considerations should be integral, and not just added as afterthoughts. Second, it expands understanding of social elements by identifying conceptually distinct processes which explain, either individually or in combination, the success and failure of knowledge management initiatives.

A major practical implication is about getting the right balance from the outset between the technical and the social aspects of knowledge management systems. This depends on context. For example, if the focus is on maintaining equipment installed in industrial firms, and this is done by service engineers with geographical areas of responsibility, it makes sense for the bulk of knowledge management to operate through social mechanisms such as communities of practice and informal networks. But when that equipment is on moving platforms, such as ships or aircraft, where problems may be encountered at any place or any time, then technical knowledge management systems will need to form the starting point, even if social processes have to be invoked in order to solve novel problems.

We identify three potential limitations to this paper. First, the framework was derived largely from prior literature, rather than from a systematic analysis of our data. There is some refinement of the model based on selective use of our data, but our overall aim is to apply the model to a range of practical issues. Second, it could be argued that there are plenty of other concepts, such as trust, identity and transactive memory, which have significant impact on knowledge transfer. But these are more relevant to individual behaviour, and do not provide insights into organization-wide patterns and mechanisms, which form the focus of this paper. Third, it is possible to question whether insights derived from an engineering context will be applicable to other sectors and kinds of organizations. In response we would point out that we employ fundamental concepts such as hierarchy, boundaries and entrainment which are commonly applied in other contexts and sectors, and whether public or private.

References

Amin, A., & Cohendet, P. 2004. ***Architectures of Knowledge: Firms, Capabilities, and Communities***. Oxford: Oxford University Press.

Ancona, D., & Chong, C. L. 1996. Entrainment: Pace, cycle, and rhythm in organizational behavior. ***Research in Organizational Behavior***, 18: 251-284.

Argote, L., & Epple, D. 1990. Learning Curves in Manufacturing. ***Science***, 247(4945): 920.

Argyris, C., & Schön, D. A. 1978. ***Organizational Learning: A Theory of Action Perspective***. London: Addison Wesley.

Arino, A., & de la Torre, J. 1998. Learning from failure: Toward an evolutionary model of collaborative ventures. ***Organization Science***, 9(3): 306-325.

Blackler, F., Crump, N., & McDonald, S. 1999. Organizational learning and organizational forgetting. In M. Easterby-Smith, L. Araujo, & J. Burgoyne (Eds.), ***Organizational Learning and the Learning Organization***: 194-216. London: Sage.

Bracewell, R., Wallace, K., Moss, M., & Knott, D. 2009. Capturing design rationale. ***Computer-Aided Design***, 41(3): 173-186.

Brown, J. S., & Duguid, P. 2000. ***The Social Life of Information***. Boston: Massachusetts: Harvard Business School Press.

Carlile, P. R. 2004. Transferring, translating, and transforming performing: an integrative framework for managing knowledge across boundaries. ***Organisation Science***, 15(5): 555-568.

Collins, R., Dunne, T., & O'Keefe, M. 2002. The "locus of value": a hallmark of chains that learn. ***Supply Chain Management***, 7(5): 318-321.

Collinson, S. 2007. Strategic knowledge transfers and unintended spillovers: Learning how to innovate through strategic alliances in China, ***Academy of International Business***. Indianapolis.

Collison, C., & Parcell, G. 2004. ***Learning to Fly***. Chichester: Capstone.

Cook, S. D. N., & Yanow, D. 1993. Culture and organizational learning. ***Journal of Management Inquiry***, 2(4): 373-390.

Crossan, M., Cunha, M. P. E., Vera, D., & Cunha, J. 2005. Time and organizational improvisation. ***Academy of Management Review***, 30(1): 129-145.

Darrah, C. N. 1995. Workplace training, workplace learning. ***Human Organization***, 54(31-41).

Davies, J., & Easterby-Smith, M. 1984. Learning and developing from managerial work experiences. ***Journal of Management Studies***, 21(2): 169-183.

De Holan, P. M., & Phillips, N. 2003. Organizational forgetting. In M. Easterby-Smith, & M. A. Lyles (Eds.), ***The Blackwell Handbook of Organizational Learning and Knowledge Management***. Oxford: Blackwell.

Easterby-Smith, M. 1997. Disciplines of organizational learning: Contributions and critiques. ***Human Relations***, 50(9): 1085-1113.

Feldman, M. S. 2000. Organizational routines as a source of continuous change. ***Organization Science***, 11(6): 611-629.

Gherardi, S. 2004. ***The background and foundation for the practice-turn in organizational learning***. Paper presented at the International Symposium on Working Life Learning, DGI-byen, Copenhagen.
Goold, M. 2005. Making peer groups effective: lessons from BP's experiences. ***Long Range Planning***, 38: 429-443.
Handley, K., Sturdy, A., Fincham, R., & Clark, T. 2006. Within and beyond communities of practice: making sense of learning through participation, identity and practice. ***Journal of Management Studies***, 43(3): 641-653.
Hansen, M. T., Nohria, N., & Tierney, T. 1999. What's your strategy for managing knowledge? ***Harvard Business Review***, 77(2): 106-116.
Hayes, N., & Walsham, G. 2005. Knowledge sharing and ICTs: a relational perspective. In M. Easterby-Smith, & M. Lyles (Eds.), ***Handbook of Organizational Learning and Knowledge Management***. Oxford: Blackwell.
Hong, J., Snell, R., & Easterby-Smith, M. 2009. Knowledge flow and boundary-crossing at the periphery of a MNC. ***International Business Review***, 18: 539-554.
Huber, G. P. 1991. Organizational learning: The contrbuting processes and the literatures. ***Organisation Science***, 2(1): 88-115.
Inkpen, A. C., & Tsang, E. W. K. 2005. Social capital, networks, and knowledge transfer. ***Academy of Management Review***, forthcoming.
Johnstone, S., Dainty, A., & Wilkinson, A. 2009. Integrating products and services through life: an aerospace experience. ***International Journal of Operations and Production Management***, 29(5): 520-538.
Jones, O. 2006. Developing absorptive capacity in mature organisations: the change agent's role. ***Management Learning***, 37(3): 355-376.
Kirat, T., & Lung, Y. 1999. Innovation and proximity - Territories as loci of collective learning processes. ***European Urban and Regional Studies***, 6(1): 27-38.
Koners, U., & Goffin, K. 2007. Managers' perceptions of learning in new product development. ***International Journal of Operations & Production Management***, 27(1): 49.
Kotlarsky, J., & Oshri, I. 2005. Social ties, knowledge sharing and successful collaboration in globally distributed system development projects. ***European Journal of Information Systems***, 14(1): 37-48.
Lave, J., & Wenger, E. 1991. ***Situated learning: legitimate peripheral participation***. Cambridge: Cambridge University Press.
Lawrence, T. B., Mauws, M. K., Dyck, B., & Kleysen, R. F. 2005. The politics of organizational learning: integrating power into the 4I framework. ***Academy of Management Review***, 30(1): 180-191.
Lervik, J. E., Fahy, K., & Easterby-Smith, M. 2010. Temporal dynamcs of situated learning in organizations. ***Management Learning*** 41.
Marshall, N., & Brady, T. 2001. Knowledge management and the politics of knowledge: illustrations from complex products and systems. ***European Journal of Information Systems***, 10(2): 99-112.
Marshall, N., & Rollinson, J. 2004. Maybe Bacon had a point: the politics of interpretation in collective sense making. ***British Journal of Management***, 15: S71-S86.

Mengis, J., Nicolini, D., & Swan, J. 2009. Working together in the space between expertise and ignorance, ***EGOS***. Barcelona.

Morris, M., Bessant, J., & Barnes, J. 2006. Using learning networks to enable industrial development; case studies from South Africa. ***International Journal of Operations & Production Management***, 26(5): 532.

Nicolini, D., & Meznar, M. B. 1995. The social construction of organizational learning - conceptual and practical issues in the field. ***Human Relations***, 48(7): 727-746.

Orr, J. E. 1996. ***Talking about Machines: An Ethnography of a Modern Job***: Cornell University Press.

Provera, B., Canato, A., & Montefusco, A. 2005. ***Assessing the influence of Karl Weick: a no-blame approach to organizational learning***. Paper presented at the Academy of Management, Honolulu, Hawaii.

Roberts, J. 2006. Limits to communities of practice. ***Journal of management studies***, 43(3): 623-629.

Saxenian, A. 1994. Lessons from Silicon Valley. ***Technology Review***, 97(5): 42-.

Scarbrough, H., Bresnen, M., Edelman, L. F., Laurent, S., Newell, S. E., & Swan, J. 2004. The processes of project-based learning: an exploratory study. ***Management Learning***, 35(4).

Simon, H. A. 1991. Bounded rationality and organizational learning. ***Organization Science***, 2: 125-134.

Sparrow, P., Brewster, C., & Harris, H. 2004. ***Globalising Human Resource Management Itself***. London: Routledge.

Star, S. L., & Griesemer, J. R. 1989. Institutional ecology, translations and boundary objects: amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. ***Social Studies of Science***, 19(3): 387.

Swan, J., Scarbrough, H., & Robertson, M. 2002. The construction of 'communities of practice' in the management of innovation. ***Management Learning***, 33(4): 477-496.

Szulanski, G. 1996. Exploring internal stickiness: impediments to the transfer of best practice within the firm. ***Strategic Management Journal***, 17(S1): 27-43.

Szulanski, G., Cappetta, R., & Jensen, R. J. 2004. When and how trutwothiness matters: knowledge transfer and the moderating effect of causal ambiguity. ***Organization Science***, 15(5): 600-613.

Vince, R. 2001. Power and emotion in organizational learning. ***Human Relations***, 54(10): 1325-1351.

Von Hippel, E., & Tyre , M. J. 1995. How learning by doing is done: problem identification in novel process equipment. ***Research Policy***, 24(1): 1-12.

Walsh, J. P., & Ungson, G. R. 1991. Organizational memory. ***Academy of Management Review***, 16(1): 57-91.

Wilkinson, A., Dainty, A., & Neely, A. 2009. Changing times and changing timescales: the servitization of manufacturing. ***International Journal of Operations and Production Management***, 29(5).

Yanow, D. 2004. Translating local knowledge at organizational peripheries. ***British Journal of Management***, 15(Special Issue): S9-S25.

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