International Journal of Innovation Management
Vol. 7, No. 2 (June 2003) pp. 163–188

Imperial College Press
www.icpress.co.uk

THE COMPLEX RELATIONS BETWEEN COMMUNITIES OF PRACTICE AND THE IMPLEMENTATION OF TECHNOLOGICAL INNOVATIONS

DONALD HISLOP
Sheffield University Management School, University of Sheffield
9 Mappin Street, Sheffield, S1 4DT, UK
d.hislop@sheffield.ac.uk

Received 20 June 2002
Revised 8 April 2003
Accepted 22 April 2003

The paper analyses the implementation of IT based innovations through a communities of practice lens. It is suggested that such a framework can add fresh insights to the dynamics of innovation processes. The paper makes an empirical and theoretical contribution to the innovation literature by both examining case study evidence from a number of technological innovation projects, and reflecting on the relationship between innovation processes and communities of practice. It is concluded that this relationship is not unidirectional. Not only did the communities of practice influence the innovation processes, for example through shaping important knowledge sharing processes, but the innovations also impinged on organizational communities of practice in important ways. The paper also proposes ways in which the analytical utility of the community of practice concept can be improved, for example by taking greater account of potential negative effects that communities of practice can have for innovation processes.

Keywords: Communities of practice; innovation implementation; knowledge sharing.

Introduction

One of the benefits of the current growth of interest in the subject of knowledge and learning in organizations is that this work has produced a number of concepts which may significantly improve the understanding of a wide range of organizational processes. Lave and Wenger's (1991) "community of practice" idea represents one of the potentially most useful of these concepts, and is arguably the most enduring element of their theory of situated learning (Contu

& Willmott, 2000; p. 272; Fox, 2000; p. 853). Its importance is indicated by the extensive way it has been used in the burgeoning knowledge literature (Baumard, 1999; Brown & Duguid, 1991; 1998; DeFillippi & Arthur, 1998; Fox, 2000; Hildreth *et al*., 2000; Liedtka, 1999; McDermott, 1999; Pan & Scarbrough, 1999; Raelin, 1997).

This paper applies the "communities of practice" concept to analyze the implementation of IT based process innovations in a number of case studies, and suggests that it has the ability to provide fresh insights into the dynamics of innovation processes. The socio-technical perspective conceptualizes the implementation of technological innovations as involving the blending and synthesis of new knowledge and artefacts with existing organizational practices, artefacts and knowledge (Clark & Staunton, 1989; McLoughlin, 1999). Thus if, as the communities of practice literature suggests, organizational communities of practice both shape the structure of the organizational knowledge base, and represent important reservoirs of organizational knowledge, they have the potential to play an important role in the implementation of technological innovations.

The paper considers how organizational communities of practice (CoPs), and innovation processes mutually impinge on each other. Thus the paper considers both how communities of practice affect innovation processes, as well as how the implementation of change affects organizational communities of practice. Specifically, this involves examining a number of questions, including: how did the existing CoPs shape the distribution of relevant knowledge; how did the sense of identity possessed by members of CoPs impact on the sharing of knowledge within and between existing CoPs during the change process; did the CoPs facilitate or inhibit the sharing and utilization of relevant knowledge during the innovation processes; what effect did the changes examined have on the knowledge/practices of existing CoPs; and what effect did the changes examined have on the population size/character of existing CoPs.

The paper has two primary objectives, to empirically and theoretically examine the links between innovation processes and communities of practice. The empirical objective is addressed through utilising case study evidence from a number of companies. The data used is drawn from longitudinal, qualitative studies of comparable innovations in seven case study companies. While the companies examined are from a range of countries, and sectors of activity, the focal innovation in each organization was similar: all the case companies researched were attempting to implement IT based, multi-site, cross-functional management information systems.

The theoretical objective is achieved by reflecting on what the empirical data presented says about the way innovation processes and communities of practice

are linked, and the general way that the community of practice concept requires to be modified and reconceptualised to make it a more useful analytical tool. This is important, as while the terminology of "communities of practice" has been become widely used, it still remains a relatively poorly developed concept. Issues which arguably require to be more effectively addressed include: taking greater account of the difficulties involved in sharing knowledge between different communities of practice; and more fully taking account of the potential negative aspects of communities of practice. Such analyses are required as too much contemporary writing on communities of practice focuses narrowly on their benefits and advantages (see e.g. Brown & Duguid, 1991; McDermott, 1998).

The next section more fully conceptualises both innovation processes and communities of practice. Following this, the paper briefly describes the organizational context of the seven case study companies, as well as the type of innovation projects they were undertaking. This section of the paper also contains empirical evidence on the extent to which communities of practice existed in the case companies. The following section, which represents the empirical core of the paper, describes the empirical evidence on the inter-relationship between the organizational CoPs outlined and the innovation processes being carried out. The main body of the paper then closes by discussing the theoretical implications of the data presented.

Theorization on Communities of Practice and Innovation Processes

The communities of practice concept is based on two central premises: the activity based nature of knowledge/knowing, and the group based character of organizational activity. The development of an activity based view of knowing in organizations, what Cook and Brown refer to as an "*epistemology of practice*" (1999), has been developed to overcome what are regarded as the limitations of traditionally static, objectified views of knowledge (Blackler, 1992; Brown & Duguid, 1991; Clark, 2000, Ch. 13; Tsoukas & Vladimirou, 2000). While traditional, static views of knowledge are based on a dichotomy between thinking and doing, in stark contrast, the activity based perspective suggests that this represents a false separation. Thus thinking and doing are fused in knowledgeable activity, the development and use of embodied knowledge in undertaking specific activities/tasks. Secondly, these organizational activities are typically social/communal activities (Gherardi *et al*., 1998; Hayes & Walsham, 2000; Lave & Wenger, 1991; McDermott, 1999; Raelin, 1997). Barnes (1977, p. 2) provides a concise summary of this idea in the following quote,

> *"knowledge is not produced by passively perceiving individuals, but by interacting social groups engaged in particular activities. And it is evaluated communally and not by isolated, individual judgments."*

Fox (2000, p. 854), and Contu and Willmott (2000, p. 272) reinforce this when they define communities of practice, as, respectively, a group of people involved in a shared practice, and a community which reproduces its knowledeability through common, collective practice. Thus activity is embedded in the particular social-occupational-functional groups that people work within. Knowing and working are therefore, ultimately social processes involving an ongoing interaction among individuals working within the same context, or addressing similar issues. For example, DeFillippi and Arthur (1998, pp. 131–132), in a study of film production showed that for apprentice technicians processes of learning by watching were crucial. Also, Brown and Duguid (1991), drawing heavily on Orr's (1990) study of photocopy repair engineers, also showed how knowing was an ongoing, development process, based in engaging with day to day, practical tasks.

Based on such insights Baumard defines a community of practice as a, "*community of practitioners within which situational learning develops*", which results in the community developing, "*a system of relationships between people, activities and the world*" (1999, pp. 209–210). Communities of practice thus typically possess three primary characteristics. Firstly, participants in a community possess a stock of common, shared knowledge. Secondly, communities typically also develop shared values and attitudes. Finally, and equally importantly, participants/members of communities also possess a sense of collective/group identity (Brown & Duguid, 2001).

The relationship between communities of practice, and the implementation of innovations is potentially of great interest for a number of reasons. Firstly, the communities of practice which exist in organizations are likely to influence the implementation process. The socio-technical perspective considers the implementation of technological innovations as involving the mutual adaptation of the technological system being implemented, and the organizational context within which they are being introduced (Badham *et al*., 1997; Bryman, 2000, p. 470; Fleck, 1997; Mcloughlin, 1999; Scarbrough & Corbett, 1992; Leonard Barton, 1995; Orlikowski, 1992). From this perspective the integration of knowledge represents a key element of these processes, typically involving the customization of "new" knowledge and artefacts and their integration with existing organizational structures, practices and knowledge (which will themselves require some level of customization) (Barley, 1986; Hislop *et al*., 1997; McCabe, 1996;

Harris, 1997). Thus, if communities of practice both shape the distribution of knowledge in organizations, and are important reservoirs of knowledge, the specific character of an organizations communities of practice may significantly influence the dynamics of technological implementation processes. Dougherty (2001), for example, suggests that one of the defining characteristics of successful innovating organizations is their effective cultivation, use and support for organizational communities of practice.

Another reason for examining the relationship between innovation processes and communities of practice is that the relationship between them is likely to be two way, and not simply unidirectional. Thus not only will an organization's communities of practice influence the nature of innovation processes, but the changes being implemented may also have implications for the communities. Lave and Wenger (1991, pp. 113–117) suggest that there is likely to be tensions and contradictions within any community of practice between continuity and change, i.e. between the sharing and utilization of existing practices/knowledge, and the evolution, development and ongoing modification of these practices. The implementation of technological innovations such as those examined thus represent a potential discontinuity impinging upon the practices, knowledge and norms of existing communities of practice.

Finally, the community of practice concept can also supplement and enrich our understanding of the dynamics of innovation processes through providing a new analytical concept with which to more fully understand behaviour during the implementation of innovations. Thus, for example, while issues such as the dynamics of inter-functional and business unit relations are well developed in the mainstream innovation literature, the community of practice concept provides a potentially useful extra dimension with which to characterize and explain these dynamics.

Organizational Context: Organization-wide Innovations, Fragmented Knowledge, and Multiple Communities of Practice

This section of the paper describes the character of the organizations and innovations which are examined, outlining their cross functional, multi-site character, and concludes by outlining the range and types of community of practice which are affected by, and involved in the change projects examined. The data presented is from seven detailed longitudinal case studies, all of which were implementing similar, standardized, cross functional, multi-site information management systems. Each company was visited at least twice (typically there were 3–4 visits per company), with visits occurring over a time period of between one year and 18 months. The focus of the research was on the progress and

Table 1. Organization and innovation characteristics.

Company	Company Details	Innovation Type	International Project	Number of Sites Involved in Innovation Project
UK-Cast	UK base International specialist castings and injection mouldings	ERP System (Enterprise Resource Planning)	Yes	12
UK-Pharm	Specialist, international pharmaceuticals corporation	ERP System	Yes	4
UK-Pen-Gem	UK Pension and life assurance company	Sales Automation Tool	No	60
UK-Pen-Swin	UK Pension and life assurance company	Telephone Service Centre	No	10+
France-Connect	French. mechanical connectors	ERP System	No	6
Neth-Bank	Dutch based, international bank	Intranet	Yes	100+
Swed-Truck	Swedish based, international fork lift truck company	ERP System	Yes	11 divisions (20+ sites)

dynamics of the implementation projects described, with the longitudinal nature of the research allowing each implementation project to be followed over a number of stages. The source of data in each of the companies was semi-structured interviews with a range of project, and general management representatives. Table 1 lists the general characteristics of the case companies, the innovations examined, and the number of sites involved in the changes.

One issue, worth briefly commenting on is the organizational context to the focal innovations. In all seven companies, the stated managerial objectives from their innovation projects were extremely similar and were concerned with the closely inter-related objectives of improving co-ordination levels (between sites, functions, business units), and/or developing greater levels of standardization

Table 2. Objectives of change.

Company	Change Type	Stated Managerial Objectives of Change
UK-Cast	ERP System	• Standardization of operating practices/IT systems • Improve cross business co-operation
UK-Pharm	ERP System	• Improve efficiency of manufacturing practices • Improve cross functional co-ordination • Improve inter-business co-ordination of manufacturing
UK-Pen-Gem	Sales Automation Tool	• Automation and standardization of sales support processes • Improve co-ordination between sales offices and corporate centre
UK-Pen-Swin	Telephone Service Centre	• Improve customer service and business retention • Improve co-ordination of assurance and pensions business
France-Connect	ERP System	• Improve/Introduce co-ordination across sites/businesses • Improve cross-functional communications
Neth-Bank	Intranet	• Create a “networked bank” • Improve co-operation across business units
Swed-Truck	ERP System	• Standardization of business processes/IT systems in Europe

(see Table 2). This issue will be returned to later, as it had quite significant implications for many organizational CoPs.

From the research conducted a number of general conclusions can be drawn regarding the communities of practice which existed in the case companies. One of the most striking common feature across all seven companies was the fragmented nature of their knowledge bases. To some extent this was related to their multi-site, multi-divisional character. However, in relation to the focus of this paper, one of the most important consequences of this fragmentation was that each organization possessed a large number of separate, and distinct communities of practice. Further, because the innovations examined were organization-wide in scope this meant that in each of the case companies significant numbers of communities both possessed organizational knowledge of relevance to the innovations being implemented, and were also affected by the changes that were occurring.

Finally, not only did the case companies all contain large numbers of distinct communities of practice, there were also a number of different and distinctive types of community. The most typical focus for these communities were business units and functions. This was largely because within these organizations work activities tended to be sub-divided and separated along these lines. Thus, any individual, or group of individuals had responsibility for, and involvement with a specific range of work activities. These groups of individuals can be referred to as communities of practice, as they possessed, to differing degrees, all three of the characteristics of such communities outlined above (some common knowledge/practices, a shared sense of identity, and some element of common, work related values). Table 3 provides a brief summary of the characteristics of the main communities of practice in the case companies which were relevant to the innovation processes examined.

These characteristics can be more fully illustrated by describing one of the cases in detail. In the case of Swed-Truck, which sold, rented and serviced fork lift trucks, work was organized into small, discrete business units, which had responsibility for all business within specific geographic regions (typically nationally focused). Within this structure, there was, in general, little need for interaction between business units, and they operated as virtual stand-alone businesses. The structuring of work within Swed-Truck had historically been managed like this, and had, to some extent become institutionalized.

While each of the national business units in principle sold the same range of products and services, in reality they had significant autonomy over how they did this. This was not only because the nature of the market, and character of customers varied significantly for each business, but that management in each business unit offered different levels of service and support to their customers. This resulted

Table 3. Communities of practice.

Company	Common Identity	Common Knowledge	Share Values	Origin
UK-Cast	Business unit	Localised, specific business knowledge (products, markets, etc).	Autonomy of business unit is positive (provides flexibility to respond to particular market/customer demands).	Corporate centre acted as holding company. History of relatively strict autonomy for BUs.
UK-Pharm	Business unit & function	Localised, specific business knowledge & specialized functional knowledge.	• Business — localised autonomy is good. • Function — collegiality within functions, but inter functional antagonism & rivalry for status.	Historical culture of functional and site/ business isolation. Sites focused on particular product lines. Lack of co-ordination between sites.
UK-Pen-Gem	Business unit & function	Localised, specific business knowledge & specialized functional knowledge.	• Business — localised autonomy is positive. • Function — collegiality within functions, but specialised nature of knowledge makes inter functional interaction difficult.	Strong historic culture of sales function autonomy. Also, dominant historical culture of product/business "silos" which operated in isolation.
UK-Pen-Swin	Business unit & function	Localised, specific business knowledge & specialized functional knowledge.	• Business — localised autonomy is positive. • Function — collegiality within functions, but specialised nature of knowledge makes inter functional interaction difficult.	Dominant historical culture of product/ business "silos" which operated in isolation from each other. Isolation and independence of IT, administration and sales.

Table 3 (*Continued*)

Company	Common Identity	Common Knowledge	Share Values	Origin
France-Connect	Function & geographic site	Specific functional knowledge.	Collegiality within functions, but inter functional antagonism & rivalry for status.	Dominant historical culture of functional isolation. Functional isolation reinforced by geographic separation of main functions (production, sales, IT).
Neth-Bank	Business unit & occupation	Localised, specific business knowledge & technical, occupational knowledge.	• Business — localised autonomy is positive. • Occupation (IT) — sense of collegiality and commitment to help and share knowledge.	Dominant, historic culture of business unit autonomy. Antagonistic, competitive relations between BUs.
Swed-Truck	Business unit	Localised, specific business knowledge.	Autonomy of business unit is positive.	Historic culture of business unit autonomy. Limited interaction between BU's.

in the development of separate and somewhat specialized knowledge communities, which only had knowledge of their own customers and working practices. The autonomy of the business units was such that the evolution and development of their working practices, the upgrading of their IT systems etc, was done purely on the basis of local considerations, and issues of corporate wide compatibility were never considered. Thus, discrete and specific knowledge communities developed, with staff in each business unit possessing substantial amounts of specialised knowledge, relevant to their own localised working practices, and customer demands, which had limited transferability and relevance, in other business units.

The implementation of a corporate wide information management system into this context had a number of implications for these local, business unit focussed communities of practice, as will be seen. Primarily, the introduction of greater levels of standardization to some extent impinged on the autonomy of the communities over how they worked. Ultimately, the greater level of interaction between and knowledge sharing amongst local communities that the changes required to some extent threatened the local communities through (attempting) to create a larger, organization-wide community. Thus, the technological innovation being implemented by Swed-Truck had quite significant implications for it's traditional, business unit focused communities of practice.

Relations Between Communities of Practice and Innovation Processes

This section of the paper presents the main empirical evidence from the organizations/innovation processes examined. The richness of the qualitative data that was collected means that, within the space available in a paper, it is impossible to fully do justice to it. Thus, to address this specific episodes/aspects from some of the case studies are presented to illustrate the diversity of ways in which the communities of practice and innovation processes interacted. This section is therefore structured thematically. A summary table (see Table 4 later) also draws these findings together. Finally, where other published data exist on the case companies, references are given, as they provide more detailed analyses.

As illustrated in the previous section, the broad, typically organization-wide scope of the innovation processes examined, combined with the fragmented nature of (all) the organizational knowledge bases meant that a diverse range of different communities of practice were involved. In fact, this arguably represents one of the defining characteristics of the innovation processes examined. These innovation processes thus required the co-ordination and management of personnel with significantly different knowledge bases, experiences, values and identities. As

will be seen, this was an important aspect of these innovation processes, as one of the main ways in which the communities of practice affected them was through the character of the interaction between different communities.

The innovation processes examined provided evidence that the existence of communities of practice can act to either inhibit, or facilitate the utilisation and sharing of knowledge. Therefore while the existence of the communities of practice identified undoubtedly had a significant impact on the innovation processes examined, their overall effect was somewhat ambiguous. The rest of this section describes different episodes which illustrate key aspects of the relationship between the innovation processes examined, and the organizational communities of practice, involved in, or affected by these processes.

Ambiguous effects: Neth-Bank

The ambiguity referred to is well illustrated by the case of Neth-Bank, where communities of practice both inhibited, and facilitated processes of knowledge sharing in its attempts to develop a corporate wide intranet system. As with all the other case companies, Neth-Bank had a strong historical culture of business autonomy. It had historically been structured into distinct and separate business units, which operated separately from each other. This therefore influenced the development of distinct communities of practice within these business units, whose staff typically had little or no knowledge of the work carried out in other business units. Further, relations between these communities were typically antagonistic and competitive, rather than supportive (Newell *et al*., 2000; Swan *et al*., 1999).

The innovation that was studied within Neth-Bank, the development of its global intranet, was an attempt to overcome this, and develop a more co-operative culture. However, without exception, the various intranet (sub) projects that were developed were significantly inhibited by the reluctance of staff from different business units to collaborate and share knowledge with each other. The character of these business communities proved to be one of the major factors inhibiting the development of their global intranet, which required them to work together collectively to effectively implement it. In fact, what occurred in Neth-Bank was that each business unit developed it's own, separate and distinctive intranet system. Thus, ironically, an innovation whose intention was to improve inter-business unit collaboration in the end had the effect of reinforcing rather than reducing business unit boundaries.

At the same time within Neth-Bank, however, another type of community of practice existed, a professional community of practice focused around their IT activities. While IT staff within Neth-Bank typically had a business unit focus,

being employed by, and working within specific business units, there was evidence that a significant number of IT personnel also possessed a sense of identity as being part of an organization-wide IT community, which to some extent transcended their narrower business unit identities. In contrast to the narrowly focused business unit communities, many IT staff, who were part of this community, had a positive, supportive impact on the development of the intranet. This was visible through the informal sharing of knowledge amongst IT staff, across business units, with business unit boundaries appearing not to inhibit these processes. These processes of knowledge sharing arguably supported the development of the global intranet through facilitating the dissemination of relevant, and important specialist knowledge. However, these communities were limited by the fact that they were typically partial, and highly localised, being based on the personal, informal networks of different IT staff. Therefore, their impact of the intranet projects was limited, and they weren't able to counterbalance the knowledge hoarding of the business communities.

Inhibiting knowledge sharing: Clashes between functional communities

In two of the companies, UK-Pharm, and France-Connect, their communities of practice had a uniformly negative influence on their innovation projects. In both companies there had been a historical culture of autonomy and isolation between the main functions involved in and affected by the innovations examined (sales, manufacturing and IT in both cases). As with Neth-Bank's business units, relations between them had typically been competitive and antagonistic. Further, in both cases these functional groups could be described as communities of practice as they had developed their own specific specialist knowledge and values and had a coherent sense of identity. In both companies these characteristics of their functional communities of practice significantly inhibited the progress of the innovation processes examined, as they failed to effectively work together and share relevant knowledge as was necessary for the success of the innovations. As a consequence, in both cases, not only were the implementation timetables extensively delayed, but the overall functionality of the innovations were also significantly compromised.

These cases are also of interest due to the way that the attitudes and behaviours of the functional communities of practice were shaped by the effect that the innovations processes had on them. The lack of co-operation and participation by the different communities of practice in both companies was due as much to the perception that they would be adversely affected by the innovations being implemented, as by any antagonism between the communities. In these companies different communities developed a perception that they would lose autonomy and

power from the implementation of an organization-wide information management system. These communities treasured their historical autonomy, and interpreted the proposed changes as being about reducing, attacking or undermining it through the development of (as they saw it) more standardised and centrally controlled working practices. Thus, in these two cases the two way nature of the relationship between innovation processes and communities of practice was clearly evident.

Local community loyalties: Resistance and transcendence

In UK-Cast and Swed-Truck, communities of practice were typically organized around business units, rather than functions. Further, while the innovations in both cases could be interpreted as reducing and undermining the historical autonomy of these communities, the communities of practice in these companies reacted quite differently to the changes that were being implemented. While in both companies, the innovations being implemented witnessed a move from highly autonomous and locally determined practices, towards more constrained local autonomy and the use of more standardised practices, in Swed-Bank these changes were embraced, while in UK-Cast they were challenged.

In the case of Swed-Truck, whose innovation process was one of the most successful of the seven companies examined, the project management methods used played a significant role in encouraging staff from business communities of practice to transcend their traditionally localised senses of identity and embrace and support the changes being implemented (Hislop, 1999; Swan *et al*., 1999). In the development phase of their innovation project, a cross-business unit project team was utilised. Further, the project team were able to create a sense of involvement and participation among local staff during the roll-out phase, as they were allowed to have an important role in local customisation activities. These project management methods had the effect of creating support for, and active involvement in the innovation process in Swed-Bank by staff from all but one business unit, and their project was deemed a success internally.[1]

These generally positive attitudes to change by Swed-Truck business communities contrasted starkly with the more generally negative reaction of staff in UK-Cast to an innovation with similar objectives. In UK-Cast the localised, business unit focussed communities of practice were resistance to UK-Cast's

[1]The only resistance of any significance in Swed-Truck's case was by one local business unit. Interviewees were extremely divided about the source of this resistance. In the end their resistance was overcome by a combination of carrot and stick methods, where some of their concerns were deemed legitimate and addressed, while others were challenged, rejected and ignored.

Table 4. Effects of community of practice on innovation processes.

Company	Community Type	Effect of CoPs on Innovation Process
UK-Cast	Business	• Need to involve staff from range of business unit communities with knowledge of their processes-systems. • Strength of identity to BU's produced resistance to change. Change seen as threatening BU autonomy.
UK-Pharm	Functional & Geographic	• Antagonistic functional communities inhibited co-operation. • Need to involve staff from range of business unit communities with knowledge of their processes-systems. • Production function/community highly resistant to change — seen as challenging their power. • Site based identity overcome through careful selection and training.
UK-Pen-Gem	Functional & Business	• Staff from sales function/community not involved in project development.
UK-Pen-Swin	Functional & Business	• Need to involve staff from product area communities with knowledge of their processes/systems. • No significant resistance to change.
France Connect	Functional & Geographic	• Antagonistic functional communities inhibited co-operation. • Cross functional nature of innovation required involvement of staff from all functions. • Strong resistance to change from sales function — seen as challenging their power/autonomy.
Neth Bank	Occupational & Business	• Need to involve staff from range of business unit communities with knowledge of their processes-systems. • Management staff from BUs resistant to development of global intranet — seen as undermining their autonomy. • Cross-BU co-operation of some IT staff supported intranet development.
Swed-Truck	Business	• Need to involve staff from range of business unit communities with knowledge of their processes/systems. • Negligible resistance to change.

proposed changes as they were interpreted as being against the interests of the local business unit communities. In this innovation process, a them-versus-us dynamic emerged between the corporate centre ("them"), who were interpreted as imposing change which would increase significantly levels of central control, and the local business units ("us") who the local communities interpreted as being the losers, through the dilution of their highly treasured autonomy. Thus, the innovation was seen to threaten existing and traditional communities of practice, which produced a negative reaction to the changes that corporate management in UK-Cast were attempting to implement.

The general findings, outlining the inter-relationship between the communities of practice and innovation processes, are detailed in Table 4.

Discussion

This section of the paper draws together the dominant themes and issues which emerge from the empirical data just examined, and links back to the theoretical issues touched on at the start of the paper. Before doing this, it is necessary to acknowledge the limitations of the empirical data utilised. Firstly, the case study based nature of the research, and the anecdotal nature of the evidence presented limits the generalizibility of the conclusions. Thus, further research is necessary to evaluate the generalizibility of the findings presented. For example, the research specifically examined innovations with organization-wide implications, thus further research could be done of different types of innovation, which may involve and affect different ranges and types of communities in different ways.

After some general issues have been discussed regarding the nature of organizational activity and knowledge, the discussion will examine three focal themes in detail: the two way nature of the relationship between innovation processes and communities of practice; the (significant) difficulties involved in sharing knowledge between different communities of practice; and the potentially negative aspects of communities of practice.

The empirical evidence presented reinforced and supported the suggestions made earlier in the paper concerning both how knowledge/knowing in organizations is deeply embedded in practice/activity and further, how such organizational practice is typically collective in nature (Barnes, 1977; Brown & Duguid, 1998; McDermott, 1999). Thus the different communities of practice in each organization developed their specialized and localized knowledge through the autonomy they had to structure, organize and carry out the (collective) tasks and activities they deemed necessary to meet the specific needs of their particular customers and market conditions. Thus the communities examined developed specialized knowledge both as a consequence of the autonomy they had, as well

as the specificity of their customer/market conditions. Therefore, the communities of practice identified did provide an important social mechanism through which knowing and understanding developed, and further, they also represented important reservoirs of knowledge within the case companies.

The empirical evidence presented also reinforced arguments concerning the diffused, fragmented and highly differentiated nature of organizational knowledge (Clark, 2000, pp. 255–257; Fox, 2000), and that organizations can be usefully conceived as distributed knowledge systems (Blackler *et al.*, 2000; Grant, 1996; Tsoukas, 1996). All of the case companies examined contained large numbers of separate and distinct communities of practice, with their own specialist knowledge bases. Therefore, they require to be viewed as a "community-of-communities" (Brown & Duguid, 1991, p. 53), making one of the general tasks of management being to co-ordinate these diverse communities (Brown & Duguid, 2001; Cohen & Levinthal, 1990; Kogut & Zander, 1992).

Relations between communities of practice and innovation processes

In general terms, the data presented reinforces the mutuality of the relationship between innovation processes and communities of practice, thus, not only did the communities of practice affect the dynamics of the innovation processes researched, but the innovation processes has some quite significant consequences for the organizational communities of practice.

One of the most significant ways in which the communities of practice affected the innovation processes examined was through the way they influenced attitudes and behaviour of their members/participants. This was visible in two main ways. Firstly, the sense of identity workers had as being part of a community, combined with their interpretation of how their community was being affected by the innovations examined significantly shaped their general attitude to the innovations. Thus, in Swed-Truck the business unit communities supported the changes being implemented, as did the IT based occupational community in Neth-Bank. Equally, the negative reaction of UK-Cast's business unit communities, and UK-Pharm and France-Connect's functional communities to their innovations could equally be explained in this way. These findings are also reinforced by another study which showed how scientific communities of practice in a UK research organization resisted moves towards commercialization as they interpreted this change as being fundamentally in contrast with the values of their community, which was related to developing scientific knowledge as an end in itself, rather than the commercial exploitation of scientific knowledge (Breu & Hemingway, 2002).

Secondly, the sense of identity that the workers in the case companies had to specific communities of practice also significantly shaped with whom they were willing to share knowledge. Thus, the antagonistic and competitive nature of relations between Neth-Bank's business unit communities, and UK-Pharm and France-Connect's functional communities of practice shaped their reluctance to share knowledge important to the innovations being implemented with each other.

The impact of these attitudes and behaviours on the innovation processes examined was significant, and crucially affected their degree of success. Thus the relative success of Swed-Truck's innovation and the relative failure of Neth-Bank's, UK-Pharm's and France-Connect's innovations was to a significant extent shaped the willingness or reluctance of relevant communities to share their knowledge with each other. This therefore reinforces the socio-technical perspective on innovation processes (embodied most clearly in the work of Leonard Barton, 1995; McLoughlin, 1999 and Orlikowski, 1992), which considers the blending and integration of artefacts and knowledge as being a fundamental component of all technological innovation processes.

The type of innovations examined, which have impacts and relevance for a range of different CoPs can be referred to as boundary objects (Brown & Duguid, 1998). Boundary objects, which can be physical, symbolic, or linguistic, can be utilized to develop relations between the communities they impact on, through providing a common focus (Gherardi & Nicolini, 2002). The relative success of Swed-Truck and UK-Pen-Swin's implementations is arguably because the project management methods utilized emphasized and utilized this aspect of these innovations. This resulted in community members learning that the different communities had more in common than had historically been understood to be the case, with this realization creating an element of willingness among people to collaborate in inter community collaboration.

The innovation processes examined also had significant consequences for the organizational communities of practice, which as illustrated, to some extent shaped their reaction and attitudes towards the innovations. The innovations examined were regarded by community members as presenting a potentially significant threat to the existence and viability of the their traditional communities of practice. This was because these innovations potentially undermined the three core elements of these communities: their knowledge, identity and values.

The implementation of an organization-wide information management system was regarded as threatening the **values** of independence and autonomy, which most communities treasured (see Table 3). This was because such systems, requiring a greater level of standardization than had been historically traditional (see Table 2), were felt to reduce the ability of divisions to respond independently to the specific need of their markets and customers. Secondly, and relatedly, these

innovations were perceived as threatening the **common knowledge** base of these autonomous communities through devaluing and making redundant the specific knowledge they possessed, and replacing it with more standardized knowledge and working practices developed at a corporate level. Thus the ability and need to develop local knowledge was regarded as being reduced. Finally, these innovations were also perceived to threaten and weaken the sense of **identity** possessed by community members. This sense of identity existed and was sustained because these communities had the ability to develop an independent body of common knowledge, shaped by the value of having local autonomy. Thus, by potentially undermining the values and knowledge of these communities, the innovations examined were also perceived as weakening the bonds which created a coherent and independent sense of identity.

Thus, overall the relationship between the implementation of innovations, and CoPs can be seen as two way: not only do organizational CoPs affect the dynamics of innovation processes, but these innovation processes will impact on and affect the organizational CoPs. Separating cause from effect in such a relationship is thus likely to be difficult. This relationship is summarized in Fig. 1.

These findings reinforce the idea that communities of practice are dynamic rather than static, and that they evolve over time (Fox, 2000). Lave and Wenger (1991) suggested that there are likely to be tensions between continuity and change, as new practices, or changes in the constitution of communities may threaten or undermine existing practices and social relations. Such tensions are likely to occur on an ongoing basis, as members of communities grow old and their skills and competencies change, and through changes in the membership of communities, as some members of a community leave, and new ones join. What the research data presented suggests is that if new organizational innovations introduce a significant discontinuity in working practices, then the conflict and

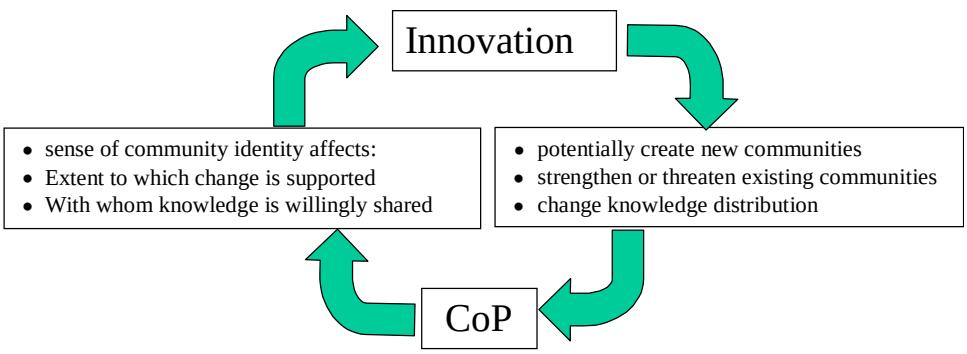

Fig. 1. Innovations and communities of practice.

tensions this produces may well result in organizational communities of practice not supporting these innovations.

The (not insignificant) difficulties of knowledge sharing between communities

One of the starkest findings from the research data presented was that the sharing of knowledge between different communities of practice was by no means straightforward. Thus, in Neth-Bank and UK-Cast there were problems in sharing knowledge between their business focussed communities of practice, and in UK-Pen-Gem, UK-Pharm and France-Connect there were problems in knowledge sharing between their functional communities of practice. In fact, the research data suggests that there are a number of significant difficulties to such processes.

Acknowledging and examining the differences of sharing knowledge within and between communities, and the potential difficulties involved in sharing knowledge across communities requires to be addressed as they are issues which are neglected in much of the literature on this subject (for example, see Brown & Duguid, 1991; DeFillippi & Arthur, 1998; McDermott, 1998). Arguably, this is because much of the communities of practice literature focussed narrowly on the dynamics of knowledge sharing within communities.

As has been well illustrated by the majority of the communities of practice literature, the existence of communities of practice facilitates the sharing of knowledge within a community, due to both the sense of collective identity, and the existence of a significant common knowledge base. However, the sharing of knowledge between communities is much more problematic, due to the lack of both these elements. Thus the dynamics of knowledge sharing within and between communities of practice are likely to be qualitatively different, with the sharing of knowledge between communities typically much more complex, difficult and problematic (Brown & Duguid, 1998).

Taking the issue of divergent identities first, the existent of different identities between different communities of practice arguably complicates the knowledge sharing process through the perceived or actual different interests between communities and the potential for conflict this creates. This was visible in the majority of the case companies, and, as illustrated earlier, one factor inhibiting knowledge sharing between communities examined was the perception that there were significant differences of interest. These findings are not unique to the case companies examined, as other research has shown that actual or perceived difference of interest have actively inhibited processes of knowledge sharing (Ciborra & Patriotta, 1998; Hayes & Walsham, 2000; Lazega, 1992; Storey & Barnett, 2000). In general terms, the communities of practice literature tends to

play down, or neglect issues of power, politics and conflict; however, this represents a general weakness of much of the contemporary literature on organizational knowledge (Hayes & Walsham, 2000; Blackler, 1995; Swan & Scarbrough, 2001).

The other factor which arguably complicates the sharing of knowledge between communities of practice, is the distinctiveness of their knowledge bases, and the lack of common knowledge which may exist. Further, not only is the knowledge of these communities different, but their knowledge bases may also be based on qualitatively different assumptions, and interpretative frameworks (Tsoukas, 1996; Becker, 2001). Brown and Duguid (2001) referred to these as "*epistemic differences*", which significantly increase the difficulty not just of sharing knowledge between communities, but understanding the knowledge of another community and the assumptions it is based on, in the first place. Thus, the limited degree of common knowledge which can exist between different communities is likely to inhibit and complicate the sharing of knowledge.

Thus, paradoxically, the features which make communities of practice effective vehicles for the communication and knowledge sharing within a community, a shared common knowledge base, and a sense of collective community identity, may inhibit knowledge sharing across communities (Alvesson, 2000). For the type of cross-functional, multi-site innovation examined in this paper, which typically involved staff from a range of communities having to work together, this issue was extremely pertinent, as the innovation processes examined involved and required a substantial amount of knowledge sharing between communities.

The potential and unexplored dark side of communities of practice

While the period since the late 1990s witnessed an enormous growth of interest in the concept of communities of practice, the vast majority of the writing on the topic has been saturated in an almost suffocating optimism. Thus communities of practice have been variously argued to underpin levels of organizational innovativeness, (Amidon, 1998; Brown & Duguid, 1991; Dougherty, 2001; Liedtka, 1999; Mitsuru, 1999), support and encourage organizational, individual and group learning (DeFillippi & Arthur, 1998; Iles, 1994; Lave & Wenger, 1991; Raelin, 1997), and facilitate processes of knowledge sharing (Brown & Duguid, 1998; Hildreth *et al*., 2000; McDermott, 1999; Ward, 2000). Connecting to the issue examined in the previous section, this bias may be a consequence of the fact that the communities of practice literature has typically focused rather narrowly on intra-community dynamics and knowledge sharing, rather than on inter-community dynamics. Arguably, however, through emphasizing the positive aspects to communities of practice, this work has tended to neglect or overlook any potential negative consequences to them.

For the community of practice concept to be a useful analytical tool for understanding organizational processes and innovation dynamics a more balanced perspective is needed which accounts for both the potential benefits and disadvantages of communities of practice. The data presented in this paper, for example, suggests that communities of practice are just as likely to resist as to support innovation processes, and that they have the potential to inhibit as much as facilitate knowledge sharing. Breu and Hemingway (2002) also show how communities of practice do not necessarily support innovations that are not deemed to be compatible with community interests.

Other work also suggests further ways in which communities of practice may have a dark side. Alvesson (2000), Baumard (199, p. 211), and Brown and Duguid (2001) all suggest that if communities of practice have a particularly strong sense of identity this may create a sense of exclusion and isolation which may inhibit communication or collaboration with the wider organization. Leonard and Sensiper (1998), and Starbuck and Milliken (1998) also suggested that a potential negative aspect to any closed working group was the way they could blinker thinking, which can result in the exclusion or sidelining of relevant ideas.

Conclusion

As outlined earlier, the twin objectives of the paper were to firstly provide empirical evidence on whether and how communities of practice influenced the appropriation of innovations in a number of case study organizations, and secondly contribute to theory on innovation processes through utilizing the community of practice concept. In general, the “communities of practice” concept proved useful and relevant for understanding the dynamics of the innovation processes examined. Not only were a wide range of communities of practice identified in all seven case companies, but they were also found to exert a significant influence in the innovation processes examined. Thus it is suggested that the communities of practice concept represents a potentially useful analytical tool for understanding the dynamics of innovation processes, and knowledge sharing practices more generally.

The data presented showed that for all of the case companies examined, organizational knowledge tended to be specialized, fragmented and highly diffused across sites, functions and business units. Further, this knowledge tended to be concentrated in specific communities of practice, with each community having responsibility for, and conducting a particular range of organizational tasks. This therefore reinforced Brown and Duguid’s (1991) vision of an organization as constituting a “community of communities”. One of the major effects of this on

the innovation processes examined was that they typically involved the collaboration of a wide range of different communities of practice.

Sharing and utilising knowledge between different communities of practice, which is an issue not adequately addressed in the large majority of the academic literature on the subject, was found to be a non-trivial issue. Firstly, the narrow specialist nature of knowledge which can develop within communities, may create problems of communication and understanding with individuals not in possession of this specialist knowledge, particularly as the knowledge of specialist communities may be based on very different assumptions and interpretative frameworks (Becker, 2001). Secondly, the sense of identity that individuals can invest in communities may act to inhibit the communication or sharing of their knowledge with individuals outside of the community of practice, particularly if there is a perception that the interests of different communities may be in conflict (Storey & Barnett, 2001).

While the majority of the communities of practice literature has typically emphasized their positive effects on knowledge sharing, the data presented here suggests that they had a more ambiguous impact. Thus, while there was evidence that communities facilitated the sharing of knowledge in some circumstances, in others, they actively inhibited it. Thus, while the communities of practice concept is useful in understanding and explaining the dynamics of innovation processes, such an analysis should be open to the possible negative aspects to communities of practice, to avoid the blinkered focus on their advantages which occurs when the concept is reified.

References

Alvesson, M. (2000) Social identity in knowledge-intensive companies. *Journal of Management Studies*, **37**(8), 1101–1123

Amidon, D. (1998) The evolving community of knowledge practice: The Ken awakening. *International Journal of Technology Management*, **16**(1/2/3), 45–63

Badham, R., Couchman, P. & McLoughlin, I. (1997) Implementing vulnerable socio-technical change projects. In *Innovation, Organizational change and technology*, ed. I. McLoughlin & M. Harris. London: Thomson

Barley, S. (1986) Technology as an occasion for restructuring: Evidence from observation of CT scanners and the social order of radiology departments. *Administrative Science Quarterly*, **31**, 78–108

Barnes, B. (1977) *Interests and the Growth of Knowledge*. London: Routledge and Kegan Paul (Routledge Direct Editions)

Baumard, P. (1999) *Tacit Knowledge in Organizations*. London: Sage

Becker, M. (2001) Managing dispersed knowledge: Organizational problems, managerial strategies and their effectiveness. *Journal of Management Studies*, **38**(7), 1037–1051

Blackler, F. (1995) Knowledge, knowledge work and organizations: An overview and interpretation. *Organization Studies*, **16**(6), 1021–1046

Breu, K. & Hemingway, C. (2002) The Power of Communities of Practice for Subverting Organisational Change. Paper presented at 3rd European Conference on Organizational Knowledge, Learning and Capabilities, Athens, Greece, April 5–6

Brown, J. & Duguid, P. (1991) Organization learning and communities of practice: Towards a unified view of working, learning and innovation. *Organization Science*, **2**(1), 40–57

Brown, J. & Duguid. P. (1998) Organizing Knowledge. *California Management Review*, **40**(3), 90–111

———— (2001) Knowledge and organization: A social practice perspective. *Organization Science*, **12**(2), 198–213

Bryman, A. (2000) Telling Technological Tales. *Organization*, **7**(3), 455–475

Ciborra, C. & Patriotta, G. (1998) Groupware and teamwork in R&D: Limits to learning and innovation. *R&D Management*, **28**(1), 43–52

Clark, P. (2000) *Organizations in Action: Competition Between Contexts*. London: Routledge

Cohen, W. & Levinthal, D. (1990) Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, **35**, 128–152

Collinson, S. (1999) Developing and Deploying Knowledge for Innovation: British and Japanese Corporations Compared. Paper presented at 15th EGOS colloquium, University of Warwick, 4–6 July

Contu, A. & Willmott, H. (2000) Comment on Wenger and Yanow — Knowing in practice: A "delicate flower" in the organizational learning field. *Organization*, **7**(2), 269–276

Cook, S. & Brown, J. (1999) Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing. *Organization Science*, **10**(4), 381–400

DeFillippi, R. & Arthur, M. (1998) Paradox in project based enterprise: The case of filmmaking. *California Management Review*, **40**(2), 125–139

Dougherty, D. (2001) Reimagining the differentiation and integration of work for sustained product innovation. *Organization Science*, **12**(5), 612–631

Fleck, J. (1997) Contingent Knowledge and Technology Development. *Technology Analysis and Strategic Management*, **9**(4), 383–397

Fox, S. (2000) Practice, Foucault and actor–network theory. *Journal of Management Studies*, **37**(6), 853–868

Gherardi, S. & Nicolini, D. (2002) Learning in a constellation of interconnected practices: Canon or dissonance. *Journal of Management Studies*, **39**(4), 419–436

Gherardi, S., Nicolini, D. & Odella, F. (1998) Towards a social understanding of how people learn in organizations: The notion of situated curriculum. *Management Learning*, **29**(3), 273–297

Grant, R. (1996) Towards a knowledge based theory of the firm. S*trategic Management Journal*, **17**(Winter Special Issue), 109–122

Harris, M. (1997) Power, knowledge and social process in technology analysis: The case of CAD/CAM. *Journal of Information Technology*, **12**, 61–71

Hayes, N. & Walsham, G. (2000) Safe Enclaves, Political Enclaves and Knowledge Working. In *Managing Knowledge: Critical Investigations of Work and Learning*, ed. C. Pritchard, R. Hull, M. Chumer & H. Willmott. London: MacMillan

Hildreth, P., Kimble, C. & Wright, P. (2000) Communities of practice in the distributed international environment. *Journal of Knowledge Management*, **4**(1), 27–38

Hislop, D. (1999) The Movex Project: Knowledge Management at Brightco. In *Case Studies in Knowledge Management*, ed. H. Scarbrough & J. Swan. London: IPD

Hislop, D., Newell, S., Scarbrough, H. & Swan, J. (1997) Innovation and networks: Linking diffusion and implementation. *International Journal of Innovation Management*, **1**(4), 427–448

Iles, P. (1994) Developing learning environments: Challenges for theory, research and practice. *Journal of European Industrial Training*, **18**(3), 3–9

Kogut, B. & Zander, U. (1992) Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, **3**(3), 383–397

Lazega, E. (1992) *Micropolitics of Knowledge: Communication and Indirect Control in Workgroups*. New York: De Gruyter

Leonard, D. & Sensiper, S. (1998) The role of tacit knowledge in group innovation. *California Management Review*, **40**(3), 112–132

Leonard-Barton, D. (1995) *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*. Boston, Ma: Harvard Business School Press

Liedtka, J. (1999) Linking competitive advantage with communities of practice. *Journal of Management Enquiry*, **8**(1), 5–16

McCabe, D. (1996) The best laid schemes o' TQM: Strategy, politics and power. *New Technology, Work and Employment*, **11**(1), 28–38

McDermott, R. (1999) Why information technology inspired but cannot deliver knowledge management. *California Management Review*, **41**(1), 103–117

McLoughlin, I. (1999) Creative Technological Change: The Shaping of Technology and Organizations. London: Routledge

Mitsuru, K. (1999) Strategic innovation in large companies through strategic community management: An NTT multimedia revolution case study. *European Journal of Innovation Management*, **2**(3), 95–108

Newell, S., Scarbrough, H., Swan, J. & Hislop, D. (2000) Intranets and Knowledge Management: De-centred Technologies and the Limits of Technological Discourse. In *Managing Knowledge: Critical Investigations of Work and Learning*, ed. C. Pritchard, R. Hull, M. Chumer & H. Willmott. London: MacMillan

Orlikowski, W. (1992) The duality of technology: Rethinking the concept of technology in organizations. *Organization Science*, **3**(3), 398–427

Orr, J (1990) Sharing Knowledge, Celebrating Identity: War Stories and Community Memory in a Service Culture. In *Collective Remembering: Memory in a Society*, ed. D. Middleton & D. Edwards. London: Sage

Pan, S. & Scarbrough, H. (1999) Knowledge management in practice: An exploratory case study. *Technology Analysis and Strategic Management*, **11**(3), 359–374

Raelin, J. (1997) A model of work based learning. *Organization Science*, **8**(6), 563–578

Scarbrough, H. (1999) Knowledge as work: Conflicts in the management of knowledge workers. *Technology Analysis and Strategic Managemen*t, **11**(1), 5–16

Scarbrough, H. & Corbett, M. (1992) *Technology and Organization: Power, Meaning and Design*. London: Routledge

Starbuck, W. & Milliken, F (1988) Challenger: Fine tuning the odds until something breaks. *Journal of Management Studies*, **25**(4), 319–340

Storey, J. & Barnett, E. (2000) Knowledge management initiatives: Learning from failure. *Journal of Knowledge Management*, **4**(2), 145–156

Swan, J., Newell, S., Scarbrough, H. & Hislop, D. (1999) Knowledge management and innovation: Networks and networking. *Journal of Knowledge Management*, **3**(4), 262–275

Swan, J. & Scarbrough, H. (2001) Editorial — Knowledge management: Concepts and controversies. *Journal of Management Studies*, **38**(7), 913–921

Tsoukas, H. (1996) The firm as a distributed knowledge system: A constructionist approach. S*trategic Management Journal*, **17**(Winter Special Issue), 11–25

Tsoukas, H. & Vladimirou, E. (2000) On Organizational Knowledge and its Management: An Ethnographic Investigation. Paper presented at Knowledge Management: Concepts and Controversies, University of Warwick, 10–11 February, 2000

Ward, A. (2000) Getting strategic value from constellations of communities. *Strategy and leadership*, **28**(2), 4–9