The need for organizations to innovate and furthermore to ceaselessly innovate is stressed throughout the modern management literature on innovation. This need comes from increasing competition and customer demands and new market areas. Closely linked, but not synonymous, with innovation is the body of knowledge referred to collectively as knowledge management. Within this discourse knowledge is considered as a potential key competitive advantage, by helping to increase innovation within the organization. This paper focuses on the role of knowledge management in sustaining and enhancing innovation in organizations. In particular the paper seeks to establish a knowledge management model within which the principles of innovation can be incorporated. First, there is a brief review of the innovation and knowledge management literature and their respective synergies. From this literature a possible knowledge management model which incorporates innovation is suggested. Second, a research study is discussed which seeks to further examine and develop the model using an inductive grounded theory approach. The study involved socially constructed workshops representing 25 organizations, each of which constructed meanings in regard to innovation and the key areas of knowledge management as outlined in the model. Overall it was found that effective systematic knowledge management can incorporate innovation drivers in key areas which will result in both increased business and employee benefits. Copyright © 2000 John Wiley & Sons, Ltd.
category of innovation: how innovation relates to knowledge. The first two categories are vitally important. However, large bodies of knowledge already exist in these areas, while the third area is relatively emergent as a discourse.

KNOWLEDGE MANAGEMENT AND INNOVATION

Concurrently with the developments in the field of innovation, there is the hegemony of knowledge management as a key element in improving organizational competitiveness (Hedlund, 1994). Knowledge management includes new knowledge construction, knowledge embodiment, knowledge dissemination and knowledge use/benefit (Demer est, 1997). Quintas et al. (1997) state ‘Knowledge management is the process of critically managing knowledge to meet existing needs, to... exploit existing knowledge...and to develop new opportunities’. These definitions indicate that knowledge management has the potential to be a catalyst for innovation within organizations.

The aim of this paper is to investigate the possible use of knowledge management within organizations as a catalyst or vehicle for increasing innovation, and hence competitiveness. Existing models of KM fall into three broad categories: intellectual capital models (Edvinsson, 1997), knowledge category models (Nonaka and Takeuchi, 1995) and social constructionist models (Demerest, 1997). The model chosen for the current study is a modified version of Demerest’s model as it is more holistic than the mechanistic intellectual capital models and the reductionist knowledge category models. The model (Figure 1) essentially consists of a highly recursive flow involving four key areas of knowledge.

First, there is the area of knowledge construction where the construction is not limited to that of scientific inputs but includes the social construction of knowledge. Second, the constructed knowledge is embodied within the organization through a process of social interchange. Third, the embodied knowledge is disseminated throughout the organization. Fourth, the use/benefits of KM considers both business and employee emancipatory benefits. In effect, as seen in Figure 1, there is no specific routing of knowledge around these four key areas, but rather a highly recursive dynamic is produced. The contribution of this view of KM towards the development of innovation is considered as follows, based on the four key areas of the model shown in Figure 1.

Knowledge construction and innovation

Knowledge construction includes the creation and recognition of knowledge that is socially constructed as well as that which is scientific in character. Organizations which take this approach are innovative as they allow new types of knowledge to become recognized and applied throughout the organization. Nonaka and Takeuchi (1995) and Boisot (1989) see this innovative recognition and use of knowledge coming from social interaction, where employees are seen as actively constructing knowledge. Amidon (1998) considers this type of knowledge to be the key input for the process of innovation within organizations. This taxonomy of knowledge allows practical and experiential learning processes to be acknowledged as sources or constructs of innovative knowledge (Marshall and Reason, 1993). Hence interaction between employees can be seen as knowledge creation. Furthermore, within these learning processes critical reflection and reflexivity within employees must be encouraged so that ‘taken for granteds’ are questioned and hence the maximum potential of new knowledge is constructed (Alvesson and Willmott, 1996; Demerest, 1997). McCartney (1998) views this process as ‘making nuggets [of knowledge] from where the organization has done things’.

By accepting socially constructed knowledge organizations are not restricted to knowledge being generated by management but can obtain knowledge from all levels in the organization and from outside the organization (e.g. customers, suppliers). Nonaka and Takeuchi (1995) describe this innovation as ‘boundary spanning knowledge construction’. Thus, knowledge construction (Figure 1) is seen as the gateway to innovation within the organisation. Unless knowledge is constructed on both a social and a scientific basis the process of innovation will not become embodied and disseminated within organizations. This failure will ultimately result in a lack of embodied knowledge within new products (Madhaven, 1998).

Knowledge embodiment and innovation

If organizations can ensure the process of innovation commences with new knowledge construction then such knowledge must be embodied (Figure 1) within the organization. The embodiment of new knowledge will enable innovation to become an essential part of the organization (Hedlund and Nonaka, 1993). McCartney (1998) states that ‘the activities that give rise to innovation are basically
the management of knowledge flows’. Polanyi (1962) sees embodiment essential, as in most organizations the rule: ‘we know more than we can tell’ applies.

Attempts to embody the new knowledge should lead to innovative organizational structures (Nonaka and Takeuchi, 1995; Handy, 1989). Organizations no longer need to guard ‘scientific’ knowledge in the apex of pyramidal structures but instead can form learning networks which span geographic location and organizational boundaries. Drath and Paulus (1994) describe such structures as ‘proactive learning networks’. Instead of a ‘them and us’ approach, a ‘collegiate’ pattern develops (Peters, 1992). Boot et al. (1994) view this approach as leading to ‘more agility and responsiveness to innovation’. This agility will become increasingly important as markets become increasingly fragmented (i.e. niche rather than segment driven) and organizations are forced to have ‘ceaseless innovation’ (Demerest, 1997). Innovation is not a ‘one act drama...but an ongoing process’ (Nonaka and Takeuchi, 1995).

Innovative organizational structure alone is not sufficient for the embodiment of new knowledge. There must be concurrent innovative developments within the role of the organization’s people. Peters (1992) states that employees should be considered as ‘brokers of knowledge’ rather than simply as task orientated. Zuboff (1988) describes such employees as ‘knowledge workers’. If these knowledge workers are to thrive and progress the process of innovation by embodying new knowledge within the organization, then the culture of the organization must be addressed. 3M consider the tacit knowledge culture to be essential for innovation (Brand, 1998). Handy (1989) states that the organization must become ‘open’ and receptive to knowledge workers ideas rather than closed. Pitt (1998) states the need for openness and freedom to encourage group interaction and sharing. Millar (1998) describes this as ‘open-mindedness’ in which a blame-free experimental approach can be accepted and adopted. In this innovative environment mistakes must be tolerated (Brand, 1998). The culture is one of ‘openness, learning and collaboration’.

Knowledge workers also increase innovation by turning tacit knowledge into explicit knowledge and by passing tacit knowledge onto others (Nonaka and Takeuchi, 1995; Hedlund, 1994). Wetlaufer (1999) sees this process as involving endless small-group discussions between employees in an open and conducive environment. Brand (1998) considers that this ‘willingness to share’ must ‘permeate the entire fibre of the organisation’. The chief executive of Ford (Wetlaufer, 1999) describes the process as ‘telling stories’ about experiences. Madhaven (1998) states that teams involves in embodying this new knowledge must develop and use new mental models which support innovation. To encourage this process of knowledge embodiment some organizations encourage job rotation and send employees to
work in different parts of the organization. Also, some organizations (e.g. 3M and Caterpillar) set aside specified time periods each week where employees can develop their own innovative ideas in small teams.

In summary, knowledge embodiment can build on new knowledge construction and enable the process of innovation to be further incorporated within the organization.

Knowledge dissemination and innovation

Innovation includes not only the construction and embodiment of new knowledge, but also the dissemination (Figure 1) of proven new knowledge across the organization and its environs (including customers and suppliers) (Demerest, 1997). Only through this dissemination process can Polanyi’s (1962) observation (see above) be addressed. Peters (1992) emphasizes the role of organizational structure in disseminating new knowledge which leads to innovation. He sees learning networks or ‘spider’s web’ type structures as being able to rapidly spread new knowledge which will lead to increased knowledge embodiment in the form of new products and services throughout the organization.

Knowledge dissemination should not be ad hoc but, as pointed by Pitt (1998), ‘exemplar organizations are systematic at making intuitive experiential knowledge explicit and in diffusing it more widely in the enterprise’. Gurteen (1998) sees this happening through dynamic interaction among learning networks (Robertson et al., 1996) which are free from the encumbrances of functional hierarchies. Roberts et al. (1998) point out that it should not be assumed that knowledge flows from the corporate centre but may now be based in the ‘peripheries of the organization. Thus, innovation is no longer the domain of senior management but can arise anywhere and at any level in the organization. Nonaka and Takeuchi (1995) see this new knowledge dissemination as leading to ‘innovation that is systematic and continuous’.

Knowledge workers have a key role in achieving increased innovation through knowledge dissemination. Acting in cross-geographical boundaries these knowledge workers can ‘sift and refine and implement’ (Gurteen, 1998) ideas from across the organization. Sometimes this process is achieved by moving members from successful past teams into new teams in other areas, by job rotation and by using experienced mentors for teams (Madhaven, 1998). As interaction with customers and suppliers increase, the knowledge worker will disseminate and embody new knowledge far beyond the organizational boundaries, leading to increased innovative partnerships and alliances (Nonaka and Takeuchi, 1995).

If organizations are to systematically disseminate new knowledge to achieve increased innovation, as suggested by Pitt (1998), the key processes will need to be identified throughout the organization, its customers and suppliers (Davenport et al., 1996). These common processes will act as rapid carrier vehicles for the increased dissemination of new knowledge. For example, Nonaka and Takeuchi (1995) single out the new product development process as entraining and disseminating new knowledge in all areas of the organization. McCartney (1998) states that these process are essential for the ‘management of knowledge flow’ or dissemination throughout the organization.

Thus, if organizations are to effectively deploy innovation they must ensure that new knowledge, which has been effectively embodied, must also be disseminated throughout the organization if a process of ‘ceaseless innovation’ (Nonaka and Takeuchi, 1995) is to become effective.

Knowledge use/benefit and innovation

Organizations which are noted for being innovative usually have an effective knowledge management system (i.e. construction, embodiment and dissemination of knowledge). For example, 3M’s key mission is to become the most innovative company in the world and it sees effective knowledge management as the way to achieve this goal. 3M requires each one of its businesses to have at least 30% of its sales from products not in the line four years ago (Brand, 1998). The organisation is a good example of organisation’s which, in the words of Nonaka and Takeuchi (1995), ‘ceaselessly innovate’. These characteristics are increasingly important in organizations as traditional predictable markets become ever more fragmented and volatile. To ‘thrive on chaos’ (Peters, 1992), organizations must ceaselessly innovate or decline.

Also, with innovation resulting from effective knowledge management there is an opportunity to ‘square the circle’ of business benefit and employee emancipation. The business benefits of increased growth through innovative new products and services can be paralleled with concurrent increases in employee creativity and empowerment (e.g. Caterpillar allow employees to spend 10% of their time developing their own ideas in small teams).
RESEARCH METHODOLOGY FOR THE CURRENT STUDY

To further develop and investigate knowledge management and innovation a qualitative research study was carried out. The research method is illustrated in Figure 2.

Research survey

The quantitative element of the research methodology involved using a questionnaire to survey the scope of KM in regard to key trends. The survey data was not used to establish reasons and meanings. The survey findings are fully discussed in McAdam and McCreedy (1999).

Participative workshops

The survey data showed who was willing to participate in the workshops, based on the level of their organization’s involvement in knowledge management. Thus, those participating in the workshops were interested and involved in the area of knowledge management and agreed to participate further.

The main purpose of the research was to inductively build theory using grounded theory (Glauser and Strauss, 1967). In this case the grounded approach was that of social constructivist workshops (Easterby-Smith and Thorpe, 1997) involving managers from organizations involved in knowledge management. In these workshops the groups of managers negotiated meaning in relation to a topic (knowledge management and innovation in this case).

This approach is consistent with the overall idea of constructing knowledge socially. The workshops were run by asking the participants to discuss each of four generic areas of the KM process shown in Figure 2. In total there were five workshops run which represented 25 different organizations from all sectors.

WORKSHOP FINDINGS: KNOWLEDGE CONSTRUCTION AND INNOVATION

The entire area of knowledge construction is akin to innovation in that new knowledge is being created which can then be incorporated within the organization (Nonaka and Takeuchi, 1995). This view was summed up by a participant:

‘We are working in the realms of creativity here [workshop discussion on knowledge construction] rather than simply discussing knowledge.’

Effective knowledge construction was seen as opening up the gateway to innovation:

‘I have these facts and figures but how do I use them creatively?’
‘Knowledge is...how to open up possibilities, how to open up other options?’

Gurteen (1998) describes this as the ability to think in ‘an abundance of new ways’ which will open up the road to innovation within organizations.

The participants quickly concluded that knowledge leading to increased innovation would have to be much wider than the paradigm of scientific knowledge construction:

‘It is much wider...for example meeting here, we could be meeting on the shopfloor somewhere having a chat, or an office, there is an argument that we are constructing knowledge [in these situations].’

Thus, it was realized that knowledge construction leading to increased innovation depended on socially constructed knowledge as well as scientifically constructed knowledge (Alvesson and Willmott, 1996). This socially constructed knowledge was considered to be tacit in addition to explicit knowledge:

‘The tacit knowledge is the influential knowledge that will make...dynamic organizations.’

Such a view is similar to that of Boisot (1989) and Hedlund and Nonaka (1993).

When the participants had constructed their wider views on knowledge construction they seemed to recognize the possibilities that were opened up for increased innovation:
‘The knowledge is already in the organization...if we started using it we could make massive developments.’
‘It is learning how to use what you know and identifying what you don’t know.’

This recognition was coupled with the need for personal responsibility to create the new knowledge:
‘That’s where we have to contribute from our perceptions.’

Furthermore, the potential resources for innovation were now grasped:
‘Maybe up to now there has been a resource or asset sitting there that hasn’t been valued within the organization.’
‘There is an awful lot of knowledge within the organization that people do not realize the value for.’

As the participants continued to construct meanings from their discussions the importance of socially constructed knowledge through people became ever more important. They recognized the need to develop the source of new knowledge and encourage it:
‘You need to build people’s confidence in themselves.’
‘We need to talk to one another and from that interact and we [then] create new knowledge and better ways of doing things.’

Linked to this view was the realization that innovated thinking could be dangerous from a personal career standpoint:
‘There is a danger in stepping outside established wisdom because you have to keep your back covered.’

This view contrasted with another participant’s experience of lack of innovation because:
‘We are not used to having discussions and letting knowledge emerge out of that, it is usually a one-way flow [top-down].’

One of the participants quoted his experience of BP where a complex drilling problem was solved not by technical experts or senior managers but by bringing together a group of people who had a lot of tacit knowledge of drilling. This tacit knowledge, through discussion and interaction, was embodied into a solution for the drilling problem. Thus, employees at all levels can contribute to innovation through knowledge construction (Demerest, 1997).

WORKSHOP FINDINGS: KNOWLEDGE EMBODIMENT AND INNOVATION

If newly constructed knowledge is to lead to innovation then such knowledge must be embodied or incorporated within the organization (Quintas et al., 1997). The need for embodiment was echoed by the participants:
‘How do I take it [new knowledge] within my organization to do something creative with it, I bring to bear my experience, my insight, contacts etc.’

Thus, knowledge embodiment was seen as essential to resulting innovation within the organization.

Participants considered innovation resulting from knowledge embodiment as being reflected in the organization’s structure. In agreement with Handy, Peters and Bessant (1997) they preferred open, flat dialogue-based structures to closed hierarchical and top-down structures:
‘It’s a mixture of bottom up and top down...you can set up depositories of knowledge which people can access...faster decision making.’

The role of a supporting open and participative culture (Brand, 1998) was seen as vital to enable innovation through knowledge embodiment:
‘We [management] try to limit them [employees] and hence lose a lot of knowledge.’
‘Knowledge is power, there also is fear...it is a cultural problem.’
‘Fear of giving up knowledge. Will it affect my usefulness?’

The culture was seem as accepting mistakes as part of the innovation process:
‘It is difficult to get people to impart knowledge about mistakes...very important knowledge.’

Coupled to removing fear of mistakes was the idea of trust:
‘Part of the discussion must be about trust...if I put another 5% of my knowledge in here and I don’t get paid anymore, then...’
‘A no-blame culture...trust is also important.’
‘In some organizations the last thing you would do is to admit a mistake.’

Thus, participants recognized the need to address employees’ needs as well as the business needs from increased innovation through knowledge embodiment (Burgoyne and Reynolds, 1997):
‘How do we tap into their aspirations? What do they want to do?’
'Make the conditions right that the person can pick up the knowledge.'

The participants believed that the role of the knowledge worker (Zuboff, 1989; Peters, 1992; Davenport et al., 1996) was key to knowledge embodiment and hence innovation:

'How can they [employees] apply their experience to information?'

'Everybody in an organization has useful knowledge, it is up to the organization to tap into that knowledge, you are back to culture again.'

Throughout, the embodiment process was seen as closely linked to converting tacit knowledge into embodied knowledge through the social interaction of knowledge workers (Boisot, 1989; Nonaka and Takeuchi, 1995):

'How prepared are people to convey the knowledge they hold in their heads? It is by exchanging thoughts.'

It was also reasoned that knowledge from without the organization must be embodied to increase innovation:

'People have this huge amount of experience outside work which they tend not to bring in with them, a good organization is good at using that.'

WORKSHOP FINDINGS: KNOWLEDGE DISSEMINATION AND INNOVATION

If knowledge is constructed and embodied within the organization, leading to increased innovation, then these knowledge-based innovations must be spread or disseminated across the organisation (Demerest, 1997):

'Knowing whether the knowledge disseminated is going to be useful.'

'What can be done with this knowledge elsewhere [in the organisation].'

'Take catering, a new menu in California is in the best restaurants in Paris a fortnight later because you have chefs who travel the world.'

Collaboration was seen as important for innovation through knowledge dissemination. The organization’s perimeter fence was not seen as a barrier to innovation in a two-way flow of knowledge dissemination (Nonaka and Takeuchi, 1995):

'Those involved with customers...we haven’t tapped into yet.'

'Maybe the knowledge is knowing who else can collaborate with you.'

Empowered knowledge workers who could network throughout the organization were seen as vital for disseminating innovation in the form of knowledge throughout the organization. This network must be enabled by a systematic approach rather than a process of osmosis:

'The best way of disseminating knowledge is to have a good strategy for knowledge capture...it might be information for someone elsewhere to use as knowledge.'

The frustrations associated with lack of innovation because of poor knowledge dissemination were also expressed:

'The information is there and available to everyone but it is not being transferred, absorbed and accepted.'

Another problem with disseminating innovation was the ‘not invented here syndrome’: 'How do you get over the I didn’t invent it? Our MD came across an innovation in hair care in Italy, the hair brush package was designed open so that you could feel the bristles before purchase. Back at base nothing happened as our marketing department hadn’t thought of it.'

WORKSHOP FINDINGS: KNOWLEDGE USE/BENEFITS AND INNOVATION

Ultimately knowledge which is constructed, embodied and disseminated must be put into effective use for the organization (Demerest, 1997). Benefits or uses can include increased business efficiency (Peters, 1992), but a key benefit is increased innovation (Leonard, 1997). This view was reiterated by the participants:

'If I know something in the marketplace that no-one else knows, I can use that and exploit that to get into a very strong position.'

Organizations who had good knowledge management systems were seen as ‘very reliant on new product development processes’, like 3M as discussed earlier. This process of new product development was seen as similar to that of 3M in that innovation comes through new perspectives due to new knowledge:

'Knowledge can lead to innovation as a new way of looking at things, questioning assumptions...'

Furthermore, effective knowledge management was seen as the gatekeeper to innovation:
‘Knowledge management really is a necessary condition before you can innovate.’

The participants reckoned that business and employee benefits due to knowledge management-based innovation were inseparably equally essential:

‘It is creating power...you can be motivated towards trust, loyalty of the company or self-affirmation or confidence and therefore innovation.’

DEVELOPMENT OF A KNOWLEDGE MANAGEMENT AND INNOVATION MODEL

As a means of summary, the different aspects of innovation in regard to knowledge management, as discussed in the literature and the research, can be shown in an enhanced version of the earlier knowledge management model (Figure 1). For each of the four key areas of knowledge management–construction, embodiment, dissemination and use/benefits–the drivers of innovation are listed in Figure 3.

CONCLUSIONS AND RECOMMENDATIONS

The review of the literature has shown there is a clear link between the emerging body of knowledge referred to as knowledge management and that of innovation. This link offers both organizations and those who work in them an opportunity to improve both the business and the work satisfaction through increased innovation in products, services and methods and conditions of work.

The research findings were based on a suitable model for linking knowledge management with innovation and were derived based on the principle that knowledge leading to innovation is socially constructed as well as scientific in nature. This opens up the possibility of organizations embodying new knowledge and innovation within the culture of the organization from a wide range of new sources. Furthermore, these sources of innovation can come from without the organization (boundary spanning). The dissemination of constructed and embodied knowledge was found to be essential if organizations are to spread an innovative culture throughout all their environs, usually geographically. The use/benefit of knowledge management leading to innovation
was found to be increased new product and service development supported by an innovative culture and an effective knowledge management system. These benefits were found to lead to both increased business and employee benefits.

Finally a further enhancement to the model of Figure 1 was added (Figure 3). This model illustrates that the drivers for innovation, based on the research, can be listed under each of the four areas of knowledge management which lead to innovation, namely construction, embodiment, dissemination and use.

To increase the level of knowledge in this area of knowledge management and innovation it is recommended that further research be carried out to:

- Determine the dynamics of the model linkages shown in Figure 3
- Apply the model and developments of it to different sectors and sizes of organizations
- Analyse case studies using this generic approach

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