Communities of Practice: Fostering Learning in the Product Innovation Process

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The importance of innovation to the survival of organizations in a turbulent environment has led to greater emphasis on improving the innovation process. The opportunity to do so is enhanced where learning is captured and applied to existing processes, the opportunity exists for improvement in innovation processes. This article presents an analysis of levers (enabling mechanisms) used to foster learning behaviors, and identifies variations between levers used by different occupational clusters. Under study are aspects of occupational culture, and problems associated with examining organizational learning from a single perspective. Although the potential for transferring learning experiences is increased by considering the multiple perspectives of the various communities of practice (*e.g.,* from engineers in one product to the development process to operations managers in the manufacturing process of another product) within organizations, this also triggers a number of potential barriers for the transfer of learning.

Introduction

The importance of innovation to the survival of organizations in a turbulent environment has led to greater emphasis on improving the innovation process. Where learning is captured and applied to existing and current innovation processes, the opportunity exists for improvement in innovation processes. Research has been undertaken with the objective of developing, testing and disseminating a methodology to facilitate product innovation. This article presents an analysis of levers (enabling mechanisms) used to foster learning behaviors and identifies variations between levers used by different occupational clusters.

In particular, under study are aspects of occupational culture and problems associated with examining organizational learning from a single perspective. In doing so, it is proposed that companies are required to increase their effectiveness, exploit synergy and learn in product innovation processes.

The necessity to learn has been emphasized by various writers. The concept of continuous product innovation enables the study of learning within product innovation processes and between product innovation processes. Although the potential for transferring learning experiences is increased in this concept (*e.g.,* from engineers in one product to the development process to operations managers in the manufacturing process of another product), there are also a number of potential barriers for transfer of learning. One barrier identified in the literature is occupational

cultures. In this article, it is argued that organizations need to make use of different occupational cultures and communities of practice and break down barriers between cultures and communities.

NPD projects and Product Innovation

To survive in a demanding and turbulent environment, organizations increasingly are investing resources and managerial attention to product innovation. Although these efforts are more and more continuous, and involve partners outside the organisational boundaries on a global basis, most literature is still focused on New Product Development (NPD) projects seen as isolated efforts, and on how they are managed and organised. This article uses an alternative perspective: NPD projects are seen as steps within a more general process of Product Innovation (PI) that, besides involving more products within a family, include phases of the product life cycle that follow the launch on the market.

In this perspective PI is a continuous and cross-functional process involving and integrating a growing number of different competencies inside and outside the organisational boundaries. As organisations have become flatter and introduced multi-disciplinary teams as part of strategic quality management the barriers between groups such as engineers, senior management and operators have narrowed. Although these groups may be in closer proximity they may be no closer in their communities of practice (Seely, Brown, and Dugud 1991). Mastering the sharing and transfer of knowledge across communities of practice can become a powerful competitive weapon, but requires a clear understanding of how different employees learn and what they perceive to be appropriate learning. Schein's (1996) classification of management culture is used here as a starting point to analyse cultural diversity and its implications for learning in organisations.

The research was developed within the context of the Euro-Australian Co-operation Centre (EACC) CIMA (Continuous Improvement and innovation Management) project. The aim of the EACC is to facilitate co-operation and knowledge/technology transfer between European and Australian organizations. CIMA, the first Euro-Australian trial project, aims at developing a methodology to support companies in managing learning and continuous improvement in the Product Innovation Process. This methodology was developed by a consortium of 5 European and 3 Australian research centres. Describe below are some of the results of the CIMA project, and an examination of the issue of clusters of learning behaviours. It is proposed that employees will tend to favour particular learning behaviours. Of favour are those that are central to developing the organizational capabilities that generate and sustain innovation and improvement in PI on the basis of occupational cultural groupings.

Cultural Diversity

All organizations are a mix. In simplest terms they are a mix of functional roles; production workers, management, administration; and much research has been conducted into the diverse nature of the individuals filling these functional roles. Organizations – business, charitable, and governmental -- have been encouraged in

recent years to manage, value, and profit from the diversity of their workforce in terms of its cultural, age, and gender mix. This concentration on the diversity of people present in society has hidden from consideration the diversity of the workforce due to the functional roles of the employees. Just as a person's age, gender, or ethnic origins influence their actions and thus their contributions to teams within the workplace, their occupational background and training are equally important.

The concept of intra-organizational cultures (some times called sub-cultures) associated with divisions, departments, groups, work teams or professions is an issue that needs to be addressed. Group affiliation and conformity is a strong determinant of the behavior of individuals within organizations. Getting intra-organizational cultural groups to recognize and value differences amongst each other is an area that has not been addressed in many of the approaches to understanding diversity in the workplace.

In management research, many researchers view diversity as the most significant force influencing current trends in organizational change strategies (Cox and Blake, 1991). Associated with increased globalization, necessary for the survival and continued growth of most industries, is the successful management of a diverse workforce. Vitiello (1998, p. 62) believes that many professionals now coming to organizations with their diverse cultures and customs is putting new pressures on management. Managers' current perceptions of the nature of diversity are mainly shaped by fundamental changes to workforce composition (Abbassi and Hollman, 1991). Few recognize diversity as a potential source of organizational success (Miller 1998, p. 151), or address other diversity issues within an organizational context, such as different organizational cultures inherent with specific work roles, teams or work groups.

Specific work roles may be described as having a culture. The nature of training, education, knowledge, skills, values, ethics and code of conduct associated with the specific work role may establish this culture. For example groups of engineers, accountants, or marketing personnel may be viewed as each having a unique culture which individual members identify with. Schein (1996) put forward three distinct cultures of management. He argues that organizational innovations such as product innovations fail to survive and grow because of learning failures, and that a principle reason organizations have difficulty in learning is because they consist of an internal operator culture and two externally based cultures which he calls an engineering culture and an executive culture. Unless these cultures are aligned, he argues, there will be failures in organizational learning. Each group may be described as sharing a core of common behavioral characteristics directly associated with their respective function within the organization. In general the performance of groups may be identified in the areas of communication, group cohesiveness and interpersonal relations.

Another approach to groups' learning, work, and innovation is what Seely, Brown, and Dugud (1991) call communities of practice. Within communities of practice, which are informal collectives working together both within organizations and across organizations, learning is an integral part of day to day working and, as work is a social constructed activity, individual learning is inseparable from collective

learning. That communities of practice can span the boundaries of a single organization is supported by Orr (1990) is his studies of technicians that describe how a technician working with a specialist such as a toolmaker in one firm learns a new way of quickly fixing a machine fault and transfers this practice to other technicians within his social community of practice. As this learning and transfer occurs as part of work, it may not be recognized as acquiring external knowledge and transferring knowledge from an external source. Rather it is regarded by members of the community as part of everyday work practices.

Continuous Improvement and Product Innovation

Continuous Improvement has been defined as “an organisation-wide process of focused and sustained incremental innovation"”(Bessant and Caffyn, 1997). This implies a systematic approach to improvement in which staff throughout the organisation are engaged in an on-going effort to implement changes which, though often small-scale, cumulatively will impact on the goals and objectives of the business. CI has been closely associated with Total Quality Management (TQM) philosophies. For some researchers (Hill and Wilkinson, 1995) CI is one of the fundamental principles underlying TQM, while others argue that despite the close relationship between CI and TQM the latter should be considered a perspective in its own right "with or without the context of TQM" (Berger 1996, p. 18).

In fact organizations have arrived at CI through a variety of entry points (Gallagher *et al.,* 1997). Bessant and Caffyn (1997) proposed a behavioural model in which continuous improvement is described in terms of a set of generic behaviours that appear to be essential for long-term success with CI. The set includes behavioural routines around individual and corporate learning.

Until recently much of the emphasis of CI has been on operations. However, as competitive pressures continue to intensify and organizations adopt a more holistic approach, attention has turned to other areas of the business. Although some writers have emphasized the importance of continually improving development processes (Karlsson and Åhlström, 1996; Wheelwright and Clark, 1992), and indeed some firms have implemented improvement methodologies within a development context, many organizations have not yet tried to apply CI to their PI processes. However, several studies of quality management practices within R&D have supported the suitability of the techniques and concepts of quality improvement for the NPD environment (Fisher *et al.,* 1995; May and Pearson, 1993; Miller, 1995), while stressing the need for implementation strategies to take account of the particular context (Debackere *et al.,* 1997; Taylor and Pearson, 1994). A more recent investigation produced evidence to support the conclusion that the application of CI to PI is appropriate in practice as well as in theory, though firms may experience difficulties turning theory into practice (Caffyn, 1998).

A learning organization is one which facilitates the learning of all its members and is thus continually transformed (Pedler, *et al.,* 1989). According to Schein (1985) it is the internal integration of individuals into a shared culture that facilitates learning, and this integration provides a major organizational challenge. The sharing of learning occurs more often when there is a similarity within the group culture. Organizational learning has been described by Dodgson (1993, p. 377) as “the ways

firms build, supplement and organize knowledge and routines around their activities and within their cultures, and adapt and develop organizational efficiency by improving the use of the broad skills of their workforces". The knowledge that is of interest to individuals and the organization is both tacit and explicit

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As organisational learning is fundamentally about changing behavioural routines and addressing learning systems that often inhibit change, researchers in recent years have turned their attention to learning styles. Honey & Mumford suggest that the following four learning styles are standard: *activists*: people who learn best when they can use trial and error*; reflectors*: people who learn best when they are given adequate time to digest, consider, and prepare; *theorists*: people who learn best when there is a sound structure and a pattern or purpose; and *pragmatists*: people who learn best when they can be given real life practical issues to discuss (Honey & Mumford, in Rylatt, 1994, p. 67). Other research suggests that individuals accumulate and experience learning in a cyclical process that transforms their experiences (Kolb, 1984).

According to Kolb, effective learning generally requires four kinds of abilities. These are the ability to be involved fully, openly, and without bias in new experiences (*concrete experience*); the ability to reflect on and observe experiences from different perspectives (*reflective observation*); the ability to create concepts that integrate reflection and observation into logical theories (*abstract conceptualisation*); and, the ability to use theories to make plans and implement action (*active experimentation*) (Kolb, 1984).

The reality of learning however suggests that learners will develop preferences and abilities for particular kinds of learning. Unless trained and encouraged to think differently, most people think in a structured way, ordering their thoughts to line up with the established patterns and beliefs that are time-honoured (Morgan, 1997). This process of structured thinking for handling various decision criteria is found in most plan-do-check-act cycles of continuous improvement where actions and strategies are repeatable on a consistent basis. It is generally acknowledged that a diversity of learning behaviours are required to help organisations create a versatile team capable of solving an array of problems fast (Takeuchi and Nonaka, 1986, p. 141).

In developing preferences for particular kinds of learning, it is useful to examine learning within communities of practice and to consider what encourages learning within these groups. Seely, Brown, and Dugud (1991, p.48) argue that what is learned cannot be separated from the conditions in which is learned. As communities of practice work and learn together they value skills, information and knowledge that adds to their work practices. In this way they learn to function as a community and as such they acquire the particular community's viewpoint, language and culture. As they are communities of practice they will not recognize that the tools they use on a regular basis enable, or even encourage, the community and its members to learn. For example, designers using CADCAM would not see it as a source of information and knowledge, but as a tool like a lathe or saw, perhaps a complex tool but none the less a tool. The tools of their practice do not contain large quantities of knowledge and information that is useful to the organization, although

some of the information may be useful for other members of the community of practice.

Organizations that are determined to improve their processes, including their PI process, need to recognize the importance of learning. Once they have recognized the importance of learning they will need to identify and implement management techniques and practices that encourage learning throughout the organization. For many organizations this will require a transformation in behaviors, attitudes and even organizational culture. In this transformation the learning behaviors adopted must ensure that learning at the organizational level is more than merely the collective knowledge of its members shared throughout the organization (Baldwin *et al*., 1997, p.54). The organizational change must result in learning behaviors becoming embedded throughout the organization. For this embedded learning to occur organizations, according to Schein (1996), need to confront the implications of differing occupational cultures. The learning structures and culture of the organization will be shaped by the behaviors the organization demonstrates during and after the transformation process.

Scant attention has been paid to how learning can be used to competitive advantage in the PI process. Studies have demonstrated that focusing on learning within single projects is not enough to sustain a competitive advantage. While firms can build a competitive advantage through superior manufacturing or service delivery, to sustain it over time requires skills in developing a continual stream of new, improved products and processes. Here attention progressively shifts from single projects or products to families of products or projects (Meyer *et al.,* 1993; Sanderson *et al.,* 1995) and to the process of knowledge capture, transfer, and reuse (Bartezzaghi *et al.,* 1997). If this learning is to provide a competitive advantage, organizations need to have sufficient internal diversity in strategies, structures, people and processes to facilitate different kinds of innovation and organizational learning. Managers need to recognize that different groups and cultures learn differently and will value different learning behaviors.

Supporting knowledge management in PI: CIMA methodology

The CIMA methodology is designed to be used by researchers acting as facilitators to help companies in fostering and sustaining the process of continuous learning in product innovation. The main engine underpinning the methodology is a contingent model of learning in PI, which makes use of the CIMA computer-based survey tool and report generator to gather data and to feed back to companies, and of the CIMA database to compare practices and suggest actions. The CIMA model describes the learning and knowledge generation processes within product innovation in terms of a number of interrelated variables. These variables are: Continuous Innovation (CI) performance; learning behaviors within PI; levers that can foster these behaviors; company contingencies; and continuous learning/innovation capabilities. The relationships between these variables are depicted in Figure 1.

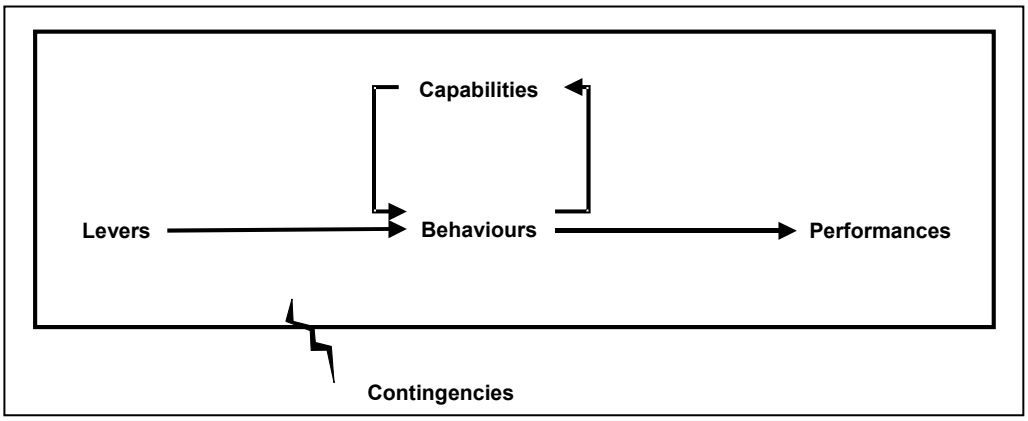


Figure 1: Elements in the CIMA explanatory for learning in PI

Performance is the result of improvement activities carried out in the product innovation process. It can be 'measured' by, for instance, looking at the generation of improvements, and the diffusion of improvements and learning experiences within and between product innovation projects. CI performance is achieved by a set of eight particular *behaviors* enacted by individuals, such as creating, using and transferring knowledge; aligning improvement activities with strategic goals and objectives; and experimenting with new solutions. The implementation and application of levers can influence these behaviors. *Levers* are mechanisms that managers use when managing the product innovation process, even though they may not be consciously trying to stimulate learning. The *contingencies* are factors that influence the choice of levers to foster behaviors. *Capabilities* can be described as integrated stocks of resources that are accumulated over time through learning, or established through deliberate decisions. These stocks of resources include internalized behaviors, technical skills, organizational routines, and corporate assets (*i.e.*, Information Systems, databases, libraries, tools, and handbooks). The level of a company's CI capabilities determines the efforts that are needed to stimulate the corresponding behaviors.

The methodology has been tested in over 70 companies in Europe and Australia. The behaviors reported and the corresponding levers are listed in Tables 1 and 2 following.

Lever 1	Product Family Strategies
Lever 2	Innovation Process Definition
Lever 3	Organisational Integration Mechanisms
Lever 4	Human Resource Management policies
Lever 5	Project Planning and Control
Lever 6	Performance Measurement
Lever 7	Design Tools and Methods
Lever 8	Computer-based Technologies

Table 1: CIMA Levers

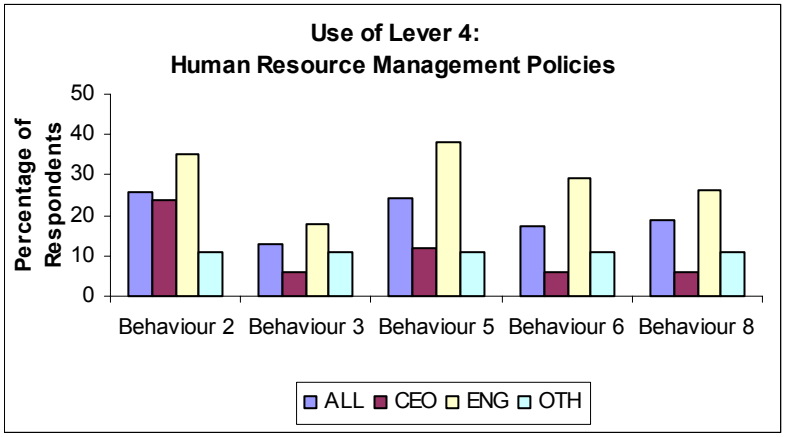
Behaviour 1	Organizations strategic goals and objectives are used to focus and prioritise CI and learning activities within the NPD process
Behaviour 2	Product innovation projects are used to develop knowledge
Behaviour 3	Available time and resources is used to experiment with new solutions
Behaviour 4	Knowledge is shared between different phases of product innovation
Behaviour 5	Knowledge is transferred between different product innovation projects
Behaviour 6	Individuals draw on knowledge from their experiences and generalize it for application within product innovation projects
Behaviour 7	Product Innovation project knowledge is disseminated through reports
Behaviour 8	People try to acquire and use knowledge from external sources

Table 2: CIMA Behaviours

Respondents had to be involved in managing the product innovation process within their firms, but they could hold any position and come from any background. The model has not as yet taken into account if the culture or occupational sub-culture of the respondents has any impact on their perceptions of learning within the product innovation process. This analysis examines if Schein's (1996) cultural groups (operator, engineering and executive) have similar views of the learning behaviors and the levers used in the product innovation process. While it would be useful to examine learning and levers within communities of practice, the sample size and demographic data available at this stage are insufficient for significant results to be obtained.

Results

This study revealed that while there was no significant difference between the cultural groups in the usage of levers to encourage behaviors 1, 4, and 7 above, significant differences existed in lever usage for all other behaviors. The most



frequently used lever by all groups was Lever 5. It was observed that this lever's usage was cited as being more frequent by the CEO and "Other" cultural groups than by the Engineering cultural group.

That this pattern was not the case for all levers is seen by a comparison of the usage of Lever 4, much more frequently cited by the Engineering group than by any other. Here it was surprising that, despite the recent moves toward enterprise bargaining and its use of a range of incentives, the CEO grouping generally did not see HRM policies as a useful organizational change tool.

The difference between occupational cultures, while most noticeable between the CEO and Engineering cultural groups, was also apparent between members of

these two cultures and the Others grouping. The differences in the lever usage of the Others group are most apparent in their usage of Lever 2, which is generally more frequent for encouraging all behaviors.

Summary

While it appears from this analysis that the Engineering culture has a distinct view of learning behaviours, this is a relatively small sample. It needs to be noted, however, that the sample is drawn from six countries and it appears that occupational culture may play a larger role than ethnic background. If, as this initial analysis suggests, it is possible that learning can be influenced by cultural factors based on occupational background this has implications for data gathering and implementing learning in organisations. From the data gathering perspective it means that it is inappropriate to judge the learning behaviours of an organisation from the perspective of one respondent, and to fully grasp the learning behaviours more detailed data gathering across cultural groupings is required.

From an organisational learning perspective mangers need to find ways to communicate across cultural boundaries. Rather than breaking down occupational cultures it will be necessary to develop tactics that encourage learning, in particular learning to analyse other occupational cultures. Further studies need to be conducted to examine the learning within communities of practice within extended manufacturing enterprises. These studies form part of our ongoing research and will be reported elsewhere.

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