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**Teamworking and Knowledge Management: A Review of Converging
Themes¹**

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Abstract

The teamworking and knowledge management fields are increasingly converging. Teamworking is turned to with an increasing disillusion with knowledge management approaches that are seen as excessively “hard”, “objectified”, or “Information Technology -dominated” (c.f. Blackler, 1995; McDermott, 1998; Tsoukas, 1998; Cook & Brown, 1999; Scarbrough & Swan, 2001). This article is a critical review, the purpose of which is to survey literature across several fields that provide insights into teamworking aspects of knowledge management, and the reverse.

This approach is chosen as disciplines tend to sustain presumptions and preoccupations that may be contradicted by other fields, as is shown. In particular, the review challenges what is referred to as the ‘Organisational Behaviour textbook theory of teamworking’ and refers to research and theory from several disciplines that qualify what is still an influential orthodoxy. The article attempts to draw together some principles from current themes such as collective mind, modularity, cross-functional teams and communities of practice.

The two themes of teamworking and knowledge management have attracted great interest and generated large literatures. This journal has previously published excellent reviews on cross-functional teams in new product development (Holland, 2000), principles of teamwork (Salas et al., 2000), while several articles have reviewed different aspects of knowledge management (Reid et al., 2001; Staples et al., 2001, Harris, 2001; Bontis, 2001; Gallupe, 2001; Beamish & Armistead, 2001). This article is a critical review, the purpose of which is to survey literature across several fields that provide insights into teamworking aspects of knowledge management, and the reverse. This approach is chosen as disciplines tend to sustain presumptions and preoccupations that may be contradicted by other fields, as shall be shown. In particular, the review challenges what is referred to as the 'Organisational Behaviour Textbook Theory of Teamworking' and refers to research and theory from several disciplines that qualify what is still an influential orthodoxy. The article attempts to draw together some principles from current themes such as collective mind, modularity, cross-functional teams and communities of practice.

The teamworking and knowledge management fields are increasingly converging. Grant (1996a; 1996b) a proponent of a Knowledge-Based View of the Firm, argues that knowledge is the pre-eminent resource for competitive advantage in the current era, and stresses the role of co-ordination mechanisms to integrate the specialist knowledge of multiple individuals in an organisation. Nonaka & Takeuchi (1995) stress the importance of teamwork in the conversion of personal, tacit knowledge into organisational knowledge. Dialogue, discussion and dynamic interaction enabled by teamwork are argued to play a vital role in the knowledge creation process. The ideas of individuals are

articulated, challenged, refined and once converted into organisational knowledge, embodied into new products, processes or services. Teamworking is turned to with an increasing disillusion with knowledge management approaches that are seen as excessively “hard”, “objectified”, or “Information Technology -dominated” (c.f. Blackler, 1995; McDermott, 1998; Tsoukas, 1998; Cook & Brown, 1999; Scarbrough & Swan, 2001).

The next section sets out the view of teamworking that might be described as a received orthodoxy in the field of organisational behaviour, and some research that challenges its assumptions. Section Three refers to the concept of “collective mind” from the literature on cognition, it shows that efficient teamworking is less a function of group identity as “heed”, and stresses the importance of the content of knowledge composed in a team. Teamworking under complexity is covered in Section Four, reviewing the debates over modular architecture in products and organisation. Section Five considers the popular phenomenon of cross-functional teamworking and discusses the benefits and drawbacks of such organisation. Section Six addressed teamworking and identity, emphasising the importance of the team member as a gatekeeper to external communities of practice. A summary of the review in the form of three key propositions is presented in the conclusions.

The Organisational Behaviour Textbook Theory of Teamworking

Where would one reasonably expect to find theory and research on teamworking and knowledge management that is practical and useful for managers? For example, one

might turn to the organisational behaviour (OB) textbooks of the type that are standard issue on MBA courses (e.g. Champoux, 1996; Martin, 1998). Here we find a theory of teamworking, where the importance of group *cohesion* is stressed. Cohesive groups perform better than non-cohesive ones and also need less management from above; the “self-managing team” idea. Factors affecting cohesive group formation typically include a number of behavioural factors allowing social interaction: proximity; members not physically isolated; members not physically tied to workspace; high-required interaction; low noise level; incomplete job description; free time at work; low degree of attention required, low absenteeism. Factors restricting social interaction and group cohesion are the opposites of these listed factors.

Knowledge bases or the dynamics of learning do not figure as a primary concern in the OB Textbook Theory of Teamworking. Instead, there is an emphasis on softer, interpersonal dynamics. Perhaps the most important variable is the basis for attraction between individuals in the group. This is influenced by interests, education, background, age, ethnicity and so on, as well as social interaction among group members, which helps form sentiments about colleagues. All other things being equal, people are attracted to others that are *similar* to themselves with regard to these characteristics. These sentiments and interpersonal attraction in general, the textbooks argue, increase cohesiveness.

However, psychological research supports only part of the OB textbook theory. Mullen & Copper (1994) show that group cohesiveness and performance are strongly correlated, and more so in small groups than larger ones. It also shows that the more time group

members have to interact with each other the greater the “groupness” among them, this is attributed to “a history of information and experience” (1994: 213) carried by the members. However, the research also shows that *commitment to task* is the most critical component of cohesiveness, ahead of factors like interpersonal attraction and group pride. The OB textbook orthodoxy would appear to overestimate the effect of these softer, social aspects on performance improvement as a result of cohesiveness. It may well be that the need for social affiliation is an indirect incentive for effective teamworking, but interpersonal group dynamics do not appear to be a primary factor. Another challenge to textbook orthodoxy is that the direction of causation is stronger from performance to cohesiveness, rather than cohesiveness to performance. In other words successful accomplishment of the task strengthens the group’s cohesion more significantly than the reverse. The social interactions and relationships are secondary, contrary to textbook theory where causation clearly runs from cohesiveness to performance, e.g. Martin: “Groups must come to terms with their own internal functioning before they can effectively address the tasks facing them.” (1998: 202).

The *ex ante* design of teams has motivated a large body of work focused on group structure. Perhaps the best known is Belbin (1993) which suggests team role archetypes that determine group effectiveness. These roles refer to qualities or tendencies in individuals, such as confidence in *co-ordinator* types, discipline in *implementers*, or attention to detail in *completers*. The idea is that when brought together, the nine roles offer a complete range of the necessary capabilities for effective teamworking. Roberts & Fusfeld (1987) identify five similar roles necessary for innovative project teams; idea generating; championing; project leading; gatekeeping and coaching. Rather than innate

tendencies or personality traits, the individual generally adopts each of these roles depending on her stage of career, suggesting that roles are more fluid and accessible than Belbin's model. The role of gatekeeper derives from Allen's (1984) identification of the importance of individuals who consistently serve to import new technological information into an organisation. Allen also points to evidence that greater cohesion in a group tends to *discourage* external contact and influence, which is vital to the high-performing teams in his study. This further undermines the value of cohesion as stressed in the OB textbook theory. In later sections this article will return to the crucial need for openness to external knowledge and influence in effective teamworking.

Prescriptive Organisational Development (OD) books aimed at practitioners stress the virtues of teamworking and the methods to build teams (Woodcock & Francis, 1994; Larson & LaFasto, 1989). Here again interpersonal dynamics are primary, while knowledge is not assigned a high significance. Larson & LaFasto do discuss competence of team members as being an important factor in team effectiveness. They distinguish between technical competencies and personal competencies. Technical competences are "the minimal requirement on any team. They refer to the substantive knowledge, skills and abilities related to the team's objective. They are what a team member must know and be able to do well in order to have a reasonable chance of achieving the team's objective." (1989: 62). However, the discussion lacks some depth, examples offered, such as communications skills would seem to fit better into the personal competencies category. Common features of competent team members are "not so well defined"; one primary technical skill identified for an effective epidemiologist team member is simply "an individual prepared to think right." (1989: 70).

Team roles and team building are essentially behavioural, rather than cognitive in nature. This is to be expected in the field of organisational behaviour, however, an understanding of managing knowledge in teams will require insight into not only the behaviour, interactions and “groupness” of the team, but also the content of the individuals’ knowledge bases and the effects of these working interdependently. One would hope to understand the rationale for combining the knowledge bases, and the benefits and problems presented by their combination. For such insight we will turn to the literature on cognition in teams.

The Cognitive Perspective: The Thinking Team or Collective Mind

Literature on the cognitive dimension of teamworking refers to teams developing a “collective mind”. For Cooke et al. (2000), ‘team knowledge’ comprises shared mental models of the task domain, its procedures and conceptual apparatus as well as the *team situation*; the specific knowledge of behaviours involved in working with the other team members in the dynamic environment. A well-developed understanding of the shared mental model and team situation is argued to predict team performance. Ciborra (1993) suggests that aside from the tasks, control, co-ordination and incentives that impact on a team’s effectiveness, there are also very real effects of identity and enculturation. Once the individual’s identity is with the team, cognition is entrusted to it both with repetitious routines and even for life and death decisions. Through familiarity with solving problems and thinking collectively the team constructs a system of interpretation and sense-making that increasingly “thinks” on behalf of the individuals in it.

This view of collective mind appears to suggest that group cognition increases in association with group identity. However, Ciborra warns that this can become dysfunctional to the extent of eliminating individual creative thinking; the “groupthink” effect. This is supported by Weick & Roberts’ (1993) research, which suggests that group formation and mind formation are distinct processes. For them, collective mind occurs through alertness, attentiveness and connection among team members; when three crucial aspects are effected by the individuals; contribution to, representation of, and subordination to the activity system of the group. The authors suggest that “group mind” emerges when these three aspects are conducted with ‘heed’. While habit is a replica of its predecessor, ‘heedful’ routines are conditioned by predecessors but each performance is novel and the actors are continually learning.

As a group matures practices may become more institutionalised, routinised and habitual, such that individuals contribute less that is addressed to other team members needs, represent others in less detail, and interact less with them. The boundaries of individuals’ activity systems are consequently narrowed. Attention is on local issues, rather than the system as a whole, interrelating becomes careless and collective mind gradually dissipates.

Crucially Weick and Roberts maintain that the development of mind is a separate process from the development of the group. Group mind is often strongest in the earliest stages when a group identity in the OB Textbook Theory sense has not yet been established. As individuals interrelate more smoothly and predictably and become comfortable in their

interactive routines, the collective mind may well be eroding. Strong groups can have no collective mind, while collective mind can exist with no strong group identity, as in the case of *ad hoc* project-based teams, or groups of “jamming” musicians.

Weick & Roberts’ contribution is strong on the internal dynamics and development of collective mind and in particular the induction of new entrants, but are less concerned with the *content* of the individual knowledge bases that are collected; what is known and how it is learned (Spender, 1998). The role of expertise, for example, is not a factor in the development of their conception of collective mind. On the combination of individual knowledge bases in a team, Hutchins’ (1993; 1995) work is particularly instructive. Hutchins presents empirically-grounded analysis of “socially-distributed cognition” in teams, challenging the presumption that individual competences are necessarily heterogeneous and complementary. Instead, the research shows individual knowledge bases that overlap or subsume others. In Hutchins’ (1993) example of navigation teams, the individuals accumulate expertise as they move on through all the knowledge domains of the group. The result is an amount of “redundancy” in the system in that knowledge bases of the team members are shared. It is this overlap or redundancy that makes teamworking more efficient.

In Hutchins’ account of the distribution of tasks in navigation teams, it is shown that among experienced experts there is little need for articulation and communication; a few words and gestures suffice. This is a collective mind but not of the instantaneous variety allowed by Weick & Roberts’ heedful interrelating. The emphasis here is on the content; of what is known. This is tacit knowledge that truly is shared, but only because the team

members have learned the task-related knowledge individually. Group efficiency reduces where novices are involved and communications needs are increased. In other words, efficiency is compromised the more that knowledge needs to be articulated in order that information may be correctly understood, and appropriate actions need to be prompted and demonstrated. For this reason it is often more efficient not to distribute tasks with high degree needs for communication across two or more people at all, thus reducing unnecessary interpersonal dynamics. This does open the hazard of overburdening the experts however.

The value of Hutchins' contribution is as a response to the "greater than the sum of its parts" platitude so common in superficial writing on teamworking and knowledge management. As he shows, "It is not the case that two or more heads are always better than one." (1995: xvi) Where the content of the heads are quite different, the implications of their necessary interactions on workflow need to be considered. This is not simply a problem of "transfer" of knowledge from one head to another, as is often presented in the KM literature. The process of individuals internalising unfamiliar knowledge domains is not a matter of 'copy and paste' but painstaking learning for each individual.

The group cognition literature stresses the factors that enable group task execution and the dynamics of individual knowledge bases in interaction. Hutchins, in particular stresses learning and expertise in the team, and there are implications also for the generalist vs. specialist issue. While Hutchins' experts are generalists in that they have acquired deep knowledge of several group tasks, in more complex settings, such overlap and redundancy is unfeasible (Cooke et al., 2000). This is addressed in the next section.

Teamworking under Complexity

Following the trend for teamworking to improve speed, quality and efficiency in manufacturing environments, it has also been advocated as an organisational design for complex organisations (Galbraith, 1994) that are performing “knowledge work” as distinguished from repetitive production (Mohrman et al., 1995). The increasingly broad needs for technical knowledge bases in Multi-Technology Corporations have been shown empirically (Patel & Pavitt, 1994; Granstrand *et al.*, 1997). In addition the growing importance of Complex Products and Systems (CoPS) in modern economies requires the integration of disparate technical and professional knowledge bases in the production of these large capital goods (Hobday, 1998; Marshall & Sapsed, 2000). This means that individuals cannot possibly absorb all the requisite knowledge domains for their team’s activities. “Generalists” in aerospace engineering teams, for instance, consider themselves more substitutable than their specialist colleagues (Jones & Jordan, 1998), by contrast to the guru status of the generalist in Hutchins’ navigation teams.

The complexity of knowledge is argued to be one driver for the trend towards the outsourcing of subassemblies and modularity in production (Sanchez & Mahoney, 1996; Brusoni & Prencipe, 2001). Sanchez & Mahoney suggest that a modular product architecture may entail a modular organisational design, for example, in component supplier networks. However, such a one-to-one relationship between product architecture and organisation is not supported by Brusoni et al. (2001) who emphasise that the knowledge bases of firms reach far beyond the boundaries of their production activities.

At the firm level, Brusoni et al. argue that knowledge is typically broader than is required for operating activities, encompassing knowledge associated with those modules that are routinely outsourced.

Sanchez & Mahoney's idea is applied to internal-to-the-firm, team-based organisation by Grant (2001) offering the example of Microsoft's Internet browser development as organising around a modular product architecture; small teams deployed to work on individual modules of the system, which were regularly integrated (Cusumano, 1997). Grant argues the efficiency of such a system is a response to the costs of knowledge integration- modularity achieves integration across a broad range of different knowledge bases while minimising the costs of knowledge transfer. Each team unit integrates the knowledge of the individuals within it, without the need for continual transfer to other units. Interfacing between the team-units becomes the second organisational task after establishing modular architecture. This model derives from Herbert Simon's (1999) description of "nearly decomposable" hierarchic systems. This is where subsystems behave independently in the short run, but retain weak linkages with other subsystems with which they are interdependent (on aggregate) in the long run.

However, as Grant (2001) suggests it is the messy interfaces between sub-units of modular organisation that are not well understood. While the modular organisation argument is intuitively appealing, research into teamworking in complex settings has long shown that the knowledge within the project team is usually insufficient for it to accomplish its tasks. Allen's (1984) studies of research and development project teams shows that consulting with organisational colleagues that are *not* assigned to the team

comprises a significant amount of engineers' time. This is particularly so with high-performing teams, and much less with low-performers. Allen concludes that technical support is needed beyond that available within the groups, and that supporting external contacts should occur on a continuing basis or else serious problems will accumulate. The research shows that consulting colleagues outside of the team as a practice is used more for problem definition and validation of this definition, rather than idea generation, which is a function performed largely within the team. Furthermore higher-performing engineers consult to about the same extent with colleagues outside, as well as inside their functional discipline.

More recent research has elaborated on Allen's original study. The degree of intimacy between team members and their external contacts has been the subject of work inspired by social network theory. This suggests that *weak ties* between organisational sub-units (Granovetter, 1973) are most efficient for a project team's search needs; transferring useful, nonredundant knowledge across teams. This transferred knowledge speeds up project activities, however there is a slowing effect where complex knowledge is transferred (Hansen, 1999). Where complex knowledge needs to be transferred, strong ties are required. However, these strong ties may preclude or limit searches for useful knowledge beyond existing contacts.

For problem-solving activities Allen suggests that intra-teamworking is less important to performance than the communication contacts outside the R&D project team:

Despite the hopes of brainstorming enthusiasts and other proponents of group approaches to problem solving, the level of interaction within the project groups shows no relation to problem solving performance...Moreover, it appears that interaction outside the project is most important. On complex projects, the inner team cannot sustain itself and work effectively without constantly importing new information from the outside world. (Allen, 1984: 122-123)

This would seem to suggest that it is not so much the knowledge of the team members immediately available that forms the advantage of project teams, but rather the access to the external communities permitted by having those team members as gatekeepers to that outside knowledge. This brings us to the literature on cross-functional teams.

Cross-Functional Teamworking

Several authors refer to the need for co-ordination and integration of the various specialist disciplines and functions within an organisation (c.f. Grant, 1996a, 2001; Pavitt, 1990, 1997; Dyerson & Mueller, 1999). Many working definitions of “teamworking” encompass team-to-team co-ordination and integration (Tranfield et al., 1998; Hoegl et al. 2000). In particular, cross-functional workflow and knowledge flow is argued to give individuals a sense of the “bigger picture” while ideally, management simply co-ordinates (Webb & Cleary, 1994). The task of *designing* the integration across teams Grant (2001) suggests, is the primary role of management. The necessary integration of specialised knowledge within teams can only be *managed* locally through mechanisms like routines. “Cross-functional” teamworking has emerged as an important

imperative for organisations, and the subject of considerable management research and literature.

Empirical research suggests that most New Product Development (NPD) activity uses the cross-functional form (Griffin, 1997). Gobeli & Larson (1987) present data for a sample of 1634 project managers in NPD, construction and new services and processes where less than 50% of managers used a pure functional structure, while 85% used some form of cross-functional matrix structure. As regards performance, Holland et al.'s (2000) review shows that inter-functional communication and transparency was correlated or associated with successful NPD projects.

Cross-functionality is only one type of diversity that is said to benefit teamworking outcomes, alongside age, gender, ethnicity, personal background etc. Roberts (1987) asserts that diversity of technical background, age and values appears to heighten project team performance, as well as maintaining tension and challenge in the team. Too much comfort and familiarity reduces productivity and tends against the refreshment of technical knowledge through external contacts. Leonard & Sensiper (1998) argue that although diversity entails the management of divergent viewpoints, this “creative abrasion” can generate discussion and thought resulting in new ideas. Contrary to OB textbook theory which stresses the advantages of similarity in achieving group cohesiveness, Leonard & Sensiper suggest “...*intellectually* heterogeneous groups are more innovative than homogeneous ones.” (1998: 118).

However, research on diverse teams also shows that group members do tend to have lower group cohesiveness and job satisfaction, higher turnover and stress (Keller, 2001). By contrast to traditional functional silos, in terms of knowledge management there is a problem to co-ordinate a diverse set of areas of expertise (Denison et al., 1996). While various authors argue that for systemic tasks like NPD, Cross-Functional Teams (CFTs) are more effective, Roberts (1987) and Allen (1984) claim functional organisations show best *technical performance*. This is contested by Gobeli & Larson's (1987) study which shows that project managers generally felt that dedicated Cross-Functional project teams and project matrix type structures were judged most effective on criteria of technical performance, costs and schedule. Those configurations tending more towards functional organisation were approaching a consideration of ineffective. It should be borne in mind, however that this is attitudinal data from project managers and such attitudes are perhaps to be expected.

Roberts (1987) warns of the erosion of technical skills if a cross-functional project team is maintained over time. Engineers are removed from the disciplinary structure of their functions, and while matrix organisation is a noble ideal, usually one interest dominates. There is often tension and conflict. Members of cross-functional teams, which are often temporary, working groups, often act as champions of their respective functions (Denison et al., 1996). Donnellon (1993) refers to team members withholding their functional knowledge from the CFT as a means of defending functional territory. As a practical solution Donnellon suggests shifting the role of the functional manager away from *controlling* the resources that are "made available" to CFTs, in favour of a "supplier" role; teams themselves should be responsible for delivery. This generally supports Gobeli

& Larson's position above that recommends the balance of responsibility in favour of project team managers.

Teamworking, Identity and Communities of Practice

These tensions could simply be interpreted as the group-serving bias observed in behavioural decision-making research, which is shown to have an even greater effect than self-serving biases (Taylor & Doria, 1981). However, individual and group identity is another notion fraught with problems and factorial issues. Social identification theory suggests that the immediate group is often more salient for the individual, than an abstract, secondary organisation, as the immediate group is where interpersonal proximity and task interdependence is greatest (Ashforth & Mael, 1989). The immediate group can be a functional discipline or project team, but typically individuals have multiple, conflicting identities in the organisation. These are usually unresolved and are managed separately; "compartmentalised", sometimes giving rise to hypocrisy and "selective forgetting" (Ashforth & Mael, 1989: 35).

These issues have long been debated in the field of ethnomethodology; the study of sense-making methods in everyday life. Sharrock (1974) refers to the problematic relationship between the individual and the collectivity, and the corpus of knowledge that is attributed to the collectivity. He observes that the identification of the individual with the collective corpus is presumptuous. Housley (2000) analyses team contexts through verbal communication and questions the relationship between team members and

purported external bodies of knowledge. Two views of team context are presented: one where context is imposed through stable, culturally defined, tacit influences, where team members merely act as filters for distinct corpuses of knowledge in their teams, and a second view where context is *locally achieved* and *situated* through interactions within the group. Housley studies “multidisciplinary” teams in health and social services, and challenges the orthodoxy that members of these teams bring a ‘specialist knowledge’ filtering into the decision-making process, such that all opinions are canvassed and a kind of consensus is achieved. His ethnological approach views context as locally achieved by the team, rather than an assemblage (albeit with some added value) of individuals, each connecting to a distinct exogenous collectivity. These are teams that contrary to those functionally-serving examples identified by Denison and Donellon, have “gone native”.

Housley notes Sharrock’s point that the relationship between individuals and an ascribed corpus of knowledge is problematic, and in the context of teams is based in “commonsensical” sense-making. It is common sense that, for example, electrical engineers draw on a corpus of knowledge referred to as electrical engineering, rather than mechanical engineering, or Asian embroidery. However, individuals may not subscribe to the corpus with which they are identified. The key point here is that the monolithic view of functions or disciplines can be a caricature. Knowledge is a *situated* phenomenon in cross-functional teams, rather than *detached* or transcendental. Professional functions/disciplines are often invoked in teamworking dialogues to legitimate positions or claims. For Housley these are not so much the display of identity with the function, but tactics to win influence and credibility *in the team context*.

Context, in this view, is not so much imposed by the external functions of the collected team members, as *negotiated* and *achieved* through the members' interactions in the team setting. The ethnomethodology view has a similar emphasis to the cognitive perspective of collective mind, where the immediate workgroup encompasses an autonomy and set of internal dynamics. Work on individual and group productivity bears this out, Roberts (1987) observes that in the innovation literature the nature of the immediate work group in terms of composition and supervision matter greatly to productivity among technical professionals, in addition to exogenous factors like the individuals' job maturity. In short, the dynamics of team members' identification with bodies of knowledge will depend on the context, but that context, in Houseley's terms, is partly imposed by the external functions and partly determined/achieved by the team itself.

This somewhat dated debate becomes relevant again with the current interest in "communities of practice", as described by Lave & Wenger (1991) and Brown and Duguid (1991) – "These groups of interdependent participants provide the work context within which members construct both shared identities and the social context that helps those identities to be shared." (Brown & Duguid, 2001: 202). These communities naturally emerge around local work practice and so tend to reinforce "balkanisation" around functions or occupation, but also extend to wider, dispersed networks of similar practitioners (van Maanen & Barley, 1984; Constant, 1987). Academic communities typify the dynamics of a collectivity sharing identity, know-how and ways of working independently of local contact, but similar communities emerge within professions, and across corporate domains where practices are shared.

Brown & Duguid (2001) argue that practice creates epistemic differences within the firm, and so balkanisation of the communities. The firm however is in a privileged position compared to the market, because it is better able to co-ordinate dynamically the knowledge produced by the communities of practice, in spite of the differences. Problems occur as knowledge “sticks” within the divisions of the firm, particularly where the firm is organised around the division of labour. Equally, knowledge may “leak” out from the divisions as well as the organisation. The knowledge bases of the firm are not limited by its boundaries, given the type of co-ordination that allows contact and flow between internal and external members of communities of practice. Brown & Duguid’s solution is “intercommunal negotiation” of differently practising individuals, challenging and stretching each other’s assumptions about ways of working. As argued above, cross-functional teamworking is an organisational setting that promotes this kind of intercommunal negotiation.

The true value of cross-functional teamworking is the channels it opens to the bodies of knowledge that are exogenous to the team. This is confirmed by recent research by Keller (2001) that shows that there is an important mediating variable between cross-functional diversity in a team and performance. The mediating variable is external communications, which effects improvement to technical quality, schedule and budget performance, but reduces group cohesiveness. This recent research further weakens the causality of the OB textbook theory that cohesiveness in a team improves its performance. In fact, it appears quite irrelevant to performance. If any cohesiveness is important it is that between an individual and her community of practice. Functional diversity allows a project team to

better tap into sources of external knowledge resources in order to cross-fertilise ideas, solve problems and integrate project-pieces so as to effect better performance. Keller shows that the primary effect of diversity is indirect, through external communications. By itself functional diversity had a strong, negative direct effect on budget performance, and no direct effect on schedules.

Kahn (1996) argues that temporary cross-functional teams are something of a *red herring*, and that interdepartmental integration should be a higher priority for organisational initiatives than trying to make these onerous teams work. Interaction is often mistaken for integration, while they are in fact, distinct phenomena. Kahn suggests remedies to functional insularity such as joint lunches to co-location, or rotating the functional managers, but not necessarily more formal interaction through cross-functional teamworking.

Kahn's view on interaction and integration is supported by Pinto & Pinto (1990) who show that greater cross-functional co-operation was associated with project teams that relied to a greater extent on informal means of communication, accidental meetings by the coffee machine, telephone calls etc. Colocation was argued to promote this type of contact and communication. This is tested by Kahn & McDonough (1997) without finding a direct relationship between colocation and performance. The influence of new Information and Communications Technologies on teamworking as well as the increasing globalisation of corporate activity reopens the research issues around workspace and interaction conducted by Allen (1984).

From this discussion several threads of research point to a view that cross-functional teamworking may be regarded as an organisational means of promoting the exchange of knowledge and practice across disciplines and communities. The literature suggests that this benefits creative activities such as new product development but there are associated penalties with regard to technical performance and professional career development. In a sense the working of the teams is secondary in that their key function is in integration. The group that the individual identifies with is unpredictable. However, teamworking is a means to an organisational end, in terms of knowledge management, by providing a setting for intercommunal negotiation across communities. Teamworking is something more than an operational solution, for example to cope with modularity or complexity.

Conclusions

The article has drawn from various branches of literature, the objective was to draw together work that gives insight into teamworking and knowledge management. This has meant the research and theory are dispersed across several fields, and the resulting discussion has been occasionally conflicting and unresolved. The final section presents three declarative propositions that might summarise the work that has been reviewed. The propositions represent the opinion of this author, having considered the foregoing literature, rather than being representative of the field. Nor are they intended or expressed as “testable” hypotheses.

(1) Team cohesion or a strong “groupness” is not a prerequisite for successful task performance.

The traditional Organisational Behaviour textbook theory of teamworking tends to overemphasise the interpersonal dynamics or “strong groupness” factor in teamworking. A broader survey of literature suggests interpersonal dynamics and attraction to colleagues is not a prerequisite for successful teamworking. Collective mind can rapidly occur in teams that have not developed groupish behaviour, but strong groups often suffer from stagnation and a narrowing activity system. Commitment to task appears to be a more powerful predictor of performance, rather than cohesiveness.

Empirical work suggests task performance and effective knowledge management are often in conflict with behavioural prescriptions of cohesiveness. The OB textbook theory typically emphasises homogeneity as a basis for interpersonal attraction in teams, but the literature on cross-functional teamworking, and innovation suggests diversity among team members improves creativity and project performance, in spite of lower cohesion. Research has also shown that teams with greater cohesion tend to be more insular, closed to the knowledge and influence outside of the team.

The point here is not that cohesion is necessarily negative, or undesirable, but it is not as important to effective teamworking as depicted in the organisational behaviour textbook theory. It should also be noted that the OB textbook theory is not representative of research done under the rubric of the OB discipline, which often displays a sophisticated understanding of knowledge and teamworking. We might expect this more recent work to impact on the textbooks in time.

(2) The content of individual knowledge bases when combined in a team, effects the efficiency of teamworking.

Research on the content of individual team members' knowledge shows why a team is not always "greater than the sum of its parts". Where team members' knowledge is similar and overlaps, teamworking is more efficient, as tacit understanding is shared and there is less need for explanation and demonstration (Hutchins, 1993; 1995). Where the individuals' knowledge bases are quite different, teamworking is slowed and complicated. This is why cross-functional teams are typically difficult to make work, creating a trade-off with the benefits that diversity brings.

In complex task environments where specialist knowledge needs to be integrated, team structures based around modular product architecture have proved successful. The advantage is that team size is restricted to a small enough scale that the combination of specialisms is made more manageable. The organisational problem is then to co-ordinate the interfaces between the teams. Research shows that for complex tasks frequent and substantive consultation with the external organisation and communities of practice is associated with higher performance. This leads to the third proposition:

(3) The team's external links are at least as important as its internal dynamics for knowledge integration.

Numerous studies have shown that inter-teamworking is as, if not more important than intra-teamworking. In complex contemporary industries such as software, "teamwork" is

an ambiguous term which in real terms expresses the need for regular group reviewing of individuals work and consulting among colleagues (Failla, 1996). In such task environments, the internal behavioural dynamics of teamworking and teambuilding stressed by the OB textbook theory are somewhat off-target.

The benefits of cross-functional teams, for example, derive from their privileged communication channels to external communities of practice; the gatekeeping function. Knowledge tends to be transferred more easily where the source and the recipient are similar, as is typical in communities of practice, and tends to stick across the boundaries of these communities. Cross-functional teams are a useful organisational setting for the “intercommunal negotiation” (Brown & Duguid, 2001) to break down the boundaries.

Although the members of such teams will still share more with their own community, they may also “go native”. As shown by the field of ethnomethodology, the immediate work group is not a negligible influence on identification. As regards identity, while Brown & Duguid are entirely right to emphasise that organisations are not monolithic, neither are communities of practice, as one may infer from some of their work. As asserted by the social identification theory cited above, there are many competing impulses for an individual working in a complex organisation.

The picture that emerges is one of teamworking as organisational design (Galbraith, 1994; Mohrman et al., 1995; Tranfield et al., 2000) to promote knowledge sharing, as well as efficiency in operations. Traditional foci on internal behavioural dynamics and group identity are supplanted in favour of the content and interactions of differentiated

knowledge bases. Teamworking is increasingly recognised as a systems solution (Ciborra, 1993, 1996; Senge, 1990), involving not only the level of the team, but the individual, the functional department, the organisation, the community of practice, and the necessary interactions between these levels.

Future work on teamworking and knowledge management is sure to continue assessing the impact of new information and communications technologies, new organisational forms, and globalisation. These are all rich research themes not covered by this review (c.f. *Organisation Science*, Special Issue, 1999: 10, 6; Maznevski & Chudoba, 2000; Shani et al. 2000; Griffith, 2000; McDonough III et al. 2001; Newell et al. 2001).

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