Managing Project Management Knowledge for Organizational Effectiveness

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Abstract

Knowledge is increasingly seen as a key but often underutilized asset. While Knowledge Management (KM) tends to focus on aspects of the capture, storing and retrieval of knowledge, knowledge creation, dissemination and application is also vital. Organizational Learning (OL) addresses much of this, looking at the way organizations learn and apply new knowledge, skills and behaviors in order to improve their performance. Many companies believe that projects provide an important means of capturing knowledge and building organizational learning, both for general enterprise-wide issues and for the management of the projects themselves. Nevertheless, there is substantial evidence that at both the enterprise and the project level, it is simply not done well.

This paper reviews extensive research and experience in project-based KM and OL over recent years. It draws on three major research projects conducted by the Centre for Research in the Management of Projects (CRMP) on project management bodies of knowledge, and on KM and OL. It shows:

- how crucial is the distinction between explicit and tacit knowledge, particular in knowledge creation;
- the special benefits, and challenges, that project management brings to KM and OL;
- that the nature of the knowledge content ["space"] crucially influences the nature of KM and OL.

These findings have implications for several areas of project management's on-going interests, not least capability maturity models, project management frameworks, supply chain management, and the relationship with [business] performance.

Knowledge Management and Organizational Learning

Many companies know that much of their effectiveness lies in the way they manage, and use, knowledge. While this is well accepted, and extensively researched, for companies, it is equally true for project-based organizations. Yet here the research is much thinner. This paper draws on three substantial research projects led by the author into aspects of knowledge management and organizational learning in projects: the CRMP (APM) BOK, KLICON, and PROBOL[1].

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[1] Specifically these research projects were:

1. The project management Body of Knowledge (with a research team comprising colleagues from CRMP – Professor Stephen Wearne and March Patel – with support

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Knowledge, and knowledge management, are somewhat elusive terms. Knowledge management (KM) has been defined as the process of systematically and actively managing and leveraging the stores of knowledge in an organization; as the framework for discovering, capturing, transmitting, and reusing knowledge to gain competitive advantage [1].

While the management of knowledge is not a particularly new concept – knowledge has been with us for ever; libraries have been around since writing was invented – in the modern sense of the discipline there is great emphasis on the technologies we can use to capture, store, access and use knowledge more effectively. And here is where the first potential for confusion arises: we need to differentiate knowledge from information and data.

Knowledge can be considered as the end of a chain that begins with data and passes through to become information, leading ultimately to insight (cognition). Data is bits and bytes of information – uninterpreted information. In the CRMP research projects, knowledge is taken as the cognitive ability to generate insight based on information and data[2]. While the distinction with data is relatively clear, that between information and knowledge is less so. We take knowledge to be the ability to use information in a predictive manner but recognize that what is knowledge to one person in this sense could be just information [conceptualized data] in another. (Literature, like life, is replete with instances where the context was assumed, and what was thus taken as 'predictive knowledge' was in fact misinterpreted information.) The value of knowledge depends on the context of the decisions or actions to which it leads, a point that will become crucial to the arguments to be developed in this paper.

KM in practice tends to deal simultaneously with both information and knowledge. KM practices will, for example, be interested in the capture, filing and retrieval of directories of information of value to the enterprise – supplier information, technical and scientific information, 'who knows what' directories [Yellow Pages], etc. The distinction that is crucial here is between explicit knowledge – that which is 'readily available' – and tacit – that embedded in a person's experience and often difficult to articulate clearly [3]. Crucially, as Figure 1 shows, explicit knowledge is more amenable to IT management while tacit requires contact with people (Subject Matter Experts, Communities of Practice, etc.). KM in practice tends to deal with both.

'Management' knowledge, as opposed to scientific or engineering based knowledge, is typically much more tacit than explicit (as we shall see later, when discussing the nature of project management knowledge). Scientific knowledge is more publicly

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2. IT tools for knowledge management in construction (with Marsh Patel and Taha Elhag from CRMP, Professor Hilary Kahn from the University of Manchester, with Kvaerner and Ove Arup): KLICON: 1998-2000, funded by the Engineering and Physical Sciences Research Council (EPSRC);
3. Project-based learning for business performance (with Irene Loch from CRMP, and Professor Joseph Lampel & Pushkar Jha from City University, with Bovis Lend Lease, BP, DFID, Fujitsu Consulting, GlaxoSmithKline, Lloyds TSB, and Rolls-Royce): PROBOL: 2001-3, funded by EPSRC

[2] Nonaka contrasts knowledge and information as follows. "Information is indifferent to human values, context free, and without intentions or commitment. Knowledge is grounded in values, experience, and purposeful action. Knowledge is meaningful; it is relational and context-

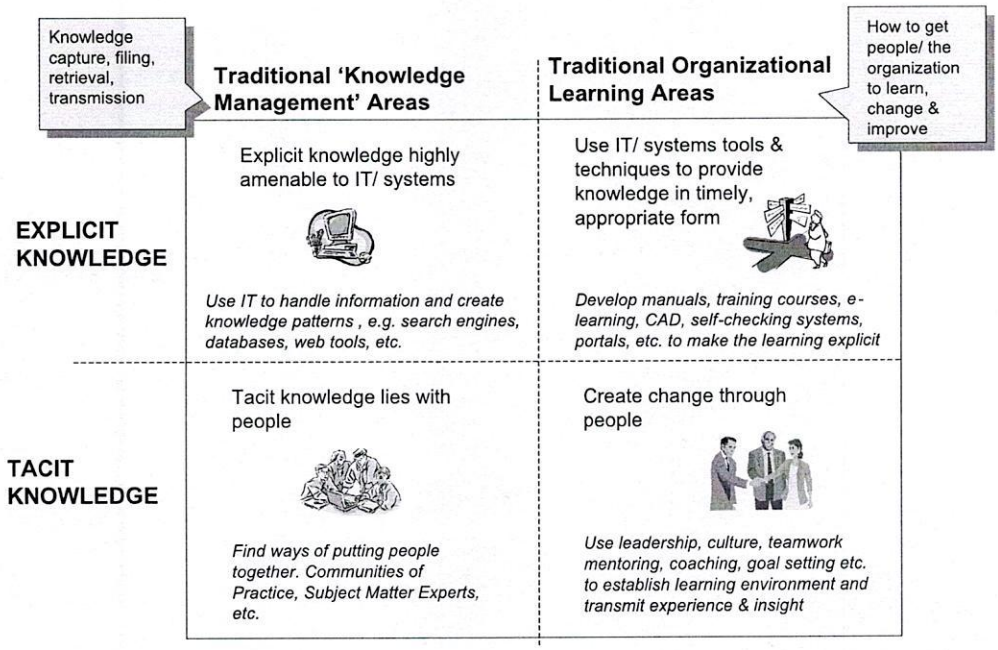

Figure 1: KM and OL

verifiable, in the Popperian sense[3], than social, while engineering knowledge applies both mathematics and the 'hard' sciences (physics, chemistry, etc.) and the 'soft' sciences (such as economics, sociology and management)[4]. Management knowledge is even more problematic: it is highly contextual and complex and difficult to render into generically valid forms. As a result, " there are plenty of theories about management but few laws" [5]. The multi-disciplinary, contextual, and experiential nature of management explains why many people find it more attractive to read or hear at first hand managers' tacit learning (albeit they typically want some form of sense-making frameworks for dealing with this knowledge).

Knowledge, until applied, is of limited use. In the world of affairs, knowledge needs to be used – effectively, so that performance can be improved. People, and organizations, need to learn how to apply knowledge effectively. And here is the second potential area for confusion: the relationship with organizational learning (OL). Organizational learning has a much longer pedigree than KM, stretching back to the late 1950s [6]. Gradually, from about the 1970s on there has been a growing torrent of research and literature on the subject [7]. Fundamentally, OL is concerned

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[3] The classical means of scientific enquiry are those of acquiring publicly testable knowledge of the world, as the philosopher Karl Popper showed, through the processes of reductionism, repeatability, and refutation. We reduce the complexity of the world into experiments; these may be validated in that they are repeatable; and we build knowledge through refutation of our theories [4].

[4] Comte, the founder of modern sociology, proposed that sciences could be placed in a natural order in which each science presupposes the less complex sciences which precede it, but shows its own irreducible laws. For Comte, this order was mathematics, astronomy, physics, chemistry, the biological sciences, and sociology; a more up-to-date sequence would be physics, chemistry, biology, psychology, and the social sciences. The problem for the later sciences in this sequence is that the number of variables – the complexity of the issue being treated – increases dramatically so that it becomes harder to apply the classical means of

with the way organizations as such (rather than individuals) learn so that their performance improves. There are several perspectives from which this question can be pursued, as Easterby-Smith has shown[5] [8].

The distinction between KM and OL is in reality an unnecessary and unhelpful one. Seen together they form a much fuller and more useful whole; one in fact that can usefully be extended so that we can see more clearly how knowledge can be managed so that business performance is improved. This, at least, is the theme explored by this paper.

The drive for improved learning, like many exercises, starts from a simple viewpoint: it is important; it needs to be done well (probably better); how can this be achieved? A relatively simple description of project management based 'best practices', for example, can be laid out quite easily (Table 1) [9] yet even within this relatively straight forward set there are difficult issues – for example, how do you get people to look up existing knowledge (learnings) and take notice, internalize, and use them.

Table 1: best practices in learning for project management

- Systematic collection of learning [on projects]
- Clarity of project development process
- Periodic project review points
  - Post-project evaluation
- Distinguishing between tacit and explicit knowledge
- Identification of key persons as repositories of tacit knowledge and as 'owners' of subject matter areas:
  - Subject Matter Experts, Coaches, Mentors
- Information Management tools to capture, store, process, archive, retrieve and present explicit knowledge
- A discipline of accessing knowledge (using checklists or other 'look up' guides etc) by the project teams before beginning a new project task
- A definition, in some way, of the knowledge in a particular area: the 'Body of Knowledge'
- Establishment of an integrated KM program in place [informally even if not formally]
- Formal management of this KM program
  - A KM manager
- A formal program of learning defined, using this knowledge
- The distinction made between individual, team and organizational learning
- A mechanism for updating the knowledge. How frequently are old, out-dated paradigms / bits of knowledge discarded?
- A program or programs developed to use the knowledge/ learning that is 'identified', for example in:
- Metrics/ benchmarking,of knowledge effectiveness
- Continuous improvement/upgrading
- A competency development program related to organizational learning
  - Individual
  - Organizational
- Training (as part of the above): face-to-face and IT/e enabled

[5] Easterby-Smith reviews the literature under six major groupings: psychology and organizational development, management science, sociology and organization theory, and

And though some immediate success can be obtained from following such principles, more sophisticated learning (for example, that leading to real change in management thinking and behavior, or that affecting the link between business objectives/ strategy and operational performance) is much harder to achieve [10]. Though there has been vast amounts written about them, there are considerable challenges in getting the results executives expect from KM and OL: knowledge is so large an area, it is still very hard to deal with tacit knowledge, etc.; and it is often extremely hard to get people to engage in the fundamental practices – to develop lessons learned, to want to learn, to use the knowledge gained, and so on.

What is clear is that technology, though potentially helpful, is not enough: there absolutely has to be an appropriate culture. Or, in Collison & Parcell's persuasive analysis, people, technology and process all have to interact for effective learning to happen [11].

Projects, project management, KM and OL

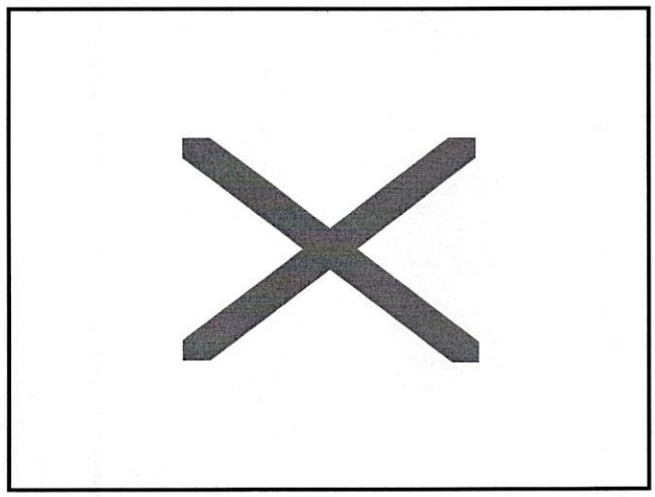
Projects are generally under-represented in organizational and management literature. In organizational learning, however, they have a little more of a prominence, being recognized as important opportunities for real organizational learning – not least because of their role as vehicles for creating change [12].

Beyond this somewhat cursory recognition, however, there is still something of a blank wall: there is little recognition of how effective project management practices could improve KM and OL and very little discussion of the importance of KM and OL to improved project management performance and competences (except within the specialist project management literature [13]).

KM and OL in project-based organisations confronts difficulties that are not commonly encountered by non-project organisations. Project-based organisations work on life-cycles that are often long, developmental, non-repetitive, and typically organized around teams assembled specifically for the project that are often disbanded, sometimes quite rapidly, upon the project's completion. Typically, companies – and people and teams – come together for the first time in 'the organization' (i.e. the project): this means there is often a scramble to create the right KM/OL culture, locate knowledge 'assets', and access and internalize previous learnings. Supply chain patterns and procurement practices mitigate against effective learning practices.

These difficulties are exacerbated by problems of measuring performance in projects, and hence relating KM and OL to performance improvement. For example, definitions of success vary between participants and over time. Further, traditional definitions of project management have been largely execution driven, that is, focused around 'on time, in budget, to specification' delivery. The broader 'management of projects' perspective, on the other hand, looks at the positioning of the project in its business/social context and focuses equally on optimizing the definition of the project as well as its execution [14]. At this level however knowledge becomes especially broad and the challenges of effective KM and OL become substantially greater. A particular difficulty is defining the project performance indicators that relate best to business performance, given there are several potential measures, often several different organisations involved with differing performance objectives, time delays, and often weak causality.

Nevertheless, there are real strengths that project management can bring to the



effective project management organizations manifest, coupled with the excellent leadership, team and other organizational behavior practices that they will also exhibit. As an example, the gate review process of moving from the early institutional/ strategic stages of a project through to its later tactical/execution ones [15] can force 'strategic learning' in a way that the 'double-loop' learning theorists have yet to acknowledge. Similarly, the formal practices of Value Management, Design (Configuration) Reviews, and Quality Reviews bring process driven opportunities for strategic learning. BP, for example, insist, through their Capital Value Process (CVP), that there be peer reviews organized by an officially identified 'gatekeeper' before the project can proceed to its next stage of development: these help ensure that both strategic and tactical learning is drawn upon by the project at these critical change points [16].

Projects thus have a vital part to play in KM and OL. They can be central to organizational learning; and good p.m. practices ought to improve significantly the effectiveness of the way KM and OL is performed.

Knowledge creation and enablement mechanisms

In recent years the process of knowledge creation has begun to dominate over the more awkward split of KM and OL. Influential writers such as Boisot and Nonaka et al. have pointed out how the process of creating knowledge in an organization can illuminate the challenges of managing knowledge and generating improved organizational performance. Antal, Dierkes, Child, and Nonaka, in their recently published *Handbook of Organizational Learning and Knowledge*, suggest that the process aspect of the nature of the learning is the area where scholars still diverge most [17]. They identify three models.

- The first is those who portray learning in terms of steps or phases - with knowledge acquisition through diffusion and sense-making to action and then storage [18];
- second, those based on feedback loops between the organization and its environment – with a grouping particularly interested in strategic learning ('double loop' to achieve cognitive learning) [19];
- more recently, a third "spiral model has emerged as a way of capturing the dynamic process of knowledge creation".

Of the latter, Nonaka's model of moving between tacit and explicit knowledge is the most developed [20]. (Boisot also recognizes this movement, in his concept of 'I-space' (see below), though in a more cyclical fashion, albeit with the addition of a

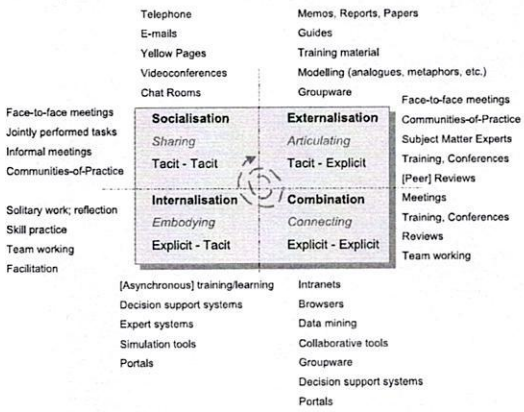
from tacit to explicit knowledge and back again is core to the way knowledge is created. He proposes a four stage sequence where:

- knowledge is shared on a tacit to tacit basis
- then tacit knowledge is articulated as explicit knowledge
- then explicit knowledge is combined with other explicit knowledge
- and then explicit knowledge is internalized (embodied) as tacit knowledge.

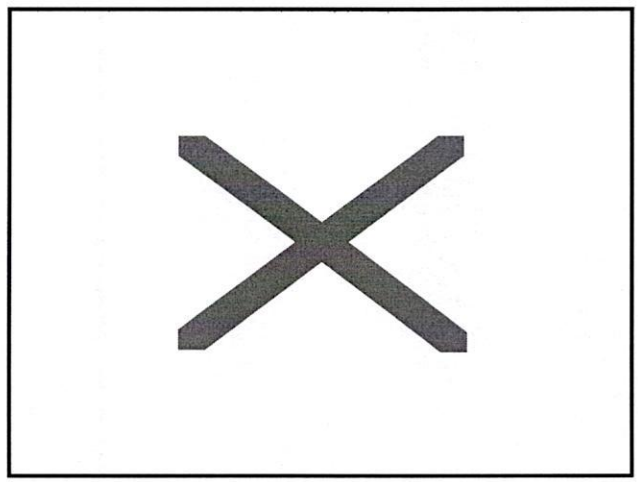
The process is repeated, spiraling within the organization, supply chain, group, etc. This is the SECI spiral – Socialization, Externalization, Combination, and Internalization. Boisot proposes a different model based on his view of knowledge (I) space: a cycle progressing from scanning, problem-solving, abstraction, diffusion, absorption, to impacting – the Social Learning Cycle (SLC)]. The CRMP research has found Boisot's insights around knowledge space to be extremely valuable, but that Nonaka spiral sequence, centered on the crucial matrix of movement between tacit and explicit knowledge, works well in all the cases of project based learning that it has investigated.

The SECI model has the further merit of showing how different knowledge enablement means are employed to support these different stages of knowledge creation. Figure 3 illustrates these different means in two basic clusters around the SECI cycle. This has become a key insight, for it shows (a) the range of different knowledge management mechanisms, (b) where each has its place. Databases, for example, have their place, but only to a limited extent for a lot of management learning. In the CRMP KLICON project for example, project data was held in computer form and then translated through a web-based front end for different users; further work looked at the ability of search engines to minimize the need for pre-defined project taxonomies [22]. Both are interesting developments within the field of KM tools, but both only go so far in addressing the overall needs of a project/ management based KM system. Fuller recognition needs to be given to the nature of the knowledge being managed, particularly the tacit dimension, and how this is best presented, and learnt.

Figure 3: the Nonaka spiral
showing the different forms of knowledge enablement



Portals represent an interesting opportunity for blending the management of explicit and tacit knowledge. Portals are essentially doorways through which the user can access a collection of information relevant to his needs. Project portals typically cover a range of project functionality, knowledge and learning being an important component (though often missed out in Off-The-Shelf products). Critically, by allowing access to communities of practice (chat rooms, threaded discussions, e-mails, etc.) and direct contact with Subject Matter Experts (coaches, mentors, etc.), they combine at one point structured access to both tacit and explicit information (Figure 4).



PROBOL's research is revealing several insights around portal-based learning, all of which are consonant with the theory reviewed above, and with common sense. One company in the PROBOL research team for example, which has quite distinct cultures in its several different divisions, is looking to offer a consistent architecture across all divisions, alongside its common project development process, but with the clear expectation that content will be tailored to reflect division (client/industry) culture. Another finds the provision of re-usable templates and project-specific very valuable; is more equivocal regarding portal-based communications; and has integration with project best practices as its next development issue. DFID – the UK government's Department For International Development – has an extensive learning portal: this is highly attractive to those coming fresh to DFID projects but is less used by those already familiar with most of the structured content (current information is accessed via e-mail).

Knowledge Space and Organizational Learning

One thing that struck the PROBOL team early on was the great range in scope posed for KM and OL in projects. INDECO, for example, a management consultancy specializing in this area, has been developing project-based portals for areas such as program management and risk management for several years. These work very well as what are in effect decision support systems. Risk Management is a clear example. The risk management portal allows, from one place, the user to access all he needs to perform effective risk management: templates, tools (software, risk registers, etc.), process guidance, e-learning support (distance learning-based guidance linked to the risk management process). It works because the knowledge area is relatively compact and well-defined. When it comes to other areas, however, the type of knowledge will require different learning support. Team building for example is almost certainly best taught in a more directly experiential way (workshops, field exercises, etc.)

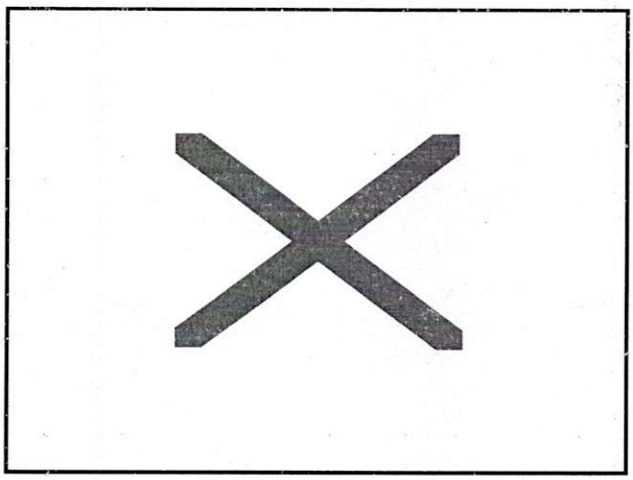
What are the areas of project management that a project based KM/OL system should support? (System being defined here in the broadest sense, and certainly more than IT.) How should these be supported?

CRMP research on the p.m. Body of Knowledge showed that, though the PMBOK® is extremely popular as a generic framework to project management knowledge areas, most project management practitioners feel that they need also to be knowledgeable in a broader range of project management areas. Knowledge guidance and support is often needed in such topics for example as project strategy,

strategy, requirements management, design management, configuration management, value management and value engineering, etc. [23]. CRMP's PROBOL research is showing again that companies, in developing their own project management 'Best Practice' guidelines, often similarly deploy KM & OL support across such a broad range of topics.

Any organization deploying knowledge support across such a range will be working on the assumption that the knowledge is reliable, but such a breadth of areas raises questions of how 'valid' our knowledge over such a broad area can be, and secondly how we can best transfer (support/ ensure) learning across such different areas.

The first question touches on the epistemology of management knowledge. As Griseri has persuasively argued, none of the classical approaches to trying to formulate valid knowledge of management – positivism and realism, interpretation[6], deconstruction, or action based research – is entirely successful. Instead, he suggests, we should consider the criterion for management knowledge as appropriateness rather than validity: what makes sense and works in the particular context that it is used and is needed [24][7]. There is an important place for generic best practice frameworks, but the really useful management knowledge will always be contextual.



The second question leads to the recognition that the different topics in a p.m. KM/OL support system will have different knowledge support requirements, depending on the characteristics of the knowledge type. At first the PROBOL team thought in terms of size – risk is a smaller, more well defined area than a whole p.m. practice guideline, for example. Boisot's analysis is richer than this however. Boisot's schematisation – his 'I-space' – shows that knowledge needs to be managed differently according to whether it is abstract or concrete, codified or uncodified, undiffused or diffused (Figure 5) [25].

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[6] Interpretation essentially covers hermeneutics and phenomenology. The CRMP work on the BOK is positioned as essentially realism based i.e. based on empirical evidence. But ultimately, insofar as people start bandying about different 'models' (essentially diagrams of the way knowledge areas relate to each other), it is becoming almost hermeneutic, i.e., a dialectic based approach where some interpretation is needed in order to give coherence to the phenomena being observed.

[7] There is a point here too, touched upon in plenary discussion at the PMI 2000 Research Symposium, and now a PMI research theme, as to what the 'theory' of project management is. Essentially, following this line of thinking, there is no single theory. Instead, there is a series of topics with their own knowledge areas connected, in my terms, with what is needed in order to define and deliver a project successfully as it evolves from its earliest stages to when it is completed. This will involve many areas of knowledge, nearly all of which will, since

Nonaka has a different version of 'knowledge space'. Nonaka uses the term *Ba* (Japanese roughly for "place") to describe the "platform where knowledge is created, shared and exploited" – where SECI takes place. "For an organization to create knowledge, leaders in the organization have to build and maintain and energize *Ba* by providing enabling conditions of autonomy; creative chaos; redundancy; variety; and love, care, trust and commitment" [26]. A poor *Ba* leads to poor learning.

Apart from *Ba*, Nonaka does not really address the process of learning. The cyclical learning theorists – most notably Argyris & Schon with double loop learning (learning how to learn), and Fiol & Lyle with their view of cognitive reshaping as a requirement for strategic learning – deal with this most explicitly, though none really address how learning takes place: what drives people (let alone organizations) to learn [27]. Boisot too has a staged learning model, but based on the economic value of knowledge, distinguishing between a hoarding model, which he labels N (Neoclassical) learning, and a sharing model, which he labels S (Schumpeterian) [28].

Project based learning and [business] performance

These ideas have relevance for several areas of contemporary project management research and development. They suggest that:

- the search for project management best practice/ world-class performance after a while is something of a chimera: advanced performance is difficult to measure and compare, and the process of learning in order to improve at these higher levels is complex;
- similarly, the idea of progressive performance improvement through capability maturity levels, though potentially leading to staged improvement at the lower levels of development, becomes more complex at higher levels of capability;
- where knowledge sharing is economically attractive, conditions across the whole project, including the supply chain, need to be aligned to support this;
- relating project learning to organizational learning at the strategic level of the enterprise is generally tentative and difficult.

World-Class

The project management community is increasingly concerned with benchmarking and other forms of comparative performance measures, particularly with reference to ideas of Best Practice, 'World-Class' and 'Maturity'. Partly this is due, no doubt, to the general interest in continuous improvement but partly because of the difficulty of measuring the value of project management. But the attempt begs questions of classification and definition. What should we be measuring (to be at world-class in project management)? Are we, for example, measuring 'on time, to budget' completion or business impact? (What do we mean by the latter, and how do we measure it?) What are the areas of knowledge that relate to these measures? Certain core project management areas are clearly helpful – scheduling for example – but others are more variable between different enterprises. Lloyds TSB and GalxoSmithKline for example are both PROBOL partners: Lloyds has no procurement activity, for GSK it is central. There is no single universal p.m. knowledge standard that everyone must apply. Best-in-Class makes more sense than World-Class. As Loch has suggested, effective learning centers around process, context and content [29]: excellence is likely to be more a function of having the right learning and other management processes operating to meet the organization's needs rather than simply worrying about p.m. knowledge standards.

Maturity Models

Great interest is currently being shown in project management capability maturity modeling [30]. The maturity idea stems from software development: a highly structured knowledge area [31]. Interestingly, in the Boisot 'I-space' sense, an area relatively codified and concrete. But managing projects requires a much broader range of knowledge. A company-specific set of p.m. guidelines or methodology is likely to cover many knowledge areas ('hard' tools, 'soft' people type issues, strategic and business areas, technical and commercial issues). While assessment against individual topic areas is quite achievable, and useful, calibrating overall performance against capability in individual areas is extremely difficult. CRMP's findings suggest that the linkage between knowledge in individual areas and overall project management capability (however that is defined) is tenuous. Two PROBOL partners have used p.m. maturity capability modeling to assess their capability. They find that confirming p.m. functional areas' comparative strength and weakness is useful, but having an overall maturity level is of limited credibility or value.

Indeed, the notion of some kind of 'staged' learning, leading to progressive movement from one maturity level to another, probably only applies at the lower capability levels. Cyclical and spiral learning, in the Boisot and Nonaka sense, seems a generally more realistic model, particularly at the more advanced or complex levels. Management is a practice, as Drucker observed [32]: management learning is about optimizing performance in a particular context, be it in a single project, across an extended supply chain, or for the company's strategic business benefit. Learning in these contexts requires reflection and iteration, based upon a sound appreciation of fundamentals [33].

Appropriate organization and learning conditions: supply chain alignment and strategic learning

If knowledge is an asset it has an economic value. Boisot shows that a company is more likely to hoard knowledge which is highly specific and important to its competitiveness than knowledge which is more diffused, which it is more likely to share. Since the early '90s BP, for example, has been an early adopter of new technology rather than a primary originator. As a result it has concentrated on creating conditions for knowledge sharing generally, not least with its suppliers and contractors[8]. Throughout the '90s BP promoted 'Alliancing' as its preferred means of engaging suppliers: creating longer term, win-win conditions – Nonaka's *Ba* – for all the key project participants to work together [35]. In the late '90s however BP merged with Amoco; Amoco had less tacit empathy towards Alliancing. This led to a move away from Alliancing as the preferred mode of contracting to, more recently, relationship-based contracting.

The BP Alliancing case raises interesting questions about how organizations really learn – or do not – strategically from projects. There is no doubt that BP's early commitment to Alliancing was promoted with a large degree of personal belief among many leading BP executives, drawing on their tacit knowledge. The enterprise articulates these tacit beliefs and learns strategically, among other means, by narratives – BP's articulation of the successful development of the Andrew field via Alliancing is an example [36]. Given the essentially emergent nature of strategy, such

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[8] Boisot contrasts BP and Courtaulds. Courtaulds, a fibre manufacuturing company, placed great competitive value on its ability to generate and hoard original technical knowledge on new fibres. BP, on the other hand, concluded that "while the possession of technical know-how was a major ingredient of BPX [Exploration] competitive advantage, the critical success factor was the extent to which such know-how facilitated the adoption and application of new

'belief shaping' action is probably inevitable (and is tied into the nature of corporate leadership, in both the public and private sectors) [37].

Projects: good at knowledge pull; worse at knowledge transfer
It would seem, in short, that companies find it a lot harder to learn strategically from projects than to ensure that projects apply strategic knowledge. Most of the PROBOL companies have clear processes and practices for ensuring that teams draw on strategic knowledge at appropriate points in the life cycle (gates etc.). This practice works well and is a real strength of the project management approach: it is an effective means of achieving double-loop learning using the process discipline of good project management. With their very strong process base, tools set, leadership and team skills, projects tend to be good execution vehicles.

All the PROBOL partners however continue to find real difficulty in getting knowledge transfer from projects back into the organization; in getting learning – any learning, strategic or otherwise – to happen from past projects. Though technologies and tools, and processes and practices, exist, people and organizational pressures too often mitigate against effective learning. Projects are generally not as effective as they should be as places for learning about project management. Teams disband, supply chain members are not sufficiently aligned, learning is not high enough priority; people don't know how to learn. Getting people to attend to learning is in fact probably *the* major challenge in OL in general [38]; it is certainly the major KM and OL issue in projects. This is the area where PROBOL is now focusing.

Conclusion

There is now enough known about knowledge management (KM) and organizational learning (OL) for us to state much theoretically based best practice in this area. We can see that a number of practices, tools and conditions are appropriate for different stages of knowledge creation. Projects emerge as particularly powerful means of effecting knowledge creation; and project management brings many skills and practices that, properly applied, will facilitate KM and OL. Yet, paradoxically, projects are not as effective places as they should be for learning about project management.

Project managers need to ensure that the process, technology and people issues required to achieve effective learning are mobilized in a way that is appropriate both to the needs of the project and the enterprise, and to the type of knowledge. While some of these organizational and knowledge needs will be relatively simple, others will be complex and difficult. Models that underestimate the complexity of the overall knowledge needed to ensure successful project outcomes should be treated with caution.

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