MANAGING THE KNOWLEDGE LIFECYCLE

Julian Birkinshaw
Associate Professor
London Business School
Regents Park, London
NW1 4SA England

Tony Sheehan
Group Knowledge Manager
Arup
13 Fitzroy Street
London
W1T 4BQ

16th April 2002

Paper submitted to Sloan Management Review
ABOUT THE AUTHORS

Julian Birkinshaw is an Associate Professor of Strategic and International Management at London Business School. His research focuses on the internal dynamics of large multinational corporations, and in particular on such issues as knowledge management, corporate entrepreneurship, strategy and structure, and global account management. He is the author of four books, and over 40 refereed articles in such journals as Harvard Business Review, Sloan Management Review, Academy of Management Review and Strategic Management Journal.

Tony Sheehan is Group Knowledge Manager of Arup, a global design consultancy for projects as diverse as the Sydney Opera House and London's Millenium Bridge. He is responsible for the development and implementation of a global Knowledge Management strategy, and has interest in the areas of cultural change, process management and knowledge management technology. He is a frequent contributor to academic conferences and journals in the area of knowledge management.
MANAGING THE KNOWLEDGE LIFECYCLE

The ability to manage knowledge is recognised as a strategic imperative in most organisations – in professional services firms, industrial corporations, start-up companies, hospitals, and government. Executives now have a pretty good sense of what managing knowledge is all about. They understand that knowledge can take different forms, and that some forms are inherently more easily manipulated than others. They recognise the value of structured management information systems, as well as informal structures like communities of practice, to facilitate the sharing of knowledge. And they are acutely aware of the limitations their organisation faces in trying to make better use of its knowledge assets.

But there are many aspects of knowledge management that are less well understood. We still know relatively little about how new knowledge arises, or where it comes from. Most organisations develop systems that favour the re-use and sharing of their existing knowledge at the expense of new knowledge creation. But the reality is that knowledge creation is probably the more valuable process because it provides the raw ideas and concepts that are transformed by the organisation into useful outputs. Knowledge is similar to a living organism in this respect - it starts out as an idea in someone's mind that gradually gets modified and developed as it gets diffused throughout a population. Understanding this cycle of development, and particularly its early stages, is a clear priority.

Another issue for many executives is the need for greater clarity and simplicity in the knowledge management field. There is no shortage of useful frameworks, models and checklists from which to choose, but taken together this assemblage suffers from two basic afflictions. One is a tendency to gather every aspect of management (innovation, leadership, culture, technology etc) under the knowledge umbrella and treat them all as problems that require knowledge management solutions - when many are better dealt with elsewhere.

The second is a predisposition towards putting forward "universal" solutions to problems, when most are probably applicable in only certain settings, or in certain countries. Communities of practice, for example, have been touted as a new
organizational form that can "radically galvanize knowledge sharing, learning and change", as well as offer benefits like developing new lines of business, driving strategy, and helping recruitment. Our experience suggests that Communities of Practice are immensely valuable in certain contexts, and of limited utility in others. But no clues are typically offered as to which tools work best in which settings, so executives are left to make their own mistakes.

The purpose of this article is to make progress on both fronts by exploring the Knowledge Life Cycle – the concept that new knowledge emerges first as a nebulous idea that gradually gets tested out and clarified, applied in a few settings, and then is diffused to and picked up by other individuals and commercial enterprises until it is widely understood and recognised as common practice. The lifecycle metaphor allows us to make sense of both the stages of knowledge development as well as the processes of evolution and exploitation, as it moves from one stage to the next. It also offers a way of making sense of the conditions under which different knowledge management strategies are appropriate. Rather than suggest that knowledge management tools are universally applicable, our argument is that different tools apply to different stages in the lifecycle. Some tools, such as centres of excellence, are more appropriate for knowledge in its early lifecycle stage, some, such as communities of practice for the middle, and others, such as knowledge repositories, make more sense for later stages of the lifecycle. By better understanding the dynamics of the knowledge lifecycle in their industry, executives will be better able to make sense of their knowledge needs, and be able to select and develop the appropriate tools and techniques for knowledge management far more effectively.

The article draws from a five-year study of knowledge management processes in more than 15 companies (see box). Our of the core themes that emerged from the research was that companies are increasingly recognising the importance of defining knowledge from the perspective of user. So while it is interesting to make sense of how knowledge evolves over its lifecycle, the real insight comes from identifying the ways that a company can generate value for the customer at each and every stage of that lifecycle. This is in direct contrast to many of the approaches adopted to date that have led to futile searches for content which may never be used.
Lifecycle models have been applied to great effect in other settings – think of the product lifecycle and the technology lifecycle, for example. And the idea that knowledge changes form as it diffuses through a population is already well established in the literature. However, the practical implications of the knowledge lifecycle have not previously been discussed in detail, so the purpose of this article is to pursue this line of thinking. We develop the concept of the knowledge lifecycle in detail, and then we describe the appropriate strategies for managing knowledge at each stage of the lifecycle. Finally, we consider the implications of this model for firms’ overall knowledge strategies.

THE KNOWLEDGE LIFECYCLE

It is possible to represent the knowledge lifecycle as a simple S-curve, as shown in figure 1. The horizontal axis represents elapsed time. The vertical axis represents the percentage of the relevant market (e.g. individuals or firms) that has access to the knowledge in question.

The knowledge lifecycle can be applied to any knowledge assets, including intellectual property, knowledge embedded in products, and knowledge services. The focus here is primarily on knowledge services that are sold, as in the management consulting, engineering, banking, and IT services sectors. We also discuss knowledge services that are used internally. Four stages in the lifecycle can be identified, which we call creation, mobilisation, diffusion, and commoditisation.

Figure 1. The Knowledge Life Cycle
Knowledge starts out in the *creation* stage as nothing more than an idea in the head of one or a few people. Think, for example, of a scientist in a research lab who is experimenting with a new drug compound, or a management consultant who is toying with a new model of organisation change. At this stage, the idea is likely to be rather abstract, and not even well understood by the individual who thought of it, but there is enough coherence that this individual can start to test it out - in a laboratory setting in the case of the scientist, or in conversation with a client in the case of the management consultant. During this stage, many ideas will turn out to be dead-ends or they will fail to generate interest, but those that survive will become more clearly formed and better understood by their creators.

In the *mobilisation* stage the idea becomes more concrete, and its broader value is established through a process of testing and validation. At this stage, the key individuals are in a position to codify -to some extent- the tacit knowledge they have developed. For example, a scientist will often write an academic paper explaining her findings, which puts the knowledge in a form that is replicable by others with the relevant scientific training. The management consultant will often write up his insights as a piece of leading-edge thinking that is available to colleagues in the same firm. The mobilisation stage, in other words, involves some codification as a means of making the knowledge available to others, some 'testing’ within a trusted community.

In the *diffusion* stage, the knowledge in question starts to become fairly widely understood in the relevant marketplace. Scientific breakthroughs are reverse-engineered or successfully imitated by other firms\(^5\). New management tools are widely copied, and often adapted, by other consultancies. At this stage essentially anyone who wants to get hold of the knowledge in question can do so, though there will still be a cost to internalising that knowledge.

Finally, in the *commoditisation* stage, knowledge turns into common-knowledge, or in economic language, a public good. In principle such knowledge is free – it is available in a book or on the Internet, or it is taught in school. In the field of science, for example, think about the molecular structure of aspirin, or the design of the internal
combustion engine. And in the field of management a good example is quality management – once a highly specialised and esoteric technique, now standard practice in many firms (see box). However, while such knowledge is freely available, there are still opportunities for individuals and firms to generate value from it, as the large number of quality management consultants that are still in existence will attest.

KNOWLEDGE MANAGEMENT TOOLS FOR EACH STAGE

While all knowledge moves through the lifecycle, the speed of progress varies enormously from one case to the next.

What determines the rate at which a particular body of knowledge moves through this lifecycle? Three major factors accelerate the lifecycle. The first is competitive imitation – the efforts made by competitor firms to understand and gain access to the knowledge. This can be done through reverse-engineering, hiring key employees, plant tours, corporate espionage, and so on. The second is natural leakage – through customers, suppliers, and other entities learning from the firm and sharing their newfound knowledge. The third is deliberate codification and diffusion by the firm – a strategy which may make sense if the knowledge in question is going to be impossible to protect. We discuss this in detail later.
In terms of factors that slow the lifecycle down, two are key. One is the extent to which intellectual property rights can be established for the knowledge in question. In the pharmaceutical industry, patent protection is highly effective and essentially halts the lifecycle at the mobilisation stage for the 10-20 years during which a compound is protected. In the software industry, patent protection is harder to enforce, so the knowledge lifecycle proceeds much faster. The other is the tacitness of knowledge. Some knowledge is intrinsically less codifiable than other knowledge, and will thus move through the knowledge lifecycle much more slowly. Compare, for example, the knowledge needed to design a car versus a new computer system. Cars are made up of multiple interdependent systems, and the way they interact cannot be entirely predicted in advance. In contrast computer systems are perfectly logical, and often highly modularised. While both require high levels of expertise, computer system design is far easier to codify and transfer than car design.

However, the key point is that regardless of the rate of progress through the lifecycle, the firm can generate value for themselves at any and every stage. Some firms make a very good living in the creation stage, others generate considerable profits from the commoditisation stage. The trick is to understand the appropriate tools and
techniques to generate value from knowledge at each stage. We discuss these below, in four categories - the informal systems for mobilising and sharing knowledge, Information Technology systems, relationships with external parties, and human resources. The table provides a summary of the following discussion.

Table 1. Summary of Knowledge Management Tools for each Lifecycle Stage

<table>
<thead>
<tr>
<th></th>
<th>Creation</th>
<th>Mobilisation</th>
<th>Diffusion</th>
<th>Commoditisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal Knowledge Systems</td>
<td>Cultivating spontaneity</td>
<td>Building centres of excellence, communities of practice</td>
<td>Building communities of users</td>
<td>Teaching and learning</td>
</tr>
<tr>
<td>IT Systems</td>
<td>Systems for facilitating interaction</td>
<td>Systems for sharing ideas</td>
<td>Tools for storage and Application</td>
<td>Knowledge reuse systems</td>
</tr>
<tr>
<td>Human Resources</td>
<td>Managing mavericks</td>
<td>Valuing generalists and ambidextrous employees</td>
<td>Mobilising implementers</td>
<td>Manage experts in declining fields</td>
</tr>
<tr>
<td>External Relationships</td>
<td>Market pull through lead users</td>
<td>Market pull / alliances</td>
<td>Benchmarking and differentiating</td>
<td>Redefine industry practice</td>
</tr>
</tbody>
</table>

1. Generating Value at the Creation stage

The essence of the creation stage is that no-one fully understands the idea or emerging body of knowledge, not even those creating it. The process of creation is therefore messy by nature, and does not respond well to formal methodologies or rigid timelines.
For commercial organisations, the dominant strategy for working with early-stage knowledge is to flesh out the idea sufficiently well that its viability as a commercial proposition can be tested (whereas for universities and publicly-funded entities, the production of knowledge can be an end in itself). Thus, a software company will put together a prototype to test on beta sites, and a management consultant will look for an existing client who is interested in trying out a new analytical tool. To do this, firms need to create an environment in which people feel free to think creatively and experiment, while at the same time providing some structure and discipline. As observed by Simon Best, CEO of lifesciences company Ardana, "Scientists are high-talent and high-maintenance people - they are not in it for the money, they work because they want to, and they do not respond to normal incentives and arguments. I spend my time trying to secure commitments, and somehow helping them to deliver on these commitments. And if they don't like my style, they will stop listening to me." Building an environment like this has several components:

**Informal knowledge systems.** Creativity is nourished most effectively by simply facilitating informal and spontaneous interactions among people. This can be achieved through an open plan physical layout with lots of common areas, by providing employees with the time and space to experiment with new ideas, and by providing resources for training programs and attending conferences.

For example, WCRS is a London-based creative advertising agency owned by the French group Havas. As one employee explained, it operates in a state of "structured chaos" with informal contact encouraged on a business and social level, and with the in-house wine bar as the "social hub of the organisation". In his view, the high level of social interaction among employees engendered trust and helped the agency to sell "bold" creative ideas to its clients. Hewlett Packard Laboratories is another example of a company that focuses on the creation stage of the lifecycle. It operates in a quasi-university style, giving its researchers funding for conferences, "slack" time to pursue pet projects, and free access to all laboratory materials and equipment.

**Information Technology systems.** In the creation stage of the lifecycle there is little value in systems for codifying and storing knowledge. Instead, IT systems are better used to enable personal interaction - essentially as a way of mobilising tacit
knowledge. For example, most management consultancies now have "Yellow Pages" directories for identifying the firm's resident experts in certain industries or subject areas. Discussion forums, videoconferencing facilities, and software for brainstorming are also useful, but only as enabling devices. The other role IT plays at the creation stage is access to highly specialised Internet forums. For example, Java programmers at Icon Medialab the Swedish consultancy, commented that they will often seek out ideas and advice on Internet forums because they know they can interact with others who are at the "bleeding edge" of technology. Despite the fact that the participants in these forums never meet, there is still considerable prestige to be part of such an elite community.

**Human resources.** Companies that succeed in knowledge creation are somehow able to hire and live with oddballs and mavericks - people who see the world differently, and who constantly challenge the status quo. Such people typically need special contracts, different compensation models, and a more patient style of management than is usually found in commercial companies. For example Leif Edvinsson, one of the originators of the Intellectual Capital movement, worked as a vice president of Swedish insurance company Skandia, but in a unique and continuously changing role.

**External relationships.** New knowledge can be created in a company's research labs, or simply in the mind of an employee, but most often it emerges through contacts outside the company - in conversation with a customer or a supplier for example. Companies that are focused on the first stage of the lifecycle therefore deliberately seek out relationships with external partners that are likely to lead to knowledge creation. 3M for example has an active "lead users" program for developing new ideas in partnership with customers. Management consultancies will often have long-term clients they can bounce their new ideas off. In the world of engineering, companies will often take on high-profile projects (such as Otis providing elevators on Sugarloaf mountain in Rio de Janeiro) on a break-even basis because they give them an opportunity to push industry practice.

2. Generating Value at the Mobilisation stage
The mobilisation stage is about refining, elaborating, and increasing sales of the knowledge in question, whilst retaining as much control over the knowledge as possible. The firm believes it has something valuable that it can extract value from, but to do that effectively it typically helps if that knowledge is proprietary. So the trick is to find ways of mobilising its knowledge internally, while keeping it obscured from those outside the firm.

One approach to keeping knowledge proprietary is through intellectual property right protection, which essentially halts the knowledge lifecycle for the duration of the patent. However most knowledge services of the type under discussion here cannot be meaningfully protected. Even if a term can be protected - The Balanced Scorecard for example - it is almost impossible to stop imitators from using the same concept under a different name. The best overall policy, in such cases, is generally to keep knowledge relatively uncodified, whilst creating internal mechanisms for exploitation. This means ensuring that it is so hard to make sense of, or context-specific, or diffused across multiple people, that it cannot be readily copied. Approaches for doing this are as follows:

**Informal knowledge systems.** The emphasis here is on building informal networks among people so that knowledge can be transferred through experience. The classic model for doing this is the community of practice, which in its initial conception was simply a group of people with common interests who shared their experiences and in so doing learnt from one another. Many firms have adapted this idea by encouraging the establishment of informal communities. For example CSC the computer services company has several hundred communities of professional employees, each one based around a particular competence or practice area. However, to be true communities of *practice* (as distinct from communities of users, a stage 3 tool) they should be limited to a relatively small number of members with existing expertise, and with as little formalisation as possible.

Another tool that many companies use to mobilise knowledge is the centre of excellence - a small expert group in a single location with a mandate to spread their expertise across the company. For example, HP Canada has a number of centres of excellence in R&D, Sara Lee has centres of excellence in manufacturing and some
support activities, and 3M Europe has centres of excellence in corporate marketing. 3M's centre of excellence in key account management, for example, was based in Stockholm, and the manager responsible would spend time visiting other 3M businesses in Europe to explain what they had done and how their approach could be spread throughout the company.

Information Technology systems. As with stage 1, the emphasis in this stage is on technology that enables informal transfer. So a good "Yellow Pages" database is essential, but in addition there is a need for IT systems that flag the existence of current ideas and projects. A common approach in management consultancies, for example, is for consultants to to post white papers or thought pieces on a knowledge database. These typically provide readers with enough information to make sense of the idea, so that they can get in touch with the original author if they want to pursue it further. When written well, documents of this sort are in a form of shorthand so that they make far more sense to another employee of the firm than to an outsider. Often the IT system also makes it possible to comment on and evaluate the usefulness of the articles in the database.

Human resources. Knowledge mobilisation is essentially about taking creative new ideas and transforming them into commercial products and services. As such, it needs ambidextrous people - thinkers as well as doers, mavericks as well as pragmatists. McKinsey, for example, has a "specialist" career track for consultants who divide their time between knowledge creation and client-facing work, with the emphasis on the former. Splitting the role in this way is "a hard balance to achieve" but it is necessary to ensure that the links are made between stages of the knowledge lifecycle.

A similar model is to give client-facing employees a small knowledge-mobilisation role. This is akin to the centre of excellence model above, except that each centre of excellence is a single individual. For example, at Chase Manhattan bank, one executive commented, "One concept we're pushing is centres of excellence. Within each group are what we call top guns. These are the individuals who are recognised leaders in their discipline, who can be called on to answer questions or provide advice in their area of expertise... A top gun would evaluate a new product, and share the results of the analysis within the bank's technical community". 
External Relationships. As with stage 1, the mobilisation stage relies on strong relationships with leading customers and other partners. However, whereas in stage 1 the emphasis is on experimentation, the emphasis here is on applying a proven idea, so that it becomes a commercially viable proposition. In some cases, this may extend to commercial arrangements with shared risk and profit in order to focus collaborative teams toward shared goals. Alliance contracts are a common means of achieving this focus in the offshore sector, whilst in manufacturing, Bae Systems achieved the successful development of the Silicon Gyroscope through effective partnership and alignment towards stretch goals.\(^6\)

All of these approaches assume that the knowledge in question can be kept "under wraps". But if this is not the case, some level of diffusion (through codification) may not be such a bad thing because there will always be a significant tacit component. For example, the executives who read McKinsey Quarterly get access to many of the latest ideas emanating from the eponymous consultancy. This model works because some level of codification helps McKinsey to broaden awareness of its ideas, and because it creates more value by tailoring these ideas to a client's needs than by selling the ideas themselves. However it also assumes that McKinsey will win the contracts for implementing these ideas rather than their competitors who can quickly put together competing offerings.

3. Generating Value at the Diffusion stage

The diffusion stage is in some ways the exact opposite of mobilisation. Rather than trying to keep an idea or technology under wraps, the firm is deliberately propagating it - selling it to a broad base of customers, marketing the concept through various media, and to some degree inviting others to join the bandwagon. It is not typically a matter of the firm wanting to give its knowledge away; it is more an acceptance that leakage and imitation will occur. And as there are typically plenty of other ways of extracting value from knowledge, it makes sense to focus on them, rather than attempt to protect something that is unprotectable.
Many knowledge services move rapidly into the diffusion stage. In the world of computer software, for example, the standard approach is one of diffusing the product rapidly to build usage, create network economies, and pre-empt competitors, on the basis that money can be made selling upgrades and service contracts. In the consulting industry, most new service offerings move rapidly into the diffusion stage, because new management concepts are hard to patent and easy to copy (even if many are actually copied very badly). Consider, for example, the ease with which all the major consultancies developed re-engineering, ERP implementation, even Knowledge Management consultancy offerings. In such a crowded market, the challenge is not to have a unique product or insight, it is about differentiating the service and delivery aspects of your offering, for example by focusing on one particular client sector, or emphasising an existing track record or prior relationship. Approaches for doing this are as follows:

**Informal knowledge systems.** The emphasis in the diffusion stage is on packaging and standardising knowledge in such a way that it can be disseminated widely and quickly. This means that informal systems based on personal networks are no longer sufficient. Instead, systems should focus on training people in company methodologies and encouraging them to use them. For example CSC talks about "communities of users" which are distributed networks of people somewhat akin to a community of practice but with an emphasis on applying the knowledge in question rather than creating new knowledge. Similarly, Andersen Consulting (now Accenture) used to talk in terms of the shift from a competence centre to a capability, where competence refers to a group of 15-20 people with a certain skill, and capability to a group of 300-500. Clearly a large part of making 500 people effective with a particular knowledge product comes down to the IT system (see below), but there is also a strong social component.

**Information Technology systems.** The extensive knowledge databases that most large consultancies (and many other companies) have built are most useful at the diffusion and commoditisation stages. The act of codifying and standardising knowledge is an efficient way of opening it up to hundreds of people throughout the organisation. But it also makes that knowledge far easier for a competitor to copy.
Information technology essentially provides the capacity to create large, easy-to-search databases. For example Accenture's Knowledge Exchange and McKinsey's PD Net both include vast bodies of information about company models, previous client work, databases, and employee CVs. The important point here is that the actual information in these databases is proprietary, but the concepts and ideas are typically very similar from company to company. So competitive advantage typically comes from the ease of access to information, or the quality of previous work, rather than the underlying idea or model. For example Egon Zehnder, the recruitment consultant, has an enormous database with information about recruiters and recruitees. It derives its competitive advantage not from any unique services, but from an organisation model in which everyone works together (rather than just for their own commission) and therefore from a more comprehensive database.

IT systems in the knowledge diffusion stage can also be used to identify new trends - such as the Data Warehouse applications developed by First American to help turn its traditional banking business around (turning it from a $60m loss in 1990 to a profitable leader by 1999).

**Human resources.** The diffusion stage revolves around people who are good implementers - people who are good at working with customers, and who recognise the value of applying the company's knowledge to their customers' problems. Obviously there is a need for such people to be alert to new opportunities, because new ideas typically come out of existing customer relationships, but this is a relatively small part of their job.

**External relationships.** When competitors are selling services with broadly the same intellectual content, the relationship with customers has to shift towards other aspects of service - a successful track record, or special skills in one sector. It is also possible through clever branding to create a perception of difference when the product is actually very similar. One way to do this is through publication. Many consultancies invest in their own in-house journals and in writing management books as a means of giving profile to ideas which are -almost by definition - not proprietary.
The other important aspect of the diffusion stage is keeping a close eye on your competitors. If your knowledge is readily copied, then so is your competitor's. So the active use of reverse engineering, hiring of staff from competitors, and reading their written materials are all recommended as ways of ensuring that you are up to speed on their ideas.

4. Commoditisation stage

If the diffusion stage is about deliberately spreading the word, then commoditisation stage is about how to manage knowledge that is already well-known, or "common knowledge". Essentially this is knowledge that has become so diffused that it no longer needs any special attention. As an executive in Bovis, the engineering company observed several years ago: "There are one or two centres of excellence that have basically died out. Tall buildings was one.. its not that we don't do any tall buildings, its just that we have enough experience globally that we don't need it as a centre of excellence. Because what made it a specialism is now common knowledge, it is widely dispersed."

Many firms will take the attitude that once knowledge is widely understood then there is nothing they can do with it - they might as well move on to other more interesting areas. But the truth is that there are plenty of opportunities open to the firm to extract value from knowledge that has already reached commodity status. Tall Buildings, for example, are being looked at in new ways post September 11th, and this requires revisiting old principles, as well as generating new ones. A number of approaches can be identified.

Informal knowledge systems are almost eliminated at this stage and the focus becomes increasingly geared towards supply of recognised 'best practice' codified knowledge to add value to well developed processes. As with the diffusion stage, the emphasis here is on systems that encourage standardisation and sharing of existing knowledge, but with the twist that the existing knowledge has to be commercialised in different ways. For example, Derwent is a business within the Thompson group that takes public-source patents, interprets and packages them, and sells them as easy-to-use databases. And Pink Roccade, the Dutch IT services company, developed a highly
profitable business selling training in ITIL - the Information Technology Infrastructure Library - which is essentially a set of standards and protocols for systems development. The initial insight in both these cases is creative, but the actual work is highly standardised, and needs to managed accordingly.

**Information Technology systems.** To create value out of commoditised knowledge the key imperative is to stay current. Derwent updates its patent database on a continuous basis, and Pink Roccade has to be right up to date with the latest standards in IT infrastructure. For IT systems to be current there has to be an active approach to content management, use of sell-by dates on documents, and continuous input of new information. Search and retrieval systems also need to be very well organised.

**Human resources.** The commoditised stage typically requires similar employee skill-sets as were discussed in the diffusion stage, but with a couple of important differences. One is that the demand for the knowledge in question is in decline, so career opportunities in that area are less attractive. A common approach to solving this problem is to use contract employees. Many large companies still have Cobol programmers, for example, but these are typically contractors who have been programming in Cobol for twenty years. The second difference is that companies working with commoditised knowledge have to find ways of redeploying their human resources towards more fertile opportunities. This means winding down some projects, killing off communities of users in sunset technologies, as well as continuing to invest in those areas that still have commercial potential.

**External relationships.** Even if knowledge is widely held, a company can still create value from it by influencing the way that it is used. One example of this is Arup, the Engineering consultancy, that developed a solution to the "wobbling" Millenium bridge across the Thames river in London. Rather than keep its innovative solution to these problems proprietary, it chose instead to build them into "best practice" bridge standards for all future projects of this type, as a means of promoting their name as a technology leader. This approach is also widely used in the high-technology arena - for example Ericsson's strategy of pushing standards in GSM, 3G, Bluetooth and other mobile technologies. In both, the purpose is essentially to push the knowledge lifecycle as far as possible so that the knowledge becomes a *de facto* standard.
A rather different - but equally valid - model is to focus on customers in other sectors where the knowledge in question is not yet at the commoditisation stage. For example in construction, regulations in some countries will lead those in others. Polymer composite materials use in US construction is well developed, for example, but lags behind in the UK. For an international company, taking commoditised knowledge in one country and rolling it out in other countries becomes a powerful source of competitive advantage.

DEVELOPING A COHERENT KNOWLEDGE STRATEGY

The knowledge lifecycle offers insights at a number of levels. The primary one is that it helps identify the appropriate knowledge tools and techniques to apply at each stage. There are also implications for a company’s overall knowledge strategy.

The first point is that no company can realistically aim to be active in all four stages of the lifecycle. As the discussion above shows, the organization model differs by stage, as do the appropriate IT systems, the skills, and the types of people. There are many cases of companies that have struggled to try to span all these different stages. For example EDS, which focuses on diffusion-stage knowledge, acquired AT Kearney, which focuses on mobilization-stage knowledge. This resulted in a culture clash, and ultimately a decision to keep the two businesses operating as stand-alone entities because they had such different approaches to their work.

A mid-sized UK consultancy called Exta illustrates this problem. When it was formed, Exta’s proposition was very clear – it would put a small team of experienced consultants to work with the client team, to enable their change effort rather than do it for them. Projects ranged from managing an ERP system implementation to a culture change program. The model was highly successful, but its success lay in the deep implementation experience of Exta’s consultants, rather than any unique ideas or offerings they could bring to the table. In terms of the Knowledge Life Cycle, Exta was working with either diffusion-stage or even commoditisation-stage knowledge. However as the company grew, investments in “practice development” were made – new techniques and tools that could be used to offer greater value to clients. While
great progress was made in a number of areas, these new tools never took off. The executives running the company were reluctant to invest sufficient resources to fully develop these new areas, and the client relationship managers could not be easily convinced of the benefits of selling these unproven techniques to their clients. The organisation Exta had created, in other words, was well suited to diffusion-stage knowledge but ill-equipped to deal with creation- or mobilisation-stage knowledge.

Rather than trying to span all stages, the most effective model appears to be to do one extremely well, or to focus on two adjacent stages. One example is Strategos, Gary Hamel's boutique consultancy that focuses on knowledge creation and early-stage mobilization. Arup, the engineering consultancy, spans stages 2 and 3. Much of its bread-and-butter work uses diffusion, or even codified-stage knowledge, but it extracts most value in the early stages of the life cycle through the mobilisation of new ideas and using new technologies to a much greater extent than its competitors.

It is worth commenting that this argument is rather different to the often-quoted distinction between personalization and codification knowledge strategies. Hansen, Nohria and Tierney⁷ argue that a firm should essentially choose one knowledge strategy or the other. Our belief is that the appropriate strategy should vary according to the lifecycle stage of the knowledge in question, not the firm as a whole, so that a firm bridging stages 2 and 3 is likely to need both personalization and codification capabilities.

The second point, which applies particularly to firms that bridge stages two and three, is that a firm needs to choose between hoarding and sharing its knowledge. Hoarding means keeping it proprietary for as long as possible, sharing means deliberately opening it up and moving into the diffusions stage. Both approaches can backfire. Hoarding works well if you genuinely have an advantage, but often there will be rival offerings that substitute for that knowledge or technology. For example, the patent protection of polymer composites in construction work inhibited widespread adoption of that technology by clients in the UK. In the US, a stronger open research community developed, leading to wider acceptance. Sharing, in contrast, runs the risk of getting steamrollered by better-organized or more efficient competitors who adapt the idea and end up dominating the market.
A last point to consider is what to do when knowledge gets corrupted. This is an all too common phenomenon. An interesting concept like reengineering becomes popular, gets picked up by dozens of other consulting companies, and gradually gets misapplied and corrupted to such an extent that the value of the original idea is lost. Unfortunately, there are no easy ways of avoiding this scenario. One approach is to distance yourself from the discredited concept and re-launch the original idea with a new name. Another approach is to trademark the term, and aggressively defend it - but there are few cases of this succeeding. Failing these approaches, the best bet is to acknowledge the loss in value, move on and look for the next big idea.
This article is based on five years of research into knowledge management practices in large companies. The first author conducted a two-stage study beginning in 1996. The first stage consisted of interviews in ten multinational service firms, including Accenture, Bovis, Oxford University Press, Royal Sun Alliance, DHL, Citibank, Mckinsey and KPMG. The second stage involved detailed case studies in six companies - Icon Medialab, Roslin Biomed, Pink Elephant, Xansa, Ericsson and HP - focusing on identifying the elements of an effective knowledge management strategy. The second author, in his role as group knowledge manager at Arup, the engineering consultancy, undertook an extensive study of the company's knowledge management activities, including more than 100 interviews, and developed a global knowledge management strategy that is currently being implemented.
The field of quality management illustrates the evolution of a body of knowledge over the complete lifecycle. The origins of the quality movement, as we know it today, lay in the experiences of W. Edwards Deming and Joseph Juran in American industry in the 1920s and 1930s. Deming spent the early part of his career developing and applying statistical methodologies to industrial production systems. As head mathematician at the US Bureau of the Census, and then as lecturer at USDA and Stanford he observed the frustrations engineers experienced in applying the techniques of statistical control. Which in turn led to his insight that quality improvement cannot be achieved without the active support of top management.

Juran began work in the 1920s, in the inspection department of the famous Hawthorne works of Western Electric. He experienced the limitations of quality inspections, and began publishing in-house pamphlets for controlling quality. In 1945 he became a freelance consultant, publishing the Quality Control Handbook in 1951.

While the initial insights into quality management (the creation phase) were developed in the US, they were not effectively mobilised until Deming went to Japan in 1947 as advisor in sampling techniques to MacArthur’s Supreme Command. He began lecturing to the leading industrial companies in Japan in 1950, and found a ready and willing audience. Juran also spent some time in Japan in the 1950s, with a series of lectures to the Union of Japanese Scientists and Engineers. Japanese companies quickly adapted Deming and Juran’s ideas to their needs and the quality movement took off.

Once the benefits of quality management had begun to emerge, the practice diffused quickly through Japanese industry. However it was not until the 1960s that the movement really took hold in America and Europe. The process was spearheaded by Deming himself, who worked at NYU’s Graduate School of Business from 1946, and by Juran whose career as a consultant took off with the publication of Managerial Breakthrough in 1964. By this time, quality management had evolved into a relatively codified form – witness Deming’s 14 points, his 7 deadly diseases, and
Juran’s 10 key steps. Other quality management thinkers emerged (Crosby, Conway), and all the major consultancies developed their own quality management services. Throughout the 1970s and 1980s, quality management programs were at the heart of the change agenda in most industrial corporations.

The final phase of evolution in quality management thinking occurred in the 1980s. Quality techniques were commoditised to such an extent that they became enshrined in certification and compliance tools such as ISO 9000. Rather than managing quality through a separate group, firms began to institutionalise it as a corporate-wide capability. Today quality thinking is part of the standard lexicon of business – it is taught in textbooks, and it is part of most firms’ standard operating procedures. However, this does not prevent companies selling quality offerings. The Deming and Juran Institutes, for example, are still promoting new ways of adapting and extending the principles of quality management.

Interestingly, some companies still struggle to implement quality programs. For example, an observer in Ford commented on a visit by Deming in 1990, ‘I distinctly remember some of Dr Deming’s first visits. We wanted to talk about quality, improvement tools, and which programs work. He wanted to talk to us about management, cultural change, and senior managers’ vision for the company. Ford’s implicit belief was that quality could be treated as a codified body of knowledge that could be bolted on to its existing system. Deming’s belief was that for quality management to be effective in Ford it had to be treated as an interdependent and central part of Ford’s entire management philosophy. So while quality thinking is -at one level- common knowledge, the ability to apply it and integrate with the rest of the company’s systems is still highly tacit.
NOTES

3 This builds particularly on the ideas developed by Max Boisot in Knowledge Assets
4 The key point is that as you move up the vertical axis, more and more firms or individuals are aware of, and have access to the knowledge in question, but this does not mean that it is either valuable to them, or that they can actually internalise or apply that knowledge without effort. It is also important to point out that having knowledge is not the same as applying it. Thus, there will be cases of fully-diffused knowledge that for whatever reason is not applied or used appropriately.
5 Of course patent protection may limit other firms' ability to use this knowledge. In this paper we do not give much consideration to patent protection, as it rarely applies to knowledge services like management consultancy.
6 See http://www.livinginnovation.org/create.html