Choosing Your Knowledge Management Strategy

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In this paper, we survey a number of different knowledge management strategies and a range of driving forces for knowledge management activities.. We then attempt to produce a simple classification tool that will allow us to link the drivers to the KM strategies, using a number of published heuristics. Finally, a case study is presented in which we apply the method suggested and discuss its usefulness.

1. Introduction

Knowledge Management (KM) has been the subject of much discussion over the past decade. Organisations are told that they will not survive in the modern Knowledge Era unless they have a strategy for managing and leveraging value from their intellectual assets, and many KM lifecycles and strategies have been proposed. However, it has become clear that the term "Knowledge Management" has been applied to a very broad spectrum of activities designed to manage, exchange and create or enhance intellectual assets within an organisation, and that there is no widespread agreement on what KM actually is. IT applications that are termed "knowledge management applications" range from the development of highly codified help desk systems to the provision of video conferencing to facilitate the exchange of ideas between people.

One fact that does seem to be agreed on is that different situations require different knowledge management strategies. But the range of different "Knowledge Management Strategies" on offer can be bewildering and it is often unclear where to begin in choosing a strategy for a particular situation. The thesis of this paper is that the task of selecting a KM strategy is itself a knowledge-based task that can be approached using techniques from the field of Knowledge Engineering. We will start by examining a number of published KM strategies and consider how these can be classified. We go on to consider a range of driving forces behind the strategies, and then propose a strategy and a number of heuristics for the selection of a suitable KM strategy.

First, though, we need a working definition of what KM is. Many different definitions of KM have been published, and several will be discussed in this paper. To avoid pre-empting the discussion on the best definition of knowledge management in a given situation, a very broad definition of KM is used for current purposes:

> Knowledge Management can be thought of as the deliberate design of processes, tools, structures, etc. with the intent to increase, renew, share, or improve the use of knowledge represented in any of the three elements [Structural, Human and Social] of intellectual capital.

Patricia Seemann and colleagues, [Seemann et al, 1999]

2. KM Strategies

In this section, we survey various knowledge management strategies that have been proposed. The major difference between the various approaches is that they emphasise different aspects of knowledge management; some strategies focus on the knowledge, others on the business processes/areas, and others on the end results.

2.1. Classification by Knowledge: Nonaka & Takeuchi's Matrix of Knowledge Types

For KM practitioners, some of the most influential and helpful classifications are based on a combination of knowledge *accessibility* (i.e. where is the knowledge stored or located and in what form?) and knowledge *transformation* (i.e. the flow of knowledge from one place to another and from one form to another). This perspective underlies the analysis of Nonaka & Takeuchi in their "knowledge spiral", as well as the "Information Space" ("I-Space") model developed by Boisot. Innovation or learning occurs as a result of the flow and transformation of knowledge.

One of the most widely quoted approaches to classifying knowledge from a KM perspective is that of Nonaka & Takeuchi [Nonaka & Takeuchi, 1995]. While the best way to classify knowledge is a matter of some debate (see [Beckman, 1999]), the "knowledge matrix" proposed by Nonaka & Takeuchi has been widely accepted and widely quoted. This matrix classifies knowledge as either *explicit* or *tacit*, and either *individual* or *collective*. Nonaka & Takeuchi also propose corresponding knowledge processes that transform knowledge from one form to another: *socialisation* (from tacit to tacit, whereby an individual acquires tacit knowledge directly from others through shared experience, observation, imitation and so on); *externalisation* (from tacit to explicit, through articulation of tacit knowledge into explicit concepts); *combination* (from explicit to explicit, through a systematisation of concepts drawing on different bodies of explicit knowledge); and *internalisation* (from explicit to tacit, through a process of "learning by doing" and through a verbalisation and documentation of experiences).

Nonaka & Takeuchi model the process of "organisational knowledge creation" as a spiral in which knowledge is "amplified" through these four modes of knowledge conversion. It is also considered that the knowledge becomes "crystallized" within the organisation at higher levels moving from the individual through the group to organisational and even inter-organisational levels.

2.2. A Second Knowledge Classification: Boisot's I-Space Model

Boisot [Boisot, 1998] proposes a model of knowledge asset development along similar lines to that of Nonaka and Takeuchi. However, Boisot's model introduces an extra dimension (*abstraction*, in the sense that knowledge can become generalised to different situations). This produces a richer scheme allowing the flow and transformation of knowledge to be analysed in greater detail.

In Boisot's scheme, knowledge assets can be located within a three dimensional space defined by axes from "uncodified" to "codified", from "concrete" to "abstract" and from "undiffused" to "diffused". He then proposes a "Social Learning Cycle" (SLC) which uses the I-Space to model the dynamic flow of knowledge through a series of six phases:

1. *Scanning:* insights are gained from generally available (diffused) data
2. *Problem-Solving:* problems are solved giving structure and coherence to these insights (knowledge becomes 'codified')
3. *Abstraction:* the newly codified insights are generalised to a wide range of situations (knowledge becomes more 'abstract')

4. *Diffusion:* the new insights are shared with a target population in a codified and abstract form (knowledge becomes 'diffused')
5. *Absorption:* the newly codified insights are applied to a variety of situations producing new learning experiences (knowledge is absorbed and produces learnt behaviour and so becomes 'uncodified', or 'tacit')
6. *Impacting:* abstract knowledge becomes embedded in concrete practices, for example in artefacts, rules or behaviour patterns (knowledge becomes 'concrete')

In his model, Boisot develops an interesting application of the laws of thermodynamics in which knowledge assets that are highly abstract, highly codified and undiffused, are seen to be the most ordered and so have the lowest rate of entropy production and therefore the maximum potential for performing value-adding work. Knowledge assets at the opposite extreme of the I-Space (least abstract, least codified and most diffused) have the highest level of entropy production and, therefore, have the least potential for performing useful value-adding work. An organisation pursuing competitive advantage is constantly seeking to move their knowledge assets into the region of minimum entropy production and hence maximum value. However, the dynamics of the SLC mean that they can never stay in this region, but are constantly pulled away in a continual cycle of innovation and application; trying to stem the lifecycle is fruitless, since knowledge must be diffused to those who do not possess it in order to have any practical value.

This thermodynamic analogy points to the elusive and dynamic nature of knowledge. It seems that what is happening is a cycle in which *data* is filtered to produce meaningful *information* and this information is then abstracted and codified to produce useful *knowledge*. As the knowledge is applied in diverse situations it produces new experiences in an uncodified form which produces the data for a new cycle of knowledge creation.

What seems clear from both Boisot's model and that of Nonaka & Takeuchi is that the process of growing and developing knowledge assets within organisations is always changing. Organisations are living organisms that must constantly adapt to their environment. This means that the KM strategy identified as appropriate at one moment in time will need to change as knowledge moves through the organisational learning cycle to a new phase. The rate at which this cycle operates will vary from one sector to another, so that in some rapidly evolving sectors new knowledge is being created and applied in rapid succession, while in some more established sectors, the cycle time of innovation is much slower.

2.3. Classification by Business Process: APQC International Benchmarking Clearinghouse study

Karl Wiig and the APQC (American Productivity and Quality Center), identified six emerging KM strategies in a study of organisations considered to be leading the way in this area. The strategies reflect the different natures and strengths of the organisations involved ([Wiig, 1997], [Manasco, 1996]).

1. Knowledge Strategy as Business Strategy

   A comprehensive, enterprise-wide approach to KM, where frequently knowledge is seen as the product.

2. Intellectual Asset Management Strategy

   Focuses on assets already within the company that can be exploited more fully or enhanced.

3. Personal Knowledge Asset Responsibility Strategy

   Encourage and support individual employees to develop their skills and knowledge as well as to share their knowledge with each other.

4. Knowledge Creation Strategy

   Emphasises the innovation and creation of new knowledge through R&D. Adopted by market leaders who shape the future direction of their sector.

5. Knowledge Transfer Strategy

   Transfer of knowledge and best practices in order to improve operational quality and efficiency.

6. Customer-Focused Knowledge Strategy

   Aims to understand customers and their needs and so provide them with exactly what they want.

2.4. Another Classification by Business Process: McKinsey & Company

Day and Wendler of McKinsey & Company, identified five knowledge strategies employed by large corporations, [Day & Wendler, 1998].

1. Developing and Transferring Best Practices

   Like the "Knowledge Transfer Strategy" identified by Wiig and the APQC above, this strategy focuses on identifying best practices within an organisation and spreading them across a dispersed network of locations.

2. Creating a new industry from embedded knowledge

   This approach is to recognise that an organisation may have knowledge which it can exploit in new ways. In particular, it may have built up knowledge about its customers which reveals a gap in the market for a new product.

3. Shaping Corporate Strategy around knowledge

   This strategy was identified from the experiences of Monsanto, which encompassed two very different business groups: a chemicals group and a life sciences group. The chemicals group was focused on best practice while the life sciences group was an innovation-based business. The knowledge strategies for these two groups were perceived to be so different that Monsanto decided to sell off the chemicals group and concentrate on the life sciences business. This is an interesting example of the tensions between two very different KM strategies.

4. Fostering and Commercialising Innovation

   Similar to the Knowledge Creation Strategy identified by Wiig and the APQC above, this strategy focuses on establishing a competitive position by increased technological innovation and reduced time to market.

5. Creating a standard by releasing proprietary knowledge

   The example of Netscape is cited who responded to the rapid decline of its market share in the internet browser market by making its source code publicly available at no cost. The strategy is an example of the "Intellectual Asset Management Strategy" identified by Wiig and the APQC study. In this case, Netscape felt that it could capitalise on a key asset (its source code) by giving it away. In return, it hopes to establish its browser as a widely used standard (increased by the adaptation to new specialty areas) and gain indirectly, by securing its share of a complementary product, namely: server software.

2.5. Classification by End Results: Treacy & Wiersema's Value Disciplines

Having examined a couple of studies identifying various KM strategies being used, we now turn to two different approaches which try to provide a business framework for choosing a KM strategy. The first is based on an idea put forward by Michael Treacy and Fred Wiersema which was taken up by Carla O'Dell and C. Jackson Grayson Jr. as a way to provide focus to a KM effort ([O'Dell & Grayson, 1998]).

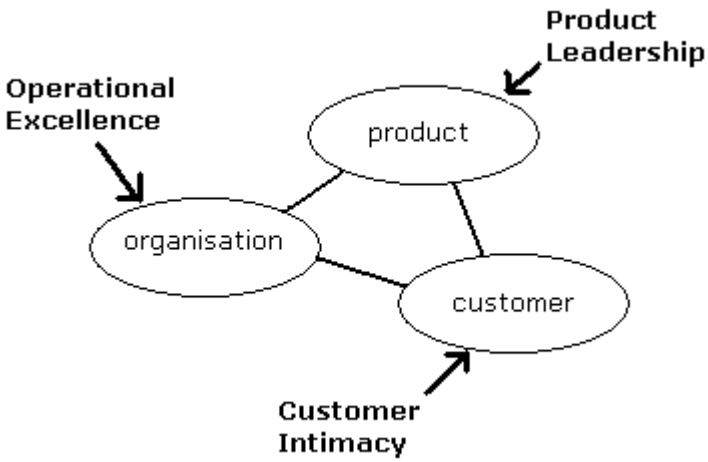
Treacy and Wiersema proposed three "value disciplines," as a way to focus an organisation's activities [Treacy & Wiersema, 1993]. Successful organisations concentrate their efforts on a particular area and excel at it, rather than trying to be all things to all people and failing to excel at anything.

- Customer Intimacy
- Product Leadership
- Operational Excellence

These value disciplines reflect the fact that 'value' is determined as a tradeoff between convenience, quality and price. It is the inherent tension between these three qualities of a product that makes it necessary for an organisation to focus on excelling at just one of them. There are a few organisations which have managed to become leaders in two disciplines, but they have done this by focusing on one area first before turning to a second one.

At a simplistic level, there are three primary elements to any competitive business: the business itself, its product(s) and its customers. Each of these components represents the focus of attention for one of the value disciplines. The focus is on the customers and their needs and desires when pursuing "Customer Intimacy"; the focus is on the product(s) when pursuing "Product Leadership"; and the focus is on the organisation itself and its delivery processes, when pursuing "Operational Excellence".

Figure 1. Focus areas for Value Disciplines



Some organisations will concentrate on their relationship with their customers (to increase customer satisfaction and retention by better understanding the customer's needs and preferences). Other organisations will focus on their products (constantly developing new ideas and getting them to market quickly). The third group of organisations focus primarily on themselves and their internal processes (sharing best practices between different units, reducing costs and improving efficiency).

2.6. Linking Knowledge and End Results: Zack's Knowledge Strategy

Another approach to identifying what KM strategy to take is proposed by Michael Zack [Zack, 1999]. He proposes a framework which helps an organisation make an explicit connection between its competitive situation and a knowledge management strategy to help the organisation maintain or (re-)establish its competitive advantage. He makes it clear that while each organisation will find its own unique link between knowledge and strategy, any such competitive knowledge can be classified on a scale of innovation relative to the rest of the particular industry as: *core*, *advanced* or *innovative*.

Core knowledge is a basic level of knowledge required by all members of a particular industry. It does not represent a competitive advantage, but is simply the knowledge needed to be able to function in that sector at all.

Advanced knowledge gives an organisation a competitive edge. It is specific knowledge which differentiates an organisation from its competitors, either by knowing more than a competitor or by applying knowledge in different ways.

Innovative knowledge is that which enables a company to be a market leader. It allows an organisation to change the way a sector works and represents a significant differentiating factor from other organisations.

Having identified the organisation's competitive knowledge position, Zack's approach is to use a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) to identify the strategic gaps in an organisation's knowledge. This allows the organisation to identify where it has knowledge which it can exploit and where it needs to develop knowledge to maintain or grow its competitive position. This is achieved by analysing the organisation's knowledge position along two dimensions:

- Exploration vs. Exploitation

  This is "the degree to which the organisation needs to increase its knowledge in a particular area vs. the opportunity it may have to leverage existing but underexploited knowledge resources."

- Internal vs. External Knowledge

  This refers to whether the knowledge is primarily within the organisation or outside. Some organisations are more externally-oriented, drawing on publications, universities, consultants, customers, etc. Others are more internally-oriented, building up unique knowledge and experience which is difficult for competitors to imitate.

Putting these two dimensions together, Zack describes organisations which are more exploitative of internal knowledge as having a "Conservative" KM Strategy while those that are more innovative (exploring external knowledge) have a more "Aggressive" KM Strategy. However, he points out that a KM Strategy cannot be made without reference to competitors. Thus, some industries (where knowledge is changing more rapidly) tend to be characterised by more aggressive firms, while other industries are generally more conservative.

3. A Synthesised Approach: Binney's KM Spectrum

Given that the classifications by knowledge listed above (Nonaka & Takeuchi's and Boisot’s) focus on the process of knowledge transformation, and that most real world processes operate on a continuum rather than a step transformation, it is perhaps not surprising to find that some researchers have suggested that "explicit" and "tacit" knowledge should be considered to be at the ends of a spectrum of knowledge types rather than being the only two categories on that spectrum. Beckman [Beckman, 1999] has suggested that "implicit" knowledge is an intermediate category of knowledge that is tacit in form, but is accessible through querying and discussion. And Nickols

[Nickols, 2000] proposes that Nonaka & Takeuchi's categories should be further broken down according to whether they focus on declarative or procedural knowledge.

What is needed is a classification that proposes a spectrum of knowledge management approaches. If this spectrum can accommodate the various approaches suggested in the previous section then it can be considered to be sufficiently comprehensive to be useful. Derek Binney, [Binney, 2001], provides a framework, The KM Spectrum, to help organisations make sense of the large diversity of material appearing under the heading of KM, and to help them assess where they are in KM terms. His focus is on the KM activities that are being carried out, grouped into six categories:

1. *Transactional KM:* Knowledge is embedded in technology.
2. *Analytical KM:* Knowledge is derived from external data sources, typically focussing on customer-related information.
3. *Asset Management KM:* Explicit management of knowledge assets (often created as a by-product of the business) which can be reused in different ways.
4. *Process-based KM:* The codification and improvement of business practice and the sharing of these improved processes within the organisation.
5. *Developmental KM:* Building up the capabilities of the organisation's knowledge workers through training and staff development.
6. *Innovation/creation KM:* Fostering an environment which promotes the creation of new knowledge, for example through R & D and through forming teams of people from different disciplines.

For each of these categories of KM, Binney lists several examples of KM Systems or approaches that support them—see Table 1

Table 1. KM Spectrum and Applications (from [Binney, 2001])

Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
Case Based Reasoning (CBR)	Data Warehousing	Intellectual Property	TQM	Skills Development	Communities
Help Desk Applications	Data Mining	Document Management	Benchmarking	Staff Competencies	Collaboration
Customer Service Applications	Business Intelligence	Knowledge Valuation	Best Practices	Learning	Discussion Forums
Order Entry Applications	Management Information Systems	Knowledge Repositories	Quality Management	Teaching	Networking
Service Agent Support Applications	Decision Support Systems	Content Management	Business Process (Re) Engineering	Training	Virtual Teams
	Customer Relationship Management		Process Automation		Research and Development
			Lessons		Multi-Disciplined Teams

Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
	Management (CRM) Competitive Intelligence		Learned Methodology SIE/CMM, ISO9xxx, Six Sigma		

Binney's analysis is interesting because it reflects aspects of both the knowledge-centred classification of KM and the business perspectives classification of KM. In terms of business perspectives, Binney's categories reflect activities that support particular perspectives; for example, "Asset Management KM" matches Wiig's "intellectual asset management strategy", while "Innovation and Creation KM" reflects Treacy & Wiersema's "product leadership" strategy. And yet Binney's categories also form a progression from the management of explicit knowledge at one end to tacit knowledge at the other. So, for example, "Transactional KM" involves codifying knowledge and embedding it in applications such as Help Desk Systems or Case Based Reasoning systems, while "Innovation and Creation KM" focuses on facilitating knowledge workers sharing and creating new knowledge which rests in a tacit form in their heads. See Table 2 for a proposed mapping of Binney's categories to other classifications.

Table 2. KM Spectrum mapped to other KM Classifications

KM Spectrum:	Transactional	Analytical	Asset Management	Process	Developmental	Innovation & Creation
K. Accessibility:	explicit		implicit		tacit	
K. Conversion:	combination		externalisation		internalisation	socialisation
SLC (Boisot)	Problem Solving	Scanning / Abstraction	Impacting		Diffusion	Absorption
K. Type	Mostly procedural	Mostly declarative	Declarative	Procedural	Either	Either
Value Disciplines (Treacy & Wiersema, O'Dell & Grayson, Section 2.4)	Operational Excellence	Customer Intimacy	Any	Operational Excellence	Any	Product Leadership
KM Strategies (Wiig/APQC, Section 2.2)	Knowledge Transfer	Customer-Focused Knowledge	Intellectual Asset Management	Knowledge Transfer	Personal Knowledge Asset Responsibility	Knowledge Creation
KM Strategies	Developing	Creating a	Creating a	Developing	Transferring	Fostering

(Day & Wendler, Section 2.3)	and transferring best practices	new industry from embedded knowledge	standard by releasing proprietary knowledge	and transferring best practices	best practices	and commercialising innovation
K. Strategy type (Zack, Section 2.5)	conservative (exploiting existing knowledge)				aggressive (creating new knowledge)	

For each element of the spectrum, Binney also lists a set of enabling technologies used to implement those kinds of KM Applications. This provides an alternative way to identify KM activity already being undertaken within an organisation, even if not previously perceived in KM terms. This mapping is reproduced in Table 3.

Table 3. Enabling technologies mapped to the KM Spectrum (from [Binney, 2001])

Transactional	Analytical	Asset Management	Process	Developmental	Innovation & Creation
Expert Systems	Intelligent Agents	Document Management Tools	Workflow Management	Computer-based Training	Groupware
Cognitive Technologies	Web Crawlers	Search Engines	Process Modelling Tools	Online Training	e-Mail
Semantic Networks	Relational and Object DBMS	Knowledge Maps			Chat Rooms
Rule-based Expert Systems	Neural Computing	Library Systems			Video Conferencing
Probability Networks	Push Technologies				Search Engines
Rule Induction Decision Trees	Data Analysis and Reporting Tools				Voice Mail
Geospatial Information Systems					Bulletin Boards
					Push Technologies
					Simulation Technologies

4. Discussion of the KM Spectrum

This "knowledge management spectrum" has a number of implications for the way that knowledge management is done, and even for the definition of what knowledge management is. Binney makes

a number of observations about the spectrum, which are used in this article as starting points for discussion.

4.1. Features of the spectrum

Several features that differentiate knowledge management approaches can be observed from this spectrum. We can see how the different approaches have different specialisations; for example, there is a left-to-right transition from techniques that are good for managing explicit knowledge to techniques that are good for managing tacit knowledge, via techniques for managing Beckman's category of implicit knowledge. There are several other transitions, too: the degree of individual choice (for the user of the managed knowledge) increases from left to right; the choice of tools or approaches for carrying out a knowledge based task increases from left to right; and the emphasis on the need for organisational change also increases from left to right. It's clear that what is referred to as "Knowledge management" actually consists of a range of techniques that address different organisational issues and needs. Indeed, Binney notes that "there appears to be an author affinity to parts of the spectrum depending on each author's discipline and background. Management theorists tend to be primarily focused on the process, innovation/creation and developmental elements of the spectrum, with technologists focusing more on the transactional, analytical and asset management elements". The implications of this observation reach to the foundations of knowledge management, for it helps explain disagreements over the definition of knowledge management: technologists tend to explain knowledge management in terms of externalisation or combination of knowledge, while management theorists generally focus on knowledge management as a process of socialisation and internalisation. This in turn leads to different opinions of approaches and techniques for knowledge management, notably the use of technology; management theorists tend to think of technology as being merely an enabling factor to socialisation and communication, while technologists see it as the central focus. For example, Scarbrough and Swan [Scarbrough & Swan, 1999] collect some case studies which seem to suggest that many KM initiatives over-emphasise the role of IT systems with a resulting failure to address human factors adequately.

Scarbrough and Swan characterise these two views of knowledge management as the "cognitive" view and the "community" view. The community view emphasises knowledge as socially constructed and is managed primarily by encouraging groups and individuals to communicate and share experiences and ideas. The cognitive view regards knowledge in objective terms which can be expressed and codified, and is often expressed by the capture and codification of knowledge in computer systems.

However as Binney points out, if Nonaka & Takeuchi's knowledge spiral is accepted, then the organisation must be managing both explicit and tacit knowledge at all times in some way, in order for the knowledge spiral to keep flowing. This view is supported by Hansen and colleagues [Hansen et al,1999], who suggest that most organisations should operate with a mixture of an explicit codified knowledge strategy and a highly creative and customised strategy, but not in equal proportions. So it would seem that Binney's spectrum does identify different techniques that are applicable for different types of knowledge management, but that most organisations will be using two or more of these techniques, incorporating both a "cognitive" and a "community" approach, if their knowledge is continuing to grow or improve.

4.2. Completeness of the KM spectrum

It's worth considering whether the KM spectrum deals with all known approaches to knowledge management, and if not, to consider why. Two approaches that are not covered have been identified, and these are discussed in turn.

4.2.1. Knowledge management as a corporate strategy

One of the knowledge management approaches identified by Day & Wendler was "Shaping corporate strategy around knowledge"; Wiig has a similar category of "Knowledge Strategy as Business Strategy". Day & Wendler's example was of Monsanto, who found that its two divisions used such different approaches to knowledge management that they decided to sell off one of the divisions. This approach would not be expected to be incorporated into Binney's KM spectrum, for it does not map to a single approach in the spectrum; rather, it is a decision made as a result of the type of analysis that the KM spectrum provides.

4.2.2. Asset improvement

From a technologist's point of view, there is one area of knowledge-related technology that does not appear in the spectrum: the area of improvement of existing knowledge assets through optimisation techniques. This does appear to be an omission from the spectrum, for the optimisation of knowledge assets is aimed at increasing their utility, and so should qualify as "knowledge management". Since asset improvement is normally done using computer-based statistical techniques, but does not transform the asset into a different form, it belongs to the left of Asset Management but to the right of Analytical KM in the spectrum.

On the basis of this, we suggest a revised version of the KM spectrum (Table 4). We also suggest revisions to Table 2 and Table 3, which are presented in list form below.

Table 4. Revised KM Spectrum and Applications

Transactional	Analytical	Asset Improvement	Asset Management	Process	Developmental	Innovation and Creation
Case Based Reasoning (CBR)	Data Warehousing	Timetabling	Intellectual Property	TQM	Skills Development	Communities
Help Desk Applications	Data Mining	Job shop scheduling	Document Management	Benchmarking	Staff Competencies	Collaboration
Customer Service Applications	Business Intelligence	Configuring layouts	Knowledge Valuation	Best Practices	Learning	Discussion Forums
Order Entry Applications	Management Information Systems	Time & Motion studies	Knowledge Repositories	Quality Management	Teaching	Networking
Service Agent Support Applications	Decision Support Systems	Supply chain management	Content Management	Business Process (Re)Engineering	Training	Virtual Teams
	Customer Relationship Management (CRM)	Allocation of resources		Process Automation		Research and Development
	Competitive			Lessons Learned		Multi-Disciplined Teams
				Methodology		
				SIE/CMM,		

Transactional	Analytical	Asset Improvement	Asset Management	Process	Developmental	Innovation and Creation
	Intelligence			ISO9xxx, Six Sigma		

The technologies that might be used for Asset Improvement include:

- Linear Programming
- Genetic Algorithms
- Ant colony programming
- Operational Research techniques

And the classifications of Asset Improvement against the knowledge management perspectives of Table 2 would be:

- Knowledge Accessibility: Explicit
- Knowledge Conversion: Combination
- Knowledge Type: Mostly procedural
- Value disciplines: Operational excellence
- KM strategies (Wiig): Intellectual asset management
- KM strategies (Day & Wendler): Developing best practices
- KM strategy type (Zack): Conservative

4.3. A Knowledge Engineering Approach to the KM Spectrum

A popular approach to knowledge engineering is the very detailed CommonKADS methodology [Schreiber et al, 2000]. One of its most widely admired aspects is its classification of knowledge based tasks into knowledge types; not merely declarative and procedural, but a range of task types (classification, diagnosis, assessment, configuration, planning, etc.), generally classified under "analytic" tasks (analysis of an existing situation or artifact) and "synthetic" tasks (generation of a new situation or artifact).

CommonKADS' approach is admired not just because of the classification, but also because of the library of generic inference models that are associated with each task type. However, for current purposes, it is the classification of task types that is of most interest. This classification can be applied to the KM spectrum from two perspectives:

- Do these task types map to the KM spectrum, or to other reviewed KM approaches, in any way?
- What is the type of the task of selecting an appropriate approach from the KM spectrum, and of creating the KM spectrum itself?

4.3.1. Mapping CommonKADS task types to the KM spectrum

There is not a complete one-to-one mapping between CommonKADS' task types and the KM spectrum, or with other knowledge management approaches - not least because the development of any technology system or other knowledge management support tool is a knowledge based task in itself (specifically, a design task, unless purchasing a tool off the shelf, in which case it becomes an assessment task). However, partial mappings do exist. For example, all knowledge creation activities (or as Zack puts it, "aggressive KM approaches") must be synthetic tasks, since the definition of analytic tasks precludes the creation of new knowledge. By the same argument, all

Analytic KM activities must be analytic tasks. Asset Management, in its manifestation as content management systems (at least), is primarily a classification task; process management involves analysis of some kind; while Asset Improvement is clearly an optimisation task[1]. In general, it seems that there is a broad match between CommonKADS' categories of "analytic" and "synthetic" tasks and Zack's "conservative KM"/"aggressive KM" distinction.

Drawing this distinction is important, because from a knowledge engineers' viewpoint, analytical tasks are easier to support with knowledge-based software (i.e. transactional KM) than synthetic tasks. The main reason for this is that analytical tasks have a fixed number of possible answers (the exact number depends on the size of the artifact(s) being analysed) while synthetic tasks have a near-infinite number of possible answers. This means that synthetic tasks have to be handled using approaches that search for possible good solutions, with the possibility of much backtracking. In computational terms, therefore, synthetic tasks are more time-consuming, and require more heuristic search and consideration of multiple hypotheses, than analytic tasks (assuming a similar amount of input).

We have therefore arrived at a possible justification for the split between the technophilic "cognitive KM" community and the technophobic "community KM" camp. It may be that Developmental KM and Innovation/Knowledge Creation KM are simply harder to support well with technology (or at least, knowledge-based technology) than the more "conservative" tasks to the left of the KM spectrum.

4.3.2. The tasks associated with developing and applying the KM spectrum

It's actually simple to answer the question about the task types associated with developing and applying the KM spectrum: developing the spectrum was a classification task, for Binney took a number of existing KM approaches and classified them; while applying it is an assessment task, for applying the spectrum involves selecting a suitable KM approach based on the features identified by Binney and others, and selection is an assessment task[2]. The implications of this are various: we see that Binney has not tried to develop any new knowledge about KM approaches, but has simply analysed existing ones. This might imply that there are more KM approaches waiting to be identified or developed; however, the fact that one or other of the approaches covers nearly all the KM approaches identified in Section 2 suggests that the set of approaches in the KM spectrum (or at least, in the revised spectrum shown in Table 4) is nearly or fully complete. We also see that the applications, technologies, and mappings to knowledge management strategies identified in Tables 2-4 are crucial to the task of selecting an appropriate KM strategy. This is discussed further in the next section.

5. Selecting a KM Strategy

Several factors need to be considered when deciding on a KM approach for an organisation (or, as Hansen et al suggested, a primary and a secondary KM approach). The approach taken here is to devise a set of self-examination questions that reflect each set of factors. These questions should form the beginnings of a potential Knowledge Management Strategy questionnaire.

5.1. The KM Spectrum

Given the preceding discussion, it should come as no surprise that the factors believed to be most significant in choosing a knowledge management approach are derived from the KM spectrum. Questions derived from the KM spectrum might include:

- What do you hope to achieve through knowledge management?
- What applications do you think you need?

- Is your focus on following best practice in-house; establishing an external standard; encouraging innovation and creativity; or learning knowledge from data?
- What technologies do you think you need? What technologies do you currently have skills in?
- Do your people rely on explicit or tacit knowledge to solve problems?
- Do you plan to analyse existing knowledge or to create new knowledge?

5.2. The Three Value Disciplines related to KM

As described above (Section 2.4), there are researchers who see the selection of a KM Strategy as based on a three-way choice determined by one of three value disciplines focusing on: customers, product(s) or the organisation's internal processes.

These value disciplines produce some obvious links with certain KM strategies:

- Organisations focused on *Customer Intimacy* strive to shape their products and services to match their customer's needs as closely as possible. This means getting to know as much about their customers as possible, and making their customers feel they are being looked after. To follow through with this approach companies will invest in systems to collect information about their customers, including CRM, Data mining, Business Intelligence, etc.
- An *Operational Excellence* approach involves minimising overheads, eliminating intermediate production steps, optimising business processes, etc. Organisations focused in this direction will invest in systems such as Best Practice transfer, TQM, BPR, Process Improvement, etc.
- The *Product Leadership* organisations strive continually to have state-of-the-art products or services, requiring a highly creative environment and the ability to bring new ideas to market quickly. These companies will choose KM strategies supporting Communities, Collaboration, Discussion Forums, etc.

So the questions an organisation might ask itself could include:

- Would your organisation fail to survive if it didn't have good relationships with/information about its customers?
- Would your organisation fail to survive if it didn't have state-of-the-art products?
- Would your organisation fail to survive if its processes were carried out inefficiently?
- Do you offer standardised or customised products?
- Do you have a mature or innovative product?
- Can you think of any products on the market that are ahead of yours?
- Can you think of any business processes that could be improved?
- Can you think of any areas where better relationships with/information about customers would improve business performance?

5.3. External Drivers

Every organisation exists in an environment that conditions the way the organisation conducts its business. Abell and Oxbrow give examples of a number of business drivers for different sectors which have influenced the way organisations in those sectors have gone about knowledge management, [Abell & Oxbrow, 2001]. A sample is given in the following table:

Table 5. Example Drivers for Different Business Sectors

Sector	Drivers

Sector	Drivers
Financial	Information-based; highly regulated; risk management; highly competitive; fast reaction times.
Professional Services	Knowledge as product; people as primary source; mobile workforce; mergers.
Law	People as creators of knowledge; increasing competition; new markets/practices; mobile workforce.
Process Industries	R & D; Intellectual Property; diverse products; global markets.
Oil	Global; fragmented; R & D; regulated.
Public Sector	Value for money; cost control; political objectives; customer focus; modernising governments.

This analysis might suggest different knowledge management approaches for different business sectors. Financial firms might focus on analytical KM due to being heavily information-based; professional services on developmental KM because people are their primary knowledge source; law on innovation/creation KM and/or a KM approach that supports best practice; process and oil industries on process management/transactional KM (to support best practice) or on innovation/creation KM (due to heavy R&D emphasis); and the public sector on analytical KM or developmental KM (due to the customer focused aspects). Questions that might be asked would include:

- What business sector do you operate in?
- What types of products do you produce?
- What are the key drivers in your business sector?

5.4. The Knowledge Engineering Approach

We have already discussed the CommonKADS approach to knowledge engineering, and how it applies to the KM spectrum. However, CommonKADS is a comprehensive methodology that also provides some guidance on knowledge management itself, in the form of a recommended knowledge-oriented organisational model from which it is expected that opportunities for Knowledge Systems will be identified. The guidelines given are to "make a shortlist of perceived problems and opportunities, based on interviews, brainstorm and visioning meetings, discussions with managers, etc." These problems are then to be put into a wider context by considering the organisation's mission, vision, goals, external factors, strategy and major value drivers. Part of this process should be to identify the various stakeholders in terms of providers and users of knowledge and the decision-makers. From this investigation, a shortlist of problem and opportunity areas related to certain business processes should emerge. Particular attention is given to the *Process* which is decomposed into tasks (specified as a UML activity diagram) and also to the *Knowledge Assets* involved - What are they? Who possesses them? Who uses them? Are they available in the right form and place and at the right time and of appropriate quality?

Questions that might be asked during, or as a result of a CommonKADS analysis might be:

- Who are the key decision makers, providers, users or beneficiaries of knowledge?

- What resources are used in the business process? - information systems, equipment, materials, technology, patents, etc.
- What are the key knowledge assets in the organisation?
- What are the cultural "rules" of the organisation? - styles of working, authority structures, communication styles and networks, etc.
- What is the task type of these key assets? - classification, diagnosis, assessment, configuration, scheduling, ...
- Is the knowledge used largely symbolic, numerical, geometric or perceptual?
- How long does a human take to solve the same problem?
- Is the knowledge available?

From these questions should emerge a recommendation whether transactional KM (and specifically, knowledge-based systems software) is a suitable approach for developing and transferring a particular knowledge asset.

5.5. Synthesised Approach

Based on the above survey of advice and methods, we now provide an overview of the categories of question that we would expect to find in a questionnaire that supports selection of a knowledge management approach. Later we will apply this approach to a case study.

The following table highlights a number of factors that contribute to the selection of a KM Strategy.

Table 6. Factors influencing the selection of a KM Strategy

Factor	Examples
Current/Planned Knowledge Management Strategy	Goals, desired applications, technology capabilities, analytic/synthetic approach
Business Sector Characteristics	Highly regulated, Innovative, Risk factors, Competitiveness, Globalisation, etc.
Strengths, Weaknesses, Opportunities and Threats (SWOT)	Reputation, Leading product, Changing regulations, Acquisitions and Mergers, Globalisation, etc.
Value Focus	Operational Excellence, Product Leadership or Customer-focused
Organisational Structure	Hierarchical, Loose
Organisational Culture	Team spirit, Individualistic, Sharing, Learning
Nature of Knowledge	Explicit, Implicit or Tacit; Task Type; Symbolic/Numeric/Geometric/Perceptual

We now propose a series of activities to undertake to help identify an appropriate KM initiative:

1. List the external business drivers for your sector.
2. Perform an organisational SWOT analysis in the context of this environment, clearly identifying your product or service.
3. Identify the primary organisational Value Discipline, which represents how your organisation attracts its segment of the market.

4. Use these findings to identify the *primary* KM area to consider (Section 5.2), using the self-examination questions listed above.
5. List the (major) knowledge-intensive or knowledge transfer activities undertaken by the organisation, looking initially for those that match the primary KM type identified above. Try to sort these into order of importance to the organisation's mission. Then, for each of these activities, identify:
    i. the Knowledge Assets used
    ii. the nature of these Assets (explicit, implicit or tacit)
    iii. the location, form and quality of these Assets
6. Make an assessment for each of the more important activities identified, as to how well it is being performed at present. Looking at the different applications in the KM Spectrum (Table 4), look for a KM approach that corresponds to the activity in question.
7. Carry out some feasibility checks on the proposed KM approach, such as those described above for Transactional KM that are drawn from CommonKADS.

Note that, for the most part, these factors should provide a focus so that any KM initiative is in line with reality. But, some of these factors may highlight a reality that an organisation wants to change. For example, the prevailing culture may lack a team spirit or a willingness to share knowledge. However, it must be stressed that simply introducing a KM system will not automatically change a culture in the way intended. There are lots of factors to do with how a system is implemented and introduced which are crucial to the change process. See, for example, [Scarbrough & Swan, 1999] and [Seemann et al, 1999] for a discussion of some of these issues.

6. A Case Study

The above approach to selection of a knowledge management strategy was applied within a knowledge management study carried out for an Edinburgh-based charity, Bethany Christian Trust (hereafter "Bethany").

6.1. Bethany: An Overview

Bethany's mission is to relieve the suffering and meet the long term needs of homeless and vulnerable people. Driven forward by a desire to show Christian love in action within the community, Bethany has grown dramatically over the years, in both the range and the quality of the care services they provide. Across all of its seven levels of care, ranging from street work and emergency accommodation to employment training and the Homemaker service, Bethany aims to meet the needs of homeless and vulnerable people in a truly holistic way. Bethany also has a commercial division which operates a number of shops whose purpose is to raise money to support the care services provided. Most of Bethany's activities take place in Edinburgh, although there are initiatives beginning in a few other Scottish towns and cities.

Bethany has 114 staff, about 90 of whom work full time, plus a large number of staff working on a voluntary basis (both full time and part time). About 60% of staff work in or for the caring division, 30% work for the commercial division and the remaining 10% work in various administrative roles serving the organisation as a whole. Many of the full time volunteers stay for a year, which provides Bethany with a relatively large workload in training new staff each year. Bethany's caring activities are currently vertically integrated around residential units, but they are moving to a more matrix/project-oriented system where residential units each deliver a base level of care, with specialist teams moving across those units providing input as required.

From the viewpoint of technology and communication, Bethany has a website (http://www.bethanyct.com), and staff in Bethany's central offices have access to networked PCs

which are used for e-mail and for other office-related tasks. There are computers in each of the residential units, which are used for e-mail and general day to day office tasks (mainly word processing and financial spreadsheets). The shops communicate with the central offices primarily by fax (none of the shops have a PC), and customers offering goods communicate either by telephone or by simply turning up, usually at the shops.

There are few technology systems that are widely used in Bethany apart from e-mail and Microsoft Office products. A number of applications are run locally, however, such as databases used to help find potential funders for clients.

6.2. The KM Study

Bethany's work practices were investigated in two ways: a questionnaire was used, and some diagrams of high level business processes were developed based on interviews, and validated by Bethany staff. The questionnaire included questions related to the organisation as a whole, the business sector(s) that Bethany operates in, the nature and use of knowledge in Bethany at present, and questions related to strengths, weaknesses, opportunities and threats to Bethany. The high level business processes highlighted some features that are unique to the charity sector (such as having to build customer relationships in order to get stock to sell in the shops!) and also showed a fairly clear demarcation between the caring and commercial divisions.

Identifying a Value Discipline for Bethany was difficult. It might seem that their primary value discipline would be customer intimacy, and yet they strive to provide excellence in both their caring and their commercial activities, partly through significant investment in staff training. And, since the "product" they provide in their care division is directly dependent on how well their staff carry out their jobs, it could be argued that they are also interested in product leadership. Furthermore, Bethany are making efforts to cross these barriers - one of their shops currently has an area used as a coffee shop, which does not make a great deal of money, but provides an opportunity for building relationships with customers, and even for providing informal care to customers in the form of a listening ear and perhaps a pointer to Bethany's other caring services. It could be argued, therefore, that the approach of using "value disciplines" mitigates against a holistic approach to business as a whole, or at least to customers' needs. However, for current purposes, we can eliminate "Product leadership" from Bethany's value disciplines and say that it focuses on both customer intimacy and operational excellence.

6.3. Results

Based on this analysis, the knowledge management approaches recommended for Bethany were (one or more of) Asset Management, Process Management or Developmental. In other words, it was suggested that Bethany builds up a library of its key knowledge assets and processes, preferably in the form of self-help procedural manuals, as well as continuing to emphasise staff training. The reasons for this were:

- Bethany does not possess or use large collections of data that could be analysed for patterns;
- The availability of computer support within Bethany is limited;
- Bethany does possess key knowledge assets that could usefully be made available to other staff;
- The knowledge in the two business sectors does not change fast enough for innovation in knowledge to be a major concern;
- Current knowledge distribution activities include a lot of training, and one or two procedural manuals.

7. Discussion

We have surveyed a number of approaches to knowledge management and have shown how they can be brought together in the six categories of Binney's KM spectrum. We have recommended addition of a seventh category, shown how the KM spectrum maps onto the other approaches, and then used both the KM spectrum and the other approaches to develop the beginnings of a knowledge management strategy selection questionnaire. A case study shows how this approach works in practice.

One issue that has not been discussed is whether some KM strategies are more favoured by users than others. Binney has argued that "there is little evidence that mandating participation is a sustainable intervention or adoption model", and therefore approaches from the right of the KM spectrum should be more favoured than those from the left. However, Binney's argument is not necessarily correct; mandated participation is frequently accepted by the users when the need for it is clear (as in safety critical systems), when it is clearly the best approach (e.g. American Express Authorizer's Assistant [Feigenbaum et al., 1988]), or when the users can simply be forced to use it (military personnel, undergraduate students and people relying on state benefits are examples of these). This issue should probably be added to the list of factors that are used in selecting a KM approach, however.

Further work in this area might include:

- Seeing if there is an association between the KM spectrum and the value of knowledge assets, both before and after they have been "managed";
- Surveying users' attitudes to knowledge assets generated by different KM approaches;
- Considering potential negative factors that might contribute to selecting a KM approach; in the Bethany case study, the lack of computer availability was a significant factor against transactional or analytical KM;
- Analysing past case studies of KM successes and failures to determine if selecting the "right" KM approach was a significant factor.

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Notes

1. Optimisation is not considered a primitive task type in CommonKADS. However, it can be considered to be a combination of two other task types: monitoring and repair.
2. Specifically, selection involves assessment of each of a set of candidates, followed by a simple sorting task.