Managing Knowledge Capture: Economic, Technological and Methodological Considerations

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ABSTRACT

This paper examines the process of managing knowledge capture from within an organization, i.e. the process of making tacit knowledge explicit. Any knowledge management decision to capture tacit knowledge needs to be informed by the costs incurred and benefits produced. These costs and benefits vary radically depending on properties of the domain, the organization, the knowledge to be captured and the importance of excluding others from the benefits of the knowledge. The picture is further complicated by the difficulties involved in valuing knowledge. We survey these factors, and seek to integrate such considerations into standard knowledge management methodologies (using CommonKADS as an example), and into methodologies for the qualitative valuation of intangible assets.

Keywords

Knowledge management, knowledge acquisition, tacit knowledge, CommonKADS

INTRODUCTION

Knowledge capture is an imperative in a business world where vast quantities of data are available via the Internet. Knowledge, understood as usable information, is clearly a vital ingredient in the success of any company; we are swamped with information, but getting it into a usable form is the key to extracting its benefits.

However, knowledge capture is not only a tool for bringing knowledge into an organization. The same tools and techniques can be adopted within an organization both to convert information into knowledge, and to adapt existing knowledge sources in order to transform the form or representation of knowledge into something more appropriate for the current state of the organization.

In this paper, we will examine the use of knowledge capture and management methods and technologies to transfer knowledge from tacit forms into explicit ones, and take a close look at the management considerations that might underlie a decision to undertake such a task.

In the next section, we will examine tacit and explicit knowledge, looking at why knowledge appears in these forms, why one might wish to transfer knowledge from one form to another, and what economic and management considerations would influence such a decision. Then we will examine the ways in which such considerations might fit into current knowledge management methodologies.

Throughout this discussion, an underlying problem is the difficulty in measuring the value of knowledge [1]. We will examine the problems of managing knowledge capture strategies within this context, and try to link our discussion with the debate in accountancy over the desirability of and techniques for valuing intangible assets [2].

TACIT AND EXPLICIT KNOWLEDGE

The importance of the flow of knowledge around an organization was expressed by Nonaka and Takeuchi [3]. They sketched a picture of knowledge changing form as required to allow managers to gain the maximum benefit from it. In particular, they emphasized the transformation of knowledge from tacit forms, personal knowledge held in forms that hinder communication (e.g. the expertise that resides "in an expert's head"), to explicit statements of such knowledge, and back again.

Described as such, the implication is that explicit knowledge is superior to tacit knowledge, and that all things being equal, managers should try to ensure that tacit knowledge within their organization be made explicit. However, this is not necessarily the case; Nonaka and Takeuchi maintained that the Japanese competitive advantage was partly down to their respect for tacit knowledge [3, p.8], though that argument looks less convincing after the long Japanese slowdown. Nevertheless, there are many reasons why the relationship between tacit and explicit knowledge is a delicate balance, and in this section we will set out some of the reasons why.

Types of Tacit Knowledge

Tacit knowledge comes in a number of forms, but we can focus on three particular types. First, there is a technical dimension which might include crafts and skills [4]. These are, of course, notoriously difficult to formalize and pass on, and in general a long apprenticeship period is necessary to acquire them. Second, there is the background knowledge that underlies the use of any specific knowledge [5]. Third, there is knowledge that is in some sense distributed about an organization, in different 'little bits' of know-how that different people may have, or have access to in codified form, together with organizational structures and procedures that connect these distributed knowledge sources together to produce a reasoning or inference process that produces outcomes independently of any individual contribution.

The Process of Externalization

Nonaka and Takeuchi discuss the processes of knowledge transfer [3, pp.70-73]. The process we are interested in in this paper is *externalization*, making tacit knowledge explicit. This is in fact a type of *knowledge capture.*

As such, externalization will require the usual resources of a KA programme [6, pp.187-214]. This will in general include a knowledge engineer, KA software, and the time of experts and practitioners (i.e. the holders of the tacit knowledge), together with a code to make the explicit representation of the tacit knowledge useful. [7] describes capture processes within Unilever, while [8] shows how Schlumberger try to capture knowledge within the organization without a knowledge engineer.

As far as the KA effort is concerned, there is very little difference between externalization and the process of capturing knowledge from outside the organization. Knowledge is ghettoized by being tacit, and in general is unavailable to the organization when its holders are absent or geographically remote. The same process of drawing up organizational models, and attempting to understand the contribution of the knowledge being captured in that context [6] needs to be carried out.

Benefits of Codification

The result of a knowledge capture exercise is a body of explicit knowledge that is a representation of the tacit knowledge. Obviously, the tacit knowledge remains within the organization too. The external knowledge can be said to have been *codified*. Note that some tacit knowledge, the ability to understand the code, must underlie the use of the explicit knowledge [9, 10]. Note also that the explicit representation need not be a *translation* of the tacit knowledge; much of importance may have been missed by either the capture methodology or the code.

Holding the knowledge explicitly has a number of advantages. First, the knowledge is more easily shared around the organization. Knowledge tacitly held, e.g. in the form of an expert's expertise, is difficult to use when the expert is away from the office, otherwise engaged, or geographically removed. The explicit codification allows knowledge to be shared, e.g. by placing the codification on a corporate Intranet, and therefore allows the organization to gain maximum benefit from it [3, 7].

Second, the knowledge, when made explicit, becomes a permanent fixture in the organization. Tacit knowledge often leaves when an expert does, but the codification remains. Many knowledge capture efforts are prompted by the imminent retirement of strategically important people. The organization must ensure that the tacit knowledge required to understand the code remains [9].

Third, an explicit repository of knowledge can be the object of commerce. It can be sold to interested customers.

Fourth, the externalization of knowledge turns it from a *rival* to a *non-rival* good. In economics, a rival good is one which can be consumed only by one person at a time. If a person owns a sandwich, he or she can either eat it or exchange their property rights with someone else; however, the sandwich will only be eaten once. A non-rival good can be enjoyed simultaneously by any number of consumers, such as a piece of music. Tacit knowledge has many of the characteristics of a non-rival good, in that when its possessor is occupied with applying knowledge in one area, he or she cannot be simultaneously occupied in another. Explicit knowledge, stored on an Intranet or in a manual, can be used simultaneously by many people, and so looks more like a non-rival good [11].

Advantages of Tacit Knowledge

Much effort has gone into understanding the benefits of codification [9], and it may seem as if making tacit knowledge explicit was always going to be worthwhile. However, holding knowledge in tacit form can also be useful [3, 10, 11].

First, leaving tacit knowledge uncodified obviously saves the organization the expense of codification. This includes the knowledge capture, storage, and maintenance, including updating the explicit repository at intervals.

Second, when the exclusive use of the knowledge is important, as with a trade secret, or with some process that confers a competitive advantage, it is important to prevent the knowledge leaking out. This is difficult to do as knowledge will always create spillovers or positive externalities for others; even a patented process can be reverse engineered when the goods reach the market [2, 12]. Tacit knowledge is that it is less 'leaky', and therefore less likely to be transferable to rivals [11].

Third, it has been argued that tacit knowledge can enjoy many of the advantages of explicit knowledge in particular when embedded in processes within an organization [13]. Focusing on tacit knowledge as embodied in particular people tends to draw attention away from the possibilities of preserving competitive advantage with tacit knowledge embedded in and across an organization [10].

Fourth, the actual application of tacit knowledge can be smoother and less error-prone than the application of externalized explicit knowledge, precisely because it is internalized [3]. The knowledge is applied 'automatically' rather than 'painstakingly'. Note that this is not in itself a reason *not* to codify the knowledge, though.

In understanding the flow of knowledge throughout the organization, in effect the application of tacit knowledge would be understood as a black box, with an understanding of the types of inputs and outputs, but without any specification of the inference process that connects them.

Some Important Trade Offs

Particular areas of interest for the management decision as to whether to codify some knowledge are those where there is a trade-off of factors. In this subsection, we can briefly review four of them.

First, there is the question of securing the benefits of the knowledge exclusively. Here, the immediate issue is whether to seek the protection of law. Patents grant the developers of knowledge intellectual property rights, which allow them to command monopoly rents from the knowledge for the period of the patent. However, in order to do this, the knowledge must be codified in order to be presented to the licensing authorities. This in itself may make the knowledge more likely to leak within the period of the patent. More to the point, if the knowledge was tacitly embedded within the organization, keeping it so – and thereby foregoing patent protection – could actually help preserve the exclusive use of the benefits by keeping a codification as far from the public domain as possible.

Second, there is the question of preventing knowledge leaking out into the public domain, and therefore being exploited by rivals. Tacit knowledge is much less 'leaky' as we noted above. On the other hand, in some circumstances, the labour market acts as a proxy for a market in tacit knowledge (i.e. if a firm wishes to buy some relevant tacit knowledge, it could 'poach' experts from its rivals by offering them higher wages). If a firm's experts held much of its tacit knowledge, and were 'head-hunted', the firm would be denied the benefits of the knowledge in future. In such a situation, a pre-emptive codification effort may be worth it, so that if the experts left, at least the firm would preserve a record of the knowledge.

Thirdly, there is the question of investment in knowledge capture. Because codified knowledge is non-rival, and not fully excludable (i.e. its benefits tend to spill over for other organizations), any investment in knowledge capture tends to benefit rival organizations. On the other hand, purchasing second-hand knowledge is less of an investment. In any free market, in the long run the price of any good tends towards the marginal costs of reproduction, which in the case of knowledge is close to zero. Hence delaying an investment in knowledge capture may mean the organization can pick the knowledge up (e.g. from the Internet) for nothing. If all organizations in a sector reason in this way, then of course the effect will be that no-one invests in knowledge capture at all, to the detriment of everyone [14].

Fourth, if the organization becomes sensitive to the value issues surrounding codification, then it is inevitable that employees will too. If an organization's trade secrets are to be secured by a strategy of tacitness, then employees can realize their value within such a regime by offering themselves on the labour market [15]. If the organization's security is to be achieved through codification, then employees may not cooperate fully with the knowledge capture programme, intending to preserve the unique benefits of the knowledge for themselves [16].

Code Types and Knowledge Types: The Empirical Evidence

Much of the debate surrounding the relative merits of tacit and explicit knowledge has been theoretical, and the amount of empirical work that has been done is small, perhaps largely because of methodological difficulties in pinpointing the effect on the bottom line of a particular knowledge management or knowledge capture strategy. What little econometric work has been done seems to support the commonsense view that codification can be of some value in certain circumstances.

Schulz and Jobe [17] attempted to uncover correlations between knowledge codification strategies and performance levels of multinationals. They found no evidence to suggest either that subunits with high levels of codification outperformed those with low levels, or vice versa, showing that there is no simple best strategy for knowledge management (which, with their cyclical view, Nonaka and Takeuchi [3] would probably have predicted).

However, they did find significant improvements in special cases, for example, using appropriate codes for the type of knowledge under discussion (e.g. using text-based codes for marketing knowledge, numerical codes for technical knowledge, etc). They found that subunits with a focused approach to knowledge management outperformed the unfocused subunits.

The result of Schulz and Jobe's analysis is that improved performance will not be reached by a coarse-grained knowledge management strategy, e.g. of codifying all tacit knowledge [17]. Part of the skill of a knowledge manager is to select the tacit knowledge worth codifying, and selecting the right code type. Code types here include mathematical/numerical codes, diagrammatic codes, text-based codes and codes where the knowledge is embedded in a physical object, e.g. an expert system or a prototype. Schulz and Jobe managed, by considering different knowledge types (strategic knowledge, technical knowledge and marketing knowledge) even to uncover correlations between the best code type and knowledge type.

Clearly this is not an exact science by any means, but the empirical situation seems to back up the suspicion that there

is no straightforward rule concerning intra-organization knowledge capture; explicit knowledge is no better and no worse than tacit knowledge – in the abstract.

Conditions for Tacit Knowledge

Given that, we now have a requirement for guidelines for determining the costs and benefits for a knowledge capture programme. Much of these will depend on the underlying structure, not only of the knowledge within the organization, but also of the domain. In other words, in general there will be reasons why tacit knowledge is held tacitly, and these will impinge on the cost/benefit analysis for a codification programme.

As many commentators have claimed [10, 11, 18], the distinction between tacit and explicit knowledge is not as black and white as is often suggested. One cause of this is the relationship that knowledge has to the codification procedures that stand by them. For instance, if knowledge is explicit, it is explicit with respect to a code: it must be represented using a code and the code must be available to the organization. This leaves a number of possible relationships between the knowledge, the code, and the potential users. Each relationship will dictate a different balance of costs and benefits of codification [18].

The base case is that there is a code in use, the 'standard' case of explicit knowledge. An example would be where there was some procedure, e.g. for assigning jobs to workers, and the knowledge of how to do this was precisely described by a manual that everybody follows.

A second case would be where a code existed for some knowledge, yet it was not for some reason the optimal code. In that case, the knowledge capture process would need to establish a translation between the suboptimal code and a better one. The knowledge would exist in explicit form before the capture process began, and the costs of codification would be likely to be relatively small.

Another case would be where the code existed, but was not used. This could be because the knowledge had been internalized by its users [3, 18]. Hence, to a knowledge engineer coming in from the outside, it may look as if the knowledge was tacit, yet there would be strong case for calling the knowledge explicit. The difficulty here would be in not overestimating the costs of codification.

Yet another case would be where codes were disputed, in a contested field. Where there is little or no consensus in a domain, merely codifying one's knowledge (e.g. writing a textbook to publicise one's point of view) would not provide explicit knowledge in the sense of an account of the domain, as the codification itself would also come under dispute.

If there was no code, and the knowledge was unambiguously tacit, there are still a number of different situations affecting the cost/benefit analysis. The first would be where there were no disagreements, and everyone agreed in their use of the knowledge.

Another case would be where there was no code, and there were disagreements in the application of the knowledge, but that there was a procedural authority which commanded the support of the community.

A final case would be where there was no code, and no consensus as to how to deal with disagreements.

Relevant factors affecting the analysis of the costs and benefits of codification would include the existence of agreed codes or dispute resolution procedures. If the knowledge capture process needed to establish such codes, or, worse, even establish a decision rule, then the effort overhead would increase dramatically. However, that would also have to be ranged against the demand in the community for codified knowledge, and therefore the demand for such codes and procedures. For a fuller analysis of the various positions here, see [18].

Tacit Knowledge and Epistemic Communities

Hence, tacit knowledge can be 'caused' in a number of ways by different situations in a domain. Such situations have an effect on the *epistemic communities* that develop in such domains.

An epistemic community is, in effect, a group of like-minded people who engage in similar work and interests, and share a number of key assumptions. They develop codes and jargons that need to be learned before the interactions of the community can be fully understood. Such communities have been the focus of academic discussion for decades [19, 20, 21], but their economic and technological relevance has become appreciated more in recent years [8, 22].

In effect, an epistemic community is defined by a store of tacit knowledge that underlies the stores of explicit knowledge that it produces, either in such forms as manuals and guides for action, or in textbooks and scientific or research publications [5]. It may even be possible to discover such communities by analyzing the structures of explicit knowledge to which they contribute [1]. If such explicit, codified knowledge is to be acquired by an organization, a number of aspects of the structure of the epistemic community will affect the costs and benefits of the capture decision.

First, there is the spread of the community, and how it is defined. The community could be a world-wide group of people across organizations (such as the KA community), or it could be a group within a particular organization. In the latter case, it may be that the knowledge capture imperative is created by some management structure within that organization (e.g. research scientists banding together to resist pressure from the marketing dept.), and that there would be greater net benefits from revising management.

Second, there is the question of the organization's access to the epistemic community. There is no point expensively (or even cheaply) acquiring explicit knowledge if the organization does not have the store of tacit knowledge that

would enable anyone to understand the new knowledge. Capture of the codified knowledge may require a full programme of acquisition of the tacit knowledge underlying it.

Third, hosting an epistemic community is a little like hosting a parasite, and the key to making it pay is to achieve a little symbiosis. To retain the ability to act on some explicit knowledge will involve keeping some representative(s) of an epistemic community, which in turn will involve nurturing that community, e.g. by sponsoring conference and workshop attendance, subscribing to journals, etc. This is, of course, a long term commitment and overhead.

KNOWLEDGE MANAGEMENT METHODOLOGIES

The picture for the management of knowledge capture programmes within an organization, the decision to codify tacit knowledge or not, is very mixed, as we have seen in the previous section, with different indications having to be weighed against each other. There will be no simple algorithm to be applied whenever such a decision is to be made, as has been shown empirically [17].

However, it should be possible to include relevant issues within standard knowledge management methodologies. Much of the work on understanding the economics of codification is relatively recent, and it will of course take time for disputes to be resolved within the field (e.g. [9] vs. [10]). But one would hope that an outline of the relevant parameters and indications can be made out [1], and that such accounts may be inserted relatively painlessly into existing management methodologies.

Example: CommonKADS Feasibility Studies

We will take as an example the CommonKADS knowledge engineering methodology [6]. The essence of CommonKADS is that a knowledge manager will model different aspects of the organization from a knowledge perspective, and although it betrays its roots in expert system research by focusing to an extent on automation, it provides a full and straightforward account of knowledge modeling and management that (a) fits neatly with existing software engineering methodologies, therefore increasing the likelihood of industrial take-up, and (b) is extensible where special purposes demand it [23].

In essence, CommonKADS is focused around six models of an organization [6, pp.17-20]. The *organization model* models the use of knowledge within an organization. It is used as the basis for feasibility studies, and provides the structure for the other, more detailed, models.

We will concentrate on this model in this discussion. The other models are as follows. The *task model* models the business processes of the organization. The *agent model* models the use of knowledge by the executors, whether human or artificial, of the various tasks in the organization. The *knowledge model* explains in detail the knowledge structures and types required for performing tasks. The

communication model models the communicative transactions between agents. The *design model* specifies the architectures and technical requirements needed to implement a system that embodies the functions detailed by the knowledge and communication models.

We will focus here on the organization model, as the analyses of the costs and benefits of an intra-organization knowledge capture exercise is properly understood as part of a feasibility study.

The method of implementing CommonKADS is to perform an analysis of the organization by following the modeling steps laid out in a series of worksheets, which basically ensure that the knowledge engineer extracts the knowledge he or she needs. The organization model contains five such worksheets [6, pp.28-35].

OM-1. Identifies knowledge-oriented problems and opportunities in the organizational context, and suggests possible solutions.

OM-2. Describes the organizational aspects (organization structure, business processes, agents, resources and organizational culture) affecting knowledge solutions.

OM-3. Describes the business processes in terms of the agents it requires, its location, the knowledge assets deployed, and measures of its knowledge intensiveness and significance (e.g. in terms of frequency, costs, resources or mission criticality).

OM-4. Describes the knowledge used in the organization in terms of its possessors, the processes it is used in, and whether or not it is in the right form and location, of the right quality, and is available at the right times.

OM-5. Checks the feasibility of the suggested solutions to the knowledge problems/opportunities (OM-1), in terms of business feasibility, technical feasibility and project feasibility (i.e. is there sufficient commitment and resources available to the project within the organization), together with a set of proposed actions.

The issues discussed in the previous section would be dealt with in the various worksheets as follows.

OM-1. Here would be found the proposals for any intra-organizational knowledge capture exercises. The shortlist of problems, opportunities and solutions is generally captured by interviews and brainstorming sessions. The general character of a problem would be that knowledge, tacitly held, was not being made available around the organization. Hence a possible scenario would be that a constituency within the organization would complain that it was being kept in the dark in some respect.

OM-2. Relevant aspects of the organization would include the unwritten culture of communication (or lack of it), the agents involved, and the resources available.

OM-3. In the task descriptions, the knowledge assets used would be listed, together with descriptions of the

significance of the task. This would be important for the cost/benefit analysis of a capture programme, as the benefits of the programme would of course decline with the significance of the task.

OM-4. The knowledge assets, listed in OM-3, are described in terms of who owns them, and whether they are in the right form etc. These are essential indicators of the tacitness or otherwise of the knowledge and whether the assets could be shared more effectively.

OM-5. This worksheet is where the serious cost/benefit analysis is done. Issues to do with technical feasibility will focus most on the requirements of the knowledge capture process itself, software, methods, V&V, etc, which we can assume will be in place. Issues to do with business feasibility are closer to our concerns, and will list the benefits of the proposed capture programme, the added value to the organization, expected costs and the comparison with other solutions, and a risk assessment. Project feasibility issues of relevance include the commitment from relevant actors, and the resources available. This may be the locus of an interesting trade off within the organization between those who want access to some knowledge, and those whose interests require that they guard it and share it sparingly.

Hence much of what is required is present in the CommonKADS methodology. In the next two subsections, we will discuss missing pieces.

Problems of Knowledge Valuation
A vital issue in assessing the feasibility of some knowledge-based solution to some problem in an organization is that of valuing the knowledge and the costs of its deployment. What value will some knowledge add? Although many aspects of estimating value-added are in effect guesswork, with respect to knowledge valuation is especially difficult [1, 2]. Opinion is divided between accountants and the financial community as how best to measure knowledge value, or whether to measure it at all, either externally for investment reporting, or internally for knowledge asset management [1].

At the moment – though this is a fast-moving field – there is the beginning of a consensus around the voluntary publication of a series of qualitative parameter values designed to help investors and managers gauge the performance of an organization's knowledge assets [24, 25, 26]. It may be that the benefits that are listed for a proposed capture programme will be less tangible than the costs, some of which are relatively easy to estimate. In that case, the knowledge management decision may not be determined to any great extent by the methodology (though of course the methodology would still provide the manager with the maximal quantity of information).

A further issue is where the value of a capture programme would be expected to show. For example, one hope would be that the value would show in profits. However, of course

in the short term, a capture programme will lower profits (by increasing expenses). It may be that the capture effort, if reported, would cause an increase in the share price (i.e. persuade investors that profits would increase), which may be an appropriate measure of short-term value-added [27]. Or the benefit may be simply in an increase of efficiency, that feeds into profits in its own good time.

These are all complex issues about which there is little consensus; we could not expect to solve them now, nor that CommonKADS could be amended to solve them. But they are included here as indications of the difficulties underlying the management of knowledge assets.

Additional Aspects of Cost/Benefit Analysis of Knowledge Capture
Our final task is to check out which aspects of cost/benefit analysis are not covered by the CommonKADS worksheets. The extension of CommonKADS to cover the cost/benefit analysis of codification would involve extending the worksheets for (at least) the organization model. We have seen from our discussion above that some of these issues are addressed by the existing sheets; others are covered but not at the precise level of detail or specificity that we would require. Some issues are not covered at all.

We suggest the following as draft extensions of the CommonKADS worksheets OM-3 and OM-4 [6, p.33]. The new questions are italicized. Other worksheets would be extended analogously. For instance, the possibility of selling a codified repository should be mentioned explicitly as a possibility in OM-1, and the risks of expertise leaving the organization mentioned in OM-5.

OM-3: Process Breakdown Worksheet	
No	Task identifier
Task	Task name (part of a process already identified)
Performed by	An agent already identified
Where	Location in the organization
Knowledge asset	List of knowledge resources used
Knowledge forthcoming	*Is the knowledge generally available? Which assets are not?*
Intensive	Boolean indicating whether task is knowledge intensive
Significance	E.g. on a 5-point scale in terms of frequency, costs, resources or mission criticality

OM-4: Knowledge Assets Worksheet	
Knowledge asset	Name

OM-4: Knowledge Assets Worksheet	
Agent	Possessor
Used in	Tasks
Strategic status	How strategic are the tasks involved in the organization's total business plan? Are the assets essential for the processes?
Codified	Boolean
Relevant agents with access	Those agents associated with the relevant tasks listed above who have unlimited access to the asset
Form	If codified a specification of the form the knowledge is held in. If tacit, a specification of that (e.g. expertise held by number of people)
Type	E.g. marketing knowledge, technical knowledge
Codes	Is there a code which would be useful for codification, or to recode knowledge already codified?
Alternatives	Do alternatives exist to using the asset? Could the organization be reconfigured to make the asset less essential? What would the costs of that be?
Underlying knowledge	Is any extra knowledge required to leverage the knowledge asset? E.g. does the asset require a knowledge of physics before it can be used? How available is the underlying knowledge?
Domain properties	Is the domain particularly fast-moving? Will the asset be expected to change? Will any codified repository of knowledge be hard to maintain? If the asset is codified, what are the costs of maintenance?
Consensus	Is the knowledge consensual, or contested? If contested, how contested?
Epistemic communities	Is there an epistemic community, either within the organization or beyond, which is associated with the knowledge asset, either as a possessor of it, or as a group who would naturally understand it? Does the organization have access to members of this community?
Secrecy	Is the asset a trade secret? What would be the consequences of allowing the asset to leak out?
Vulnerability	Are the agents who possess the asset vulnerable to other organizations? Could the owners be head-hunted? If so, could they deny this organization access to the asset? And if they could, does the strategic

OM-4: Knowledge Assets Worksheet	
	status of the asset mean it should be protected in some way?
Intellectual property	What is the status of the asset in law? Is there a patent? If so, who owns it? If there is no patent, is it public domain? Is the organization legally entitled to patent? Could there be a market for licensing?
Right place	Boolean
Right time	Boolean
Right quality	Boolean

In this paper we have concentrated on the organization model. Obviously an aspect of further research is to decide whether any of the other five CommonKADS models would need to be extended as well.

DISCUSSION: THE COSTS AND BENEFITS OF EXTERNALIZING KNOWLEDGE

In this paper, we have attempted to draw some lessons from recent work in economics about the valuation of knowledge and the costs and benefits of codification. Many of the relevant aspects are present in a standard knowledge management methodology, CommonKADS, but often only in an implicit form. Furthermore, many of the major issues to be addressed are genuinely difficult issues in the valuation of intangible assets, on which there is no accountancy or financial consensus.

Where CommonKADS seems to require boosting is the addition of an understanding of the organization's context. The context of a knowledge-intensive application is modeled in CommonKADS in the communication model, but many aspects of the feasibility of a knowledge capture programme require an understanding of the context, particularly the issues relating to trade secrecy and the desirability and likelihood of knowledge becoming 'leaky', and spilling over to benefit others.

The success of knowledge capture programmes will depend on both the techniques and tools developed for the job, and on the job being done only where the chances of success are high. Any investment where measurement is difficult is risky, and intra-organization knowledge capture is no exception. In this paper, we hope to have shown that a rational risk analysis is possible, and that the decision to capture knowledge need not be a shot in the dark.

ACKNOWLEDGMENTS

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