

# Understanding the influence of organizational change strategies on information technology and knowledge management strategies

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## Abstract

While discussion about knowledge management often centers around how knowledge may best be codified into an explicit format for use in decision support or expert systems, some knowledge best serves the organization when it is kept in tacit form. We draw upon the resource-based view to identify how information technology can best be used during different types of strategic change. Specifically, we suggest that different change strategies focus on different combinations of tacit and explicit knowledge that make certain types of information technology more appropriate in some situations than in others. © 2001 Elsevier Science B.V. All rights reserved.

*Keywords:* Strategic change; Knowledge management; Tacit knowledge

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## 1. Introduction

Because of the inherent instability in the business environment today, organizations often find themselves facing the need to change their mode of operation [12]. Opportunities to acquire new resources or to move into new businesses may arise, or threats from new competition or government regulation may become more salient [31]. To face these challenges organizations may draw upon a variety of resources to which they may have access. According to the Resource-Based View (RBV) of the firm, an

organization's strategic change efforts are focused on the acquisition and use of resources, such as management experience, or workforce skill [4,35,44]. The premise of the RBV is that organizations employ a mix of acquisition and configuration of resources to change how their business is accomplished. As they change, organizations may (1) reconfigure existing resources, (2) acquire new resources and reconfigure them, (3) acquire new resources and not reconfigure them, or they may (4) preserve the status quo and engage in a business as usual strategy [4,44].

One key aspect that is influenced by the change strategy an organization employs is its general knowledge management strategy [41,44]. Knowledge is often the basis for the effective utilization of many important resources [35], and managing knowledge effectively is critical for an organization to gain and

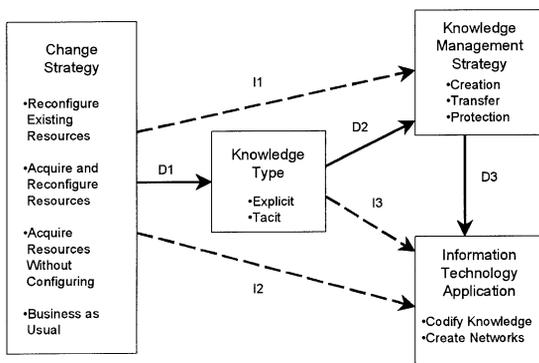
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sustain competitive advantage [22]. However, to fully understand how this may be done, we must address the character of the knowledge being managed. One specific dimension of the character of knowledge upon which we wish to focus is the degree to which it is *explicit* or *tacit*. Explicit knowledge is that which is easily expressed; it can be transmitted to others in a relatively straightforward manner [34]. On the other hand, tacit knowledge is that which is difficult to articulate and express to others [34]. We will further develop these concepts in Section 3.

We state three premises for our discussion. First, in practice, strategic change, knowledge, knowledge management strategies, and information technology are substantially interwoven. For analytical purposes, however, we attempt to separate them. Second, when we refer to information technology, we take a fairly high-level view. We will refer to information technology in terms of its use as a repository of codified or explicit knowledge [22], and in terms of its use as a means to facilitate communication networks in organizations [22]. Third, we believe that the codification and communication capabilities provided by information technology should be emphasized differently depending on the type of strategic change, and the knowledge being managed.

With these premises in mind, for our analysis, the relationship we see between change strategy, knowledge, knowledge management strategy and information technology is depicted in Fig. 1. From this



D-Direct Relationship (solid line)  
I-Indirect Relationship (dotted line)

Fig. 1. Conceptual view of relationships.

figure, we believe that the following direct relationships (solid lines — labeled **D1**, **D2**, and **D3**) exist. First, the change strategy selected by an organization influences the kinds of knowledge that it will need to draw upon (**D1**). Second, the knowledge applied to enact the change strategy directly influences the knowledge management strategy (**D2**). Finally, the knowledge management strategy selected, in turn, influences the application of information technology for that strategy (**D3**). Fig. 1 further indicates indirect relationships (dashed lines — labeled **I1**, **I2**, and **I3**) between the various elements. There is likely some influence of change strategy on knowledge management strategy (**I1**), change strategy on information technology application (**I2**) and knowledge type (tacit or explicit) on use of information technology for either codifying knowledge or creating networks (**I3**). However, the most direct linkage we see between change strategy and the appropriate information technology application is mediated by knowledge type and knowledge management strategy.

Given the relationships we believe exist between change strategy, knowledge type, knowledge management, and information technology, this paper discusses issues that should be addressed when using information technology to implement general knowledge management strategies in support of strategic change. We begin with a discussion of the RBV and strategic change, and move on to the nature of knowledge (specifically the tacit or explicit nature of knowledge), followed by knowledge management and general knowledge management strategies. Next, we address the fit between IT and the various knowledge management strategies used to support strategic change efforts. Finally, we offer implications for managers and researchers.

## 2. Strategic change choices

Firms' quest for competitive advantage through strategic change can best be explained through what is referred to as the RBV of the firm. The RBV originated in the Management and Industrial Organization literatures and it states that firms deploy their resources in an effort to gain a sustainable competitive advantage over their competitors [4,35,44]. Re-

sources include such things as management expertise or knowledge, high-tech equipment, firm reputation, and a multitude of other potential sources of advantage.

Four characteristics of a resource must be present for it to be the basis of a sustainable competitive advantage [3,39]. First, the resource must be *valuable* in the situation it is to be used. A valuable resource enables a firm to do something beneficial. While nearly any resource is by definition valuable, an example of a valuable resource could be a manufacturing plant, or a specialized expertise useful in the industry in which the organization operates [4,9]. Second, the resource must be *rare*. Resources that are held by one or only a few firms enable those firms to do things their competitors cannot. This enables the firm or firms to gain an advantage over their competitors at least temporarily. Federal Express' web-based package tracking was a rare resource, at least until it was imitated. Which brings us to the third characteristic of a resource, which is that it must be *inimitable*. Inimitability is the extent to which a given competence cannot be copied [3,4], and is analogous to the concept of *structural differences* [8], at least to the extent to which it may enhance competitive advantage. A resource that is difficult for competitors to copy enables the possessing firm to sustain its advantage for an extended period of time. For example, DeBeer's has an inimitable resource in the form of its access to diamond reserves. Fourth, the resource must be *non-substitutable*. Resources that are non-substitutable enable a firm to sustain an advantage by preventing competitors from accomplishing the same thing using a different set of resources. An example of a non-substitutable resource would be Toyota's new product development and production system. Toyota can produce a new car in eighteen months compared to the 30 months required by its fastest U.S. competitors [24]. At the present time, other car companies have no way of rivaling this resource.

According to the RBV, organizations have four primary choices in strategies for change. For one, they may *reconfigure existing resources*, which involves using resources already owned by the organization in new ways. This strategy attempts to increase the performance of the organization by increasing the efficiency or effectiveness of various

portions of the firm and to achieve a better fit with the current external environment by changing the way existing resources are used by the organization. An example of this type of change would be if a firm changed from organizing engineers in a functional structure to organizing them in a matrix structure. The matrix structure would use the same engineers, but assign them to projects with other types of engineers and non-engineering personnel in order to facilitate closer coordination between the functional areas in new product development [32].

Another strategy is to *reconfigure with new resources*. This involves the novel use of both existing resources and those that the firm may acquire. Typically, organizations will combine these sets of resources in new and different ways in order to increase the efficiency and effectiveness of the organization. An example of this strategy occurs when organizations purchase computer hardware and software and integrate them into the existing organization [4]. The organization is reconfigured in order to accommodate the new equipment and software, while at the same time the computer hardware and software is customized to the existing organization.

*Acquiring new resources without reconfiguring* them is concerned with simply buying new resources and using them as they were designed. Organizations that engage in this type of strategic change do not focus on the use of existing resources. Rather, these organizations use new resources to provide increased efficiency and effectiveness. An example of this occurred in the 1980s when General Motors brought in a large number of robots to use in their assembly operations. Many of the robots were used exactly as their manufacturer intended with little effort to fully integrate them into the existing organizational structure. GM's organizational structure remained, in essence, unchanged. Recently, General Motors has more fully integrated robotics into the organization [42].

The final change strategy is called *business as usual*. This strategy involves performing activities as they have always been performed. This strategy can include minor variations in operations, but for the most part no material adjustments are made. Many times the organization fails to change because of inertial forces acting to restrict potential adjustments [21]. An example of this occurs when a corner drug

store in a downtown area fails to address the movement of people away from the central parts of the town out to the suburbs.

### 3. Tacit and explicit knowledge

We have organized change strategies based on the extent to which they use new or existing resources. Many of the valuable resources within organizations are based on knowledge possessed by the firm [20]. The management of knowledge within the organization includes activities critical to gaining and sustaining competitive advantage [43]; however, these activities are dependent on the type of knowledge necessitated by the chosen strategy, that is to say that strategy choices drive the type of knowledge used as seen in Fig. 1. As we discussed previously, there are two general classifications of knowledge with which firms must cope. These are *explicit* knowledge and *tacit* knowledge. Explicit knowledge is *knowledge that is easily expressed*; it can be written down or passed verbally to others. Because of its ease in expression, explicit knowledge is more easily transferred and imitated. Examples of explicit knowledge include product characteristics, testing procedures, marketing strategies, and accounting procedures that have been documented.

On the other hand, tacit knowledge is *knowledge that is difficult to articulate and express to others*. This nature of tacit knowledge is often discerned in the form of generally accepted background understandings [17] about reality held by members of a culture or organization [5,10,13,18]. Such knowledge emerges over time, and is learned by immersion rather than rote [36]. Many times the possessor of the knowledge is unaware of its existence, due to its implicit nature. The management of this type of knowledge is a difficult process given that the knowledge is difficult to express [15,27]. The knowledge may be expressed in terms of a restricted code [6] that, while obvious to organizational members may not at all be so to non-members. Indeed, members may not be consciously aware of the existence of the knowledge and, hence, may be unable to easily communicate it to non-members, or even members with less tenure. Examples of tacit knowl-

edge include implicit organizational routines [33] such as those used for creating new product designs and competitive strategies. These routines are not codified, rather they occur through the institutionalized interactions occurring in the organization [5,33]. The major components of managerial work, such as strategy making, are considered to emerge in this way. Mintzberg [30] has documented the process of managerial work including strategy making as difficult to describe. He portrays managers as participating, on a daily basis, in a large number of brief, informal interactions that are composed of non-written communications. These interactions, when combined with recognition of other environmental cues, slowly enable strategy making to progress, at times without the conscious awareness of the manager.

Organizational knowledge can exist in individuals and groups of individuals, or it can be an organization-wide phenomenon, such as an organizational routine [9,33,34]. Organizations should identify where the knowledge resides when designing strategies in order to ensure the knowledge is being created, transferred, and protected in the right way and with the right individuals. Although it is important for organizations to consider, the focus of this paper does not require distinguishing among the location of the knowledge within the organization.

### 4. Knowledge management strategies and activities

One key to organizational adaptation is how an organization manages its knowledge. Organizations can implement change, and gain and maintain a competitive advantage through the use of three general knowledge management strategies. These are: (1) *knowledge creation*, (2) *knowledge transfer*, and (3) *knowledge protection*. Speaking in broad terms, organizations that use a strategy of knowledge creation focus on creativity, experimentation, and, to a significant extent, creating a shared understanding within the creating group to construct new knowledge that can be used to develop new products and services. Organizations that use a strategy of knowledge transfer focus on rapidly disseminating knowledge through their organization in an effort to utilize

it to its fullest extent as quickly as possible [2].<sup>1</sup> Organizations that use a strategy of knowledge protection focus on maintaining knowledge in its original and constructive state (i.e. not losing it or allowing it to become altered or obsolete) and keeping knowledge from unauthorized transfer to other organizations (i.e. using security and legal measures). Because resources are limited, organizations have difficulty emphasizing all three knowledge management strategies simultaneously. Therefore, it is important for an organization to understand which knowledge management strategies it should focus on under various circumstances.

Each of the three knowledge management strategies has advantages and disadvantages. Although useful for new product development, a knowledge creation strategy means that attention may be turned away from transfer and protection of knowledge, thereby allowing the knowledge to drift uncontrollably — at times into the hands of competitors. Knowledge creation often involves high levels of explicit and tacit knowledge [34]. Competitive advantage derived from knowledge creation may not be used to its fullest potential, and it may not provide a lasting advantage when insufficient effort is expended to make the knowledge transferable within the firm and to protect the knowledge from transmittal to competitors outside the firm [2]. An example of an activity that would be part of a knowledge creation strategy would be the inclusion of suppliers and customers in a series of meetings to help define a future version of an existing product. The employees, suppliers, and customers interact in a way that enables new knowledge to be created, perhaps from the sharing and integration of unique perspectives through the back and forth discussions of the various groups [34]. This new knowledge may be used to

create new products or improve existing ones, and usually contains high levels of tacit and explicit knowledge.

Knowledge transfer, on the other hand, may lead to advantage through speedier deployment of knowledge to portions of the organization that can benefit most by it. Typically, explicit knowledge is more transferable within the organization, and when there are significant amounts of it this strategy is most useful. Some products or services can only be created and provided by organizations that possess certain knowledge throughout the entire organization. In this case, competitive advantage may not be sustainable because knowledge that is easily transferable within the firm is more likely to be transferable outside the firm as well. An example of an activity that would be part of a knowledge transfer strategy would be the internal publication of the behavioral characteristics of newly designed products that have recently undergone testing, perhaps via the use of a corporate intranet [38]. Much of this type of knowledge is explicit, making it easily communicable.

Knowledge protection activities include such things as limiting the number of employees who have access to certain information, making sure no single employee has access to the majority of information surrounding a new product, and maintaining causal ambiguity surrounding the firm's ability to successfully compete. The degree to which organizational knowledge is tacit can be a primary factor in a knowledge protection strategy because of the difficulty of copying this type of knowledge [20]. Knowledge protection can lead to products and services that are difficult to imitate, because competitors cannot figure out how to compete in an equivalent manner [20]. Many times this occurs naturally as routines evolve within firms [33], thereby creating tacit knowledge. However, this strategy at times keeps knowledge under tight wraps, which unknowingly prevents its transfer to areas of the organization that could benefit from its use. Also, in fast-changing industries existing knowledge may lose its value as competitors develop improved knowledge that allows them to "leapfrog" past the organization that depends on the older knowledge.

With the different emphases of general knowledge management strategies comes varying emphasis on the application of knowledge management activities.

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<sup>1</sup> The concepts of knowledge creation and knowledge transfer overlap in the area of shared understanding by organizational members. It is possible that these two concepts could be merged into one because of the high correlation that probably exists between them. However, for the purposes of this research, the concepts are kept separate, perhaps somewhat artificially, because some elements of knowledge creation may occur only in a single individual and not be part of a shared understanding. In this sense, to create may not always mean to share, and to transfer may not necessarily mean to create.

Holsapple and Joshi [25] provide a framework that addresses major knowledge manipulation activities. These activities are:

- *Acquiring* — identifying knowledge in the environment and transforming it for the organization's use and internalization
- *Selecting* — identifying knowledge within the organization's knowledge resources for use
- *Internalizing* — changing the organization's knowledge resource by assimilating new knowledge
- *Using* — generating new knowledge or externalizing it in a form usable outside the organization

Acquiring, selecting and using all emphasize the transfer of knowledge either within or outside the organization. As applied to the general knowledge management strategies [43] (i.e. creation, transfer and protection), it is clear that some activities as described by Holsapple and Joshi [25] will be emphasized more or less depending on the knowledge management strategy employed. Knowledge creation would appear to heavily emphasize use (generating) and internalization, while a knowledge transfer strategy would be more likely to emphasize acquisition, selection and use (externalizing). On the other hand, a knowledge protection strategy would appear to necessitate de-emphasizing the activities in the Holsapple and Joshi [25] framework save for acquisition (at least as it pertains to bringing new information into the organization) and internalization.

From the description of knowledge management strategies it is possible, even likely, that they may be in opposition to one another much of the time, because of their different emphases. For example, making knowledge more transferable within an organization also tends to make it more transferable outside the organization, thereby making it difficult to protect [43]. On the other hand, protecting knowledge can reduce the transferability of that knowledge within the firm. It is therefore important to prioritize the knowledge management objectives of the organization and to consider the type of knowledge being managed and its role in an organization's competitive advantage. It is clear that different activities

Table 1

Predominant knowledge management strategies used at high and low levels of tacit and explicit knowledge

		Explicit knowledge	
		Low	High
Tacit knowledge	High	Protection	Creation
	Low	No particular emphasis	Transfer

from Holsapple and Joshi's [25] framework will be called into use under different general strategies (e.g. creation, transfer or protection).

From our discussion of tacit and explicit knowledge, it is clear that the presence of explicit and tacit knowledge influences the effectiveness of the three knowledge management strategies. As summarized in Table 1, high levels of both explicit and tacit knowledge are typical for a knowledge creation strategy. When high levels of explicit knowledge and low levels of tacit knowledge are present, a knowledge transfer strategy is more common. Low levels of explicit knowledge and high levels of tacit knowledge are amenable to a knowledge protection strategy. When low levels of both explicit and tacit knowledge are present a knowledge management strategy is not necessary. Although some knowledge management strategies are more common based on certain levels of explicit and tacit knowledge, it does not mean other knowledge management strategies cannot be useful as well; it simply indicates that the stated strategy is likely the predominant one. For example, organizations willing to accept the risk of high cost, loss of knowledge, and reduced inimitability, may find it worthwhile to attempt to codify and transfer tacit knowledge. These risks, however, should deter many organizations from constantly transferring tacit knowledge around the firm without clear justification of the gains offsetting the risks.

## 5. Knowledge management and strategic change

If knowledge management includes the creation, transfer, and protection of knowledge within the organization [43], and knowledge may differ on the degree of its inherent tacitness [36], then it is clear that different strategic change efforts require varying

degrees of emphasis on each of these three general knowledge management strategies. Tacit knowledge, for example, requires different handling than does explicit knowledge in order for competitive advantage to be created and maintained using the knowledge management strategies described above.

Understanding tacit knowledge is important in order to understand how strategic change may be accomplished. In the following discussion, we take a descriptive approach to the explication of the influence of tacit and explicit knowledge on change strategies (i.e., the relationships are identified as an illustration of typical ways in which firms deal with these issues). It is not being suggested that firms should or can only use these approaches to deal with knowledge and change strategies. We first address tacit knowledge as it impacts the change strategy of *reconfiguring with existing resources*. Because tacit knowledge is created through learning by doing, the organization has built up a cache of tacit knowledge concerning the existing resources [33]. Strategies that rely solely on existing resources will have more tacit knowledge to deal with than will strategies that focus on new resources. This does *not* mean explicit knowledge will not be important to this strategy. Explicit knowledge is necessary for unlearning previous routines and for initiating new routines using the existing resources. Many of the existing routines may continue in order to tap the value of the existing resource. Therefore, successful change strategies of this type will likely focus on building upon the tacit knowledge already in existence [23]. The routines that do change will require some explicit knowledge, but not nearly as much as that needed for strategies that rely more heavily on new resources.

On the other hand, a strategy of *reconfiguring using new resources* indicates a different degree of importance for tacit and explicit knowledge. The use of some existing resources suggests the importance of tacit knowledge in a similar manner as reconfiguring using existing resources; however, the inclusion of new resources limits the applicability of existing tacit knowledge and provides for the expanded role of explicit knowledge in the change strategy. Organizations do not possess tacit knowledge about new resources because they have not worked with them. Rather, organizations are likely to use more explicit knowledge related to the new resources in order to

Table 2  
Relative importance of tacit and explicit knowledge in strategic change efforts

Change strategy	Importance of tacit versus explicit knowledge	
	Tacit	Explicit
Reconfiguring existing resources	High	Low
Reconfiguring with new resources	Moderate	Moderate
Acquiring new resources only	Low	High
Business as usual	Negligible	Negligible

develop successful strategies. Therefore, relatively moderate amounts of tacit *and* explicit knowledge are important to this strategy.

To *acquire resources and not reconfigure* them indicates a relatively low emphasis on tacit knowledge and a considerable role for explicit knowledge. Reliance on explicit knowledge obtained through the acquisition of new resources provides the organization with a strategy that other organizations are capable of imitating provided that they acquire the same resources and use them as they were designed [4]. Therefore, rapid transfer of explicit knowledge within the organization is critical to enabling the organization to stay ahead of its competitors. Because the role of existing resources is minimized, the role of tacit knowledge is relatively low.

Finally, the *business as usual approach* indicates a relatively negligible importance for tacit knowledge, and for explicit knowledge. Although tacit knowledge is associated with the continued use of these resources, the value of this knowledge is minimal because of the limited need for change required of these organizations. Explicit knowledge has little role in this type of strategy because of the focus on tacit knowledge stemming from the sole reliance on existing resources. Table 2 summarizes the previous discussion.

## 6. IT and knowledge management strategies

Having addressed strategic change efforts (reconfigure existing, reconfigure with new, acquire new,

business as usual), general knowledge management strategies (creation, transfer, protection) and knowledge classifications (tacit or explicit), we now move to IT and its interplay with each. We do this by first describing the generic capabilities of IT for knowledge management, followed by the interplay between IT and knowledge types and the relationship between IT and knowledge management strategies.

### 6.1. *Generic capabilities of information technology for knowledge management*

Before addressing how IT interacts with knowledge type and knowledge management strategy, we first address the generic capabilities provided by IT for knowledge management. At its basic level, IT can be seen as embodying two general capabilities with respect to knowledge: *codifying knowledge* and *creating networks* [22]. Knowledge may be codified into a decision support or expert system by making it explicit. For example, this is done in expert systems through the elicitation of knowledge from a domain expert by a knowledge engineer. As we mentioned before and will explain below, however, some knowledge has greater value when kept in a less explicit, or tacit form. Consequently, another capability provided by IT for knowledge management involves not codifying the knowledge, but helping to keep track of persons with particular expertise, and enabling rapid communication between them. This type of approach to knowledge management enables the knowledge to remain tacit. On the other hand, it also enables relatively rapid access by allowing people in the organization to easily identify who has knowledge and expertise relevant to their need and quickly contact them.

### 6.2. *IT and explicit or tacit knowledge*

While realizing the capability that IT provides for creating networks, with respect to tacit versus explicit knowledge, historically, information technology has had the net effect of making knowledge more explicit. This is done in order to facilitate more rapid transmission (e.g. by the use of email and Web pages) standardized decision-making procedures (e.g. through the use of decision support systems), or

codify knowledge (e.g. through the use of expert systems). Indeed, accounting systems where information technology was first widely applied involved extremely explicit rules and procedures [29].

Although IT can be used in all types of knowledge management, given the congruence between the effect of IT on codifying knowledge and explicit knowledge, it stands to reason that explicit knowledge is more easily handled by IT. In knowledge transfer strategies, a codification strategy with IT can be used to make the knowledge even more explicit and disseminate the knowledge throughout the organization quickly, by making it readily available in databases, decision support systems and expert systems. This approach leverages the knowledge assets of the organization as soon as possible, thereby enabling the organization to gain an advantage over competitors who transfer their knowledge more slowly [22]. Although IT has demonstrated some capability to assist in knowledge creation, it is in the transfer of explicit knowledge that codifying knowledge using IT has a relative advantage to the organization.<sup>2</sup>

Tacit knowledge, on the other hand, presents an entirely different set of issues. Explicated versions of tacit knowledge can benefit the organization by making the knowledge more available to the rest of the organization. However, efforts at using IT to codify and then transfer tacit knowledge within the firm can be costly and ineffective because of the difficulties of making tacit knowledge more explicit in preparation for its transfer. For one thing, codifying knowledge into a more explicit form for transmission using a less rich media (cf. [11]) can result in a loss of critical components of the knowledge. In addition, the very act of making tacit knowledge more explicit

<sup>2</sup> By itself, the distinction between explicit and tacit knowledge in relation to IT may not be a revelation, however, the goal of the paper is to raise awareness of the interconnectedness of change strategies, knowledge management, and IT. These topics have not had much attention as a group, and we feel that the implications for organizations are numerous. With the RBV making a significant impact on how organizations are perceived by managers and researchers, the integration with IT and knowledge management is increasingly important and would be insufficiently investigated without looking at the explicit/tacit characteristic of knowledge.

to facilitate transfer makes it more readily imitated by external entities [34]. One of the primary benefits of tacit knowledge is its inimitability. Strategies that succeed in making tacit knowledge more explicit may make it possible for easier imitation by competitors, thus negating an advantage gained by the more rapid dissemination of the information [28]. Consequently, we propose that codifying knowledge into an explicit form using IT (e.g. in the form of decision support systems and expert systems) is more appropriate for explicit knowledge than for tacit knowledge when the tacit knowledge is central to the firm's competitive advantage and competitive advantage imitation could eliminate the advantage. Still, creating networks using IT can be an appropriate strategy for transferring knowledge between organizational members while keeping tacit knowledge tacit. IT can be used as a means to catalog individuals in the organization that hold critical tacit knowledge, and then enable communication between those who need the knowledge and those who have it.

### 6.3. *IT and knowledge management strategies*

While IT can be used to create networks and facilitate interpersonal interaction (and thus be an effective means to transmit tacit knowledge), we believe it is still most amenable to codifying knowledge into explicit knowledge, and hence, that this use of IT is more appropriate for knowledge transfer than for knowledge protection. Still, firms make use of the networking capabilities provided by IT, which enables transfer of tacit knowledge without making it explicit. Nonaka and Takeuchi [34] identify the processes of *socialization* and *externalization* as means of transferring tacit knowledge throughout the organization. Socialization keeps the knowledge tacit during the transfer, whereas externalization changes the tacit knowledge into more explicit knowledge. Socialization includes activities such as apprenticeships and on-the-job training, whereby tacit knowledge is transferred directly from person to person without first making it explicit. The understanding comes from personally being in the situation. In some consulting firms [22], this is enabled by using IT as a means to catalog who has the knowledge, and then enabling individuals in the organization to coordinate face-to-face meeting times where the on-the-job

training that enables the transmittal of tacit knowledge can more readily take place.

Both of these socialization activities, from an IT perspective, can include advanced information technologies [14] such as groupware that enable direct, yet broad, communication that when combined with face-to-face communication allows the knowledge being passed to keep most of its tacit character. Hansen et al's [22] analysis of consulting firms identified several that make use of IT to network their employees together, while keeping their knowledge tacit. Of course, the ability to access this tacit knowledge does recognize that portions of it have been made explicit to some degree.

Externalization, on the other hand, includes the use of metaphor and analogy to trigger dialogue among employees that is capable of spreading tacit knowledge. In this case, knowledge that is normally gained through personal experience in a shared environment can be made explicit to some degree by organizing it and clarifying it for others, albeit at a cost and with some loss of knowledge in the transfer. As tacit knowledge is made more explicit, it becomes easier to transfer through various IT processes. Cases where this is most beneficial would include instances where the need to transfer knowledge quickly outweighs the risks of copying by competitors. Nonaka and Takeuchi [34] illustrated this concept by referring to Honda's "Tall Boy" car design which was represented by the analogy "man-maximum, machine-minimum." The analogy was supposed to indicate how Honda wanted to proceed with the creation of the vehicle: the design should come close to a sphere so that room was maximized while the actual vehicle was minimized. Obviously, the analogy made Honda's knowledge of what was needed more explicit and easier to understand, however, competitors could understand the analogy as well.

Given the potential negative outcomes from codifying tacit knowledge into a more explicit form (e.g. greater ease of duplication by competitors) it is important to identify tacit knowledge that exists in the organization and decide the extent to which the organization can or should codify it in a computer-usable form. First, organizations should evaluate the degree of tacitness of the knowledge to be transferred [33]. A key advantage of valuable knowledge

being tacit lies in its inimitable nature and managers must determine if the knowledge is a source of competitive advantage, and thus subject to detrimental imitation attempts by competitors. For this type of knowledge, organizations should rely on transfer options such as socialization activities that keep the knowledge tacit. Although this may limit the internal transfer of the knowledge, it will also reduce external transfer of this knowledge, which may be beneficial to the firm.

Tacit knowledge that is not the source of competitive advantage is less valuable to competitors and less likely to be subject to their imitation attempts [37]. Attempts can be made to make this type of knowledge more explicit for faster transfer without the risk of competitive advantage being eroded away [26]. Activities included in Nonaka and Takeuchi's [34] externalization category would be appropriate in this situation. Of course, the costs and uncertainty involved in making tacit knowledge more explicit should be taken into account before the attempt is made.

While codifying knowledge may not always be optimal for knowledge protection strategies, it is often appropriate for knowledge transfer and creation. One example of the rapid dissemination of knowledge may be found in Lotus Notes, which can be used to provide a historical record of electronic discussions of large groups. The dissemination of information and knowledge also enables redundancy to occur [34], whereby "intentional overlapping" of knowledge sets of individuals occurs. This process can increase the sharing of individual tacit knowledge by the attempted explication of it by its possessors [34].

## 7. Focus of IT for strategic change

We now address IT for knowledge management in strategic change. The four change strategies identified in this paper emphasize varying degrees of tacit and explicit knowledge, and this knowledge influences the amount of applicability IT should have on each as shown in Table 3. Our key assumption is that IT is most appropriate making knowledge more explicit [19] and therefore more imitable as well as more transferable. On the other hand, care-

less use of IT can cause tacit knowledge to inadvertently be changed into explicit knowledge to some degree. This would, of course, reduce the inimitability of the knowledge, making it subject to copying by other organizations and limiting the competitive advantage to be gained from this knowledge [28]. Precautions, through a high degree of focus on knowledge protection, should be made to make sure tacit knowledge remains tacit where desired.

While we have addressed it above, we first review the typical uses of IT for the different knowledge types. Our thesis has been that codifying tacit knowledge is difficult and has potentially negative outcomes in addition to the positive outcomes and, hence, codifying such knowledge for use in some algorithmic form may not always be the most appropriate course of action. On the other hand, using IT to create networks and track who has relevant tacit knowledge might be appropriate for tacit knowledge for which the organization would like to keep tacit. For explicit knowledge, we believe the most typical use of IT would be to codify the knowledge (e.g. by a Decision Support or Expert System). Table 3 depicts this.

IT will have varying degrees of appropriateness for the knowledge management strategies of knowledge creation, transfer and protection. We have suggested that codification using IT, in general, is more appropriate for use with explicit knowledge rather than tacit knowledge, for which creating networks may be somewhat more appropriate. And, because knowledge creation and transfer are usually driven less by tacit knowledge than knowledge protection is, we expect codification using IT to be more useful when used with knowledge creation and transfer than with knowledge protection. We believe that using IT to create networks by keeping track of those who possess relevant tacit knowledge can aid in protection, while making the knowledge more available to

Table 3  
Most typical IT uses for knowledge types

Knowledge type	Ease of codification	Appropriate IT use
Tacit knowledge	Low	Creating networks
Explicit knowledge	High	Codification

Table 4  
Most typical IT uses for knowledge management strategies

	Knowledge management strategy		
	Creation	Transfer	Protection
Most typical IT use	Codification	Codification, to some creating networks	Fairly low emphasis on codification, somewhat more emphasis on creating networks

those who the organization *does* want to access the knowledge. These issues are depicted in Table 4.

Finally, because codifying knowledge using IT is less common for tacit knowledge than it is for explicit knowledge and, hence, less common for certain types of knowledge management strategies, it is also less commonly found in certain types of change strategies than others, while greater emphasis may be placed on using IT to create networks. This is depicted in Table 5.

The culmination of the relationships among change strategies, knowledge type, IT appropriateness, and extent of socialization and externalization mentioned thus far can be illustrated as shown in Table 6. The relationships are summarized below.

The change strategy of *reconfiguring existing resources* requires a high focus on the protection of knowledge because of the relatively high dependence on tacit knowledge. The advantage of tacit knowledge is its inimitability [20], so efforts should be made to maintain the tacitness of this knowledge and not attempt to make it too explicit. Because of the reconfiguration of these resources, however, new

knowledge creation is still somewhat important and moderate emphasis should be placed on this activity. Still, socialization activities are used when needed in order to keep the knowledge as tacit as possible [34].

*Reconfiguring with new resources* combines both tacit and explicit knowledge in an effort to create something new and somewhat difficult to imitate. Therefore, high efforts are focused on knowledge creation, and moderate efforts are focused on knowledge transfer and protection. The new knowledge needs to be spread throughout the organization quickly, so some effort needs to be made at making the new knowledge somewhat explicit. This is why only a moderate focus on the protection of the knowledge is appropriate. The most important attribute of knowledge that provides for its protection is its tacitness, and if the knowledge is kept too tacit it will be too difficult to transfer quickly [20]. However, the tacit knowledge needs to remain as tacit as possible, so moderate use of socialization and externalization activities are appropriate.

*Acquiring new resources* solely requires explicit knowledge that comes with the purchase of the resources [4]. Knowledge creation is not part of this strategy, and because of the lack of tacit knowledge in this strategy, knowledge protection is not feasible. Rapid knowledge transfer is the primary goal and the means to gain a competitive advantage. Hence, this strategy places a high focus on the use of IT for codification due to the need for rapid knowledge transfer. In this case, socialization activities would be kept to a minimum and externalization activities would be the main focus.

The strategy of *business as usual* requires little in the way of new knowledge, its transfer, or its protec-

Table 5  
Most typical IT use for change strategies

Change strategy	Knowledge type emphasized		Typical IT use
	Explicit	Tacit	
Reconfiguring existing resources	Low	High	More emphasis on creating networks
Reconfiguring with new resources	Moderate	Moderate	Some emphasis on both creating networks and on codifying knowledge
Acquiring new resources only	High	Low	More emphasis on codifying knowledge
Business as usual	Negligible	Negligible	Somewhat limited application for either use of IT

Table 6  
Relationship between change strategies and knowledge management strategies

Strategic change strategies	Knowledge type emphasized		Focus on knowledge strategies			Most typical IT use	Extent of:	
	Explicit	Tacit	Creation	Transfer	Protection		Socialization	Externalization
Reconfigure existing resources	Low	High	Moderate	Low	High	Create networks	High	Low
Reconfigure with new resources	Moderate	Moderate	High	Moderate	Moderate	Fairly equal emphasis on creating networks and codifying knowledge	Moderate	Moderate
Acquire new resources only	High	Low	Low	High	Low	Codifying knowledge	Low	High
Business as usual	Negligible	Negligible	Negligible	Negligible	Negligible	Limited application for either IT use	Negligible	Negligible

tion. Instead, the organization continues to work with the knowledge they already possess; the means of knowledge transfer and protection remain unchanged. In addition, because we are only interested in organizations that have a need for change, continued sole reliance on existing resources without any reconfiguration provides little value to the organization or to competitors who might be interested in imitating successful organizations. Competitors would be unlikely to attempt imitation of organizations that are performing activities of little value [37]. Therefore, a negligible focus on all three of the knowledge management activities and on socialization and externalization is appropriate to this strategy.

## 8. Managerial and research implications

Although we have specified the degree of emphasis commonly placed on knowledge creation, transfer, and protection under various types of change strategies (and varying degrees of tacitness), recognizing the degree of tacitness of the organization's knowledge is still a difficult endeavor. Managers are usually not aware of all the intangible knowledge possessed by their organizations [33]. Continuous

effort by managers to recognize the tacit character of the knowledge is necessary so that educated decisions concerning how much emphasis to place on creation, transfer, and protection can be made. Typically, managers have had to rely on their intuition to judge the degree of tacitness of knowledge resources. Recently, however, new metrics have been developed to give managers a clearer picture of the status of their knowledge resources. Sveiby [41] and Edvinsson and Malone [16] have identified measures such as competence-enhancing customers, value added per professional, and age structure as the means of determining the level and growth of knowledge in the organization. Although these measures are merely indicators of the knowledge and not a representation of the actual knowledge, they do assist managers in gauging the types of knowledge in the organization.

Empirical investigation of the relationships among change strategies, knowledge management strategies, and sustainable competitive advantage is currently feasible except for, perhaps, the measurement of organizational-level tacit knowledge. Researchers can categorize organizations undergoing change into the four change strategies by either objective or subjective means. The degree of organizational reliance on existing versus new resources can be ascertained from top managers, company records such as min-

utes from strategic meetings, or from public announcements. If this approach is taken, guidelines will have to be established as to what percentage of resources constitutes a primary reliance on new or existing resources. Although this appears to be a theoretical question, the percentage could vary by industry.

Knowledge management strategies can be identified in a similar fashion as change strategies. The same methods can be used for categorizing the strategies and establishing guidelines for categorization by industry as is used for determining change strategies.

Empirical investigation of tacit knowledge within organizations, however, has been thwarted by a lack of tools to measure this elusive construct. Fortunately, advances are being made in the measurement of organizational-level tacit knowledge that will enable researchers to determine the degree of tacit knowledge present in various organizational resources. Two promising avenues of measuring organization level tacit knowledge have appeared recently. Both of these approaches rely on characteristics central to the nature of tacit knowledge.

The first measurement approach is an in-depth process that uses a lack of initial cognitive awareness of strategically important resources by top managers as an indicator of potentially tacit resources [1]. As demonstrated in the cognitive psychology literature, individuals are typically unaware of the tacit knowledge they possess [39]. In this approach, researchers map manager-determined causal relationships within a firm that pertain to the firm's ability to gain competitive advantage. The relationships that are difficult for managers to ascertain are considered to be relatively tacit because of the lack of conscious awareness managers have about these relationships. As a result of engaging in this approach, managers become more aware of their firm's potential sources of tacit knowledge.

The second approach for measuring tacit knowledge is concerned with the invariance among top managers as to the strategic importance they place on various resources [7]. Where there is invariance, or agreement, as to the degree of importance of a resource, there is more tacit knowledge present than when managers disagree. Disagreement is considered to stem from new and changing conditions that

require conscious reanalysis of the situation, thereby reducing reliance on existing tacit knowledge. Invariance has also been established as a characteristic of tacit knowledge according to cognitive psychology studies [39,40]. The invariance approach enables researchers to use surveys to investigate large samples of firms. While the two tacit knowledge measurement approaches are fairly new and unproven, attempts can now be made to more thoroughly test the relationships among change strategies, knowledge management strategies, and sustainable competitive advantage.

## 9. Conclusion

We have explored the importance of matching IT efforts with strategic change efforts in organizations. Specifically, we have described the relationship between change strategies and knowledge management strategies, and have assessed the degree of fit between IT and the various types of strategic change and knowledge management strategies. We have described how certain uses of IT may be more common for certain types of strategic change and knowledge management strategies than others, and the conditions under which a given IT use would most likely be used. Added costs, lack of adequate knowledge creation and transfer, and imitation of knowledge by competitors can all occur when IT efforts are not appropriately coordinated with strategic change activities, taking into account the issues surrounding knowledge management. Finally, we have identified the means to which future empirical research can be designed to investigate the relationships among change strategies, knowledge management strategies, and sustainable competitive advantage.

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