



A framework for evaluating economics of knowledge management systems

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Abstract

Organizations are implementing knowledge management (KM) systems with the assumption that the result will be an increase in organizational effectiveness, efficiency, and competitiveness. Implementing KM systems, however, may be a problem to organizations: too much or too little effort might lead to unwanted outcomes. This paper shows how the introduction of KM systems, which lead to knowledge-sharing, has a negative as well as a positive effect. Important variables from economic perspectives are identified and presented as an integrated framework to illustrate their interrelationships. This paper also explains the implications of an integrated framework for knowledge flow in organizations.

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1. Introduction

A primary objective of knowledge management (KM) research and practice is to facilitate effective and efficient knowledge-sharing among organizational members [24,30,81]. Companies across all sectors recognize that effective KM plays a critical role in their future success. Few organizations, however, have tackled KM as effectively as they should. Parlbay [87] found that many organizations still face serious problems in managing knowledge, such as: the difficulty of capturing tacit knowledge, lack of KM policies, lack of methods for mapping knowledge, and knowledge overload (the collection of overwhelming quantities of knowledge for its own sake). However, O'Dell

and Grayson [84] claim that some organizations have realized the benefits of their KM systems, as summarized in Table 1.

The question then arises: why do some organizations reap the benefits of KM systems while other organizations do not? There may be many causes. One is the fragmented approaches to KM that have been adopted in many organizations. Some examples are summarized in Table 2.

These approaches may be classified into two types: soft and hard. The *soft* approach has mainly investigated the role of tacit knowledge and the difficulties in sharing it between people. Although, through this approach many helpful insights into the process have been developed, it also has some limitations in achieving its ultimate goal of knowledge-sharing. One is the implicit assumption that there is an effective physical infrastructure for knowledge-sharing that addresses

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Table 1
Potential gains of knowledge-sharing

Company	Potential gains
Buckman Laboratories	Transfer of knowledge and best practices system helped push new product-related revenues up 10 percentage points, a 50% increase since 1992
Texas Instruments	TI generated US\$ 1.5 billion in annual free wafer fabrication capacity by comparing and transferring best practices among its existing 13 fabrication plants
Dow Chemical	Early efforts to manage intellectual capital brought an immediate kickback in the form of US\$ 40 million in savings
Chevron	Chevron's network of 100 people who share ideas on energy-use management has generated an initial US\$ 150 million savings in Chevron's annual power and fuel expense by sharing and implementing ideas to reduce company-wide energy costs
Kaiser Permanente	Benchmarking of internal best practices helped drastically cut the time it took to open a new Woman's Health Clinic and it opened smoothly, with no costly start-up problems

the temporal (e.g., time zones) and spatial (e.g., geographical) characteristics of organizations.

The *hard* approach has focused on developing tools for storage and distribution of explicit knowledge. Some information technologies, such as video conferencing, can support KM in a geographically distributed organization, but there have been some doubt about their performance. Many researchers (e.g., [12,29,30,113]) have found that virtual face-to-face interaction through such technologies as video conferencing does not lead to effective knowledge-sharing for reasons such as contextual ignorance or limited cognitive capability. One questionable assumption of the hard approach is that making information available will automatically make people more knowledgeable. Although many organizations are attempting to exploit technologies, for example, by building an intranet, there is still no concrete way to validate the argument. An organization may allege that more than half of its employees access their intranet but the questions that then need to be answered include: 'How many read the contents?' and 'How many understand the

contents?' Other questions of significance are 'How eagerly do employees put their own knowledge on the intranet?' and 'How much valuable knowledge is on the intranet?'

So, these two approaches have their own merits: the importance of tacitness of knowledge from the soft approach and the importance of hardware infrastructure from the hard approach. However, two approaches do not provide organizations with a comprehensive framework illustrating barriers to and enablers for successful KM practices. As organizations are aware of barriers and enablers for successful KM practices, there may be opportunities for them to reap the benefits when implementing new or re-examining current KM systems.

2. Analyses of knowledge-sharing from an economic perspective

Although there is not a universally accepted definition of knowledge and KM, many organizations are

Table 2
KM approaches

Approaches	Main focus
Technological	Enhancing KM quality by supplying tools for effective storage and distribution of knowledge
Intellectual asset	Enhancing KM quality by valuing knowledge assets in financial terms and reflecting them in accounting practices
Organizational learning	Facilitating knowledge creation and sharing by developing positive work environment or effective reward systems
Process	Enhancing KM quality by identifying key processes on which important knowledge flows, and managing them formally
Philosophical	Gaining a higher understanding of knowledge lead by asking questions such as 'do we know what we do not know' towards development of new ways of thinking

eager to implement KM systems. Organizations are implementing them with the assumption that the result will be increased organizational effectiveness, efficiency, and competitiveness [51,109]. Many claim that knowledge is the most important source of competitive advantage and sustained superior organizational performance [36,52,111]; however, the link between KM and organizational competitive advantage is tenuous.

Thompson et al. [118] find that KM does not provide the expected effect in the interactive service sector that involves face-to-face or voice-to-voice interaction with customers. In interaction service work, the employees, and the way they look, sound, and act, are themselves part of the product, unlike manufacturing work in which employees produce products for sale in the marketplace. Thompson et al. found that, in call centers, the emphasis was almost exclusively on the quality of vocal communication—the energy and enthusiasm of the call center operative—that influences customer satisfaction. They argued that managerial focus is on the use of empathy to create rapport with the customer, not on product knowledge. They also found that, in retail work, the aesthetic capacities and attributes of employees, such as dress code, language, or manner are the most important factors that customers find appealing.

Recognizing that there are few empirical studies on the link between knowledge and competitive advantage, McEvily and Chakravarthy [77] investigated empirically the circumstances under which the creation and share of knowledge may contribute to improving organizational competitive advantage. In the same study, they found that when a company creates and shares knowledge, particularly technological or scientific knowledge, internally and it brings about greatly improved performance (e.g., magnetic resonance imaging [23]), the innovations often result in sustainable competitive advantage. They also find that when a company creates and shares knowledge internally, bringing about incremental improvements of products, the company's competitive advantage may not be sustained and may even decrease. If the company faces competitors who have complementary knowledge and, maybe, a better understanding of domain knowledge, the company may quickly lose its competitive advantage. This argument assumes that incremental improvement of products is based on less

distinctive knowledge than innovative improvement. If competitors have better understanding of the relationships between product components and performance outcomes than the company that creates such knowledge, the competitors can gain competitive advantage by imitation.

Although there are only a few empirical studies on the link between KM and competitive advantage, these two studies imply that KM is not a panacea for improving organizational competitive advantage. However, they also suggest that KM may improve organizational competitive position by capturing and sharing valuable knowledge in circumstances where leveraging knowledge is vital for innovative operation. Many researchers argue that knowledge should be managed in an appropriate way because: (1) while too little might lead to inefficiencies, too much might lead to rigidities preventing organizations from meeting dynamically changing market challenges [70]; (2) while too little might result in an organization's knowledge drain (e.g., departure of knowledgeable employees), too much might lead to increased uncertainty (e.g., over-budgeting in KM) [72]; (3) while too little might lead to a disorganized organizational network (e.g. we do not know what we have and what we need), too much might result in over-dependence on specific sources (e.g., excessive dependence on partner organizations or connected employees of other organizations to enlarge knowledge-base) [1] and (4) while too little might lead to repeated expensive mistakes (e.g., faulty products), too much might result in unwanted obligations (e.g., the US tobacco industry having to disclose information on health issues). Developing KM systems for sharing valuable knowledge should not be undertaken on a naïve assumption that corporate competitiveness is positively correlated with knowledge-sharing. From an economic perspective, knowledge-sharing has a negative relationship with competitiveness as well as a positive one. Looking at both aspects of knowledge-sharing, the economic perspective may provide a way to investigate how to minimize barriers and cultivate enablers in order to reap the benefits of knowledge-sharing in an organization.

Resource based theory (see [7,62,64,90]) helps to identify circumstances for obtaining benefits from knowledge-sharing. This provides a foundation for examining knowledge-production costs and expected

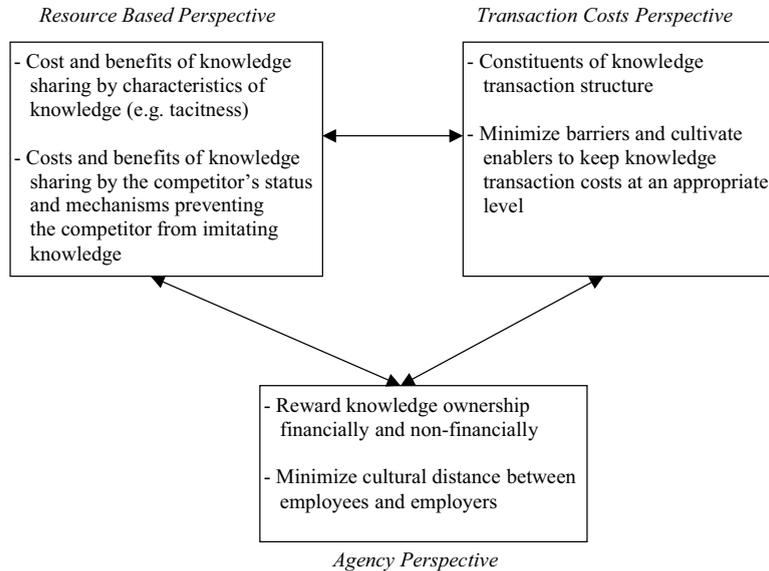


Fig. 1. Economic perspectives and concerns.

benefits in relation to the characteristics of knowledge. Here, knowledge and resources are used interchangeably. Transaction costs theory (see [126,127]) helps when studying constituents of knowledge communication structure and helps identify what factors increase knowledge-transaction costs between constituents. Agency theory (see [53]) helps to find the way to organize knowledge-sharing to reduce costs associated with the opportunistic behavior of agents. Using these economic perspectives, this study attempts to develop a framework evaluating the economics of knowledge-sharing in an organization, as shown in Fig. 1.

2.1. Resource production costs and benefits

The resource-based point of view postulates that distinctive resources of organizations lead to differences in performances and, consequently, to gaining scarcity rents [100]. Resources include, for example, patents, skilled human resources, research and development, and organizational knowledge of customers.

When organizations seek scarcity rents from knowledge-sharing they must take account of significant set-up costs, including hardware and software investments, adaptation time required for employees, and organizational restructuring/process re-engineering, if

needed. As summarized in Table 3, costs for developing KM infrastructures range from hundreds of thousands of dollars to many millions. When adaptation time of employees and other managerial costs are also taken into account, the cost total can increase considerably.

From a resource-based perspective, the object of spending substantial budgets is to generate rents from the use of idiosyncratic knowledge, which can be gained by implementing KM systems [125] to the extent that it is hard for competitors to imitate or find a substitute for the knowledge [105], and rents are retained by the company [45]. Organizations may achieve economies of scope by applying distinctive knowledge to different sorts of organizational operations by combining with other knowledge [10]. The effect, by achieving economies of scope, is more beneficial for organizational performance than the effect of achieving economies of scale, which are generated when organizations are able to apply distinctive knowledge to the same sort of organizational operations repeatedly [82]. The reason for this is the increased chance to create new knowledge when knowledge in one domain area is combined with knowledge in another. In order to apply knowledge from one domain area to another, organizations may attempt to externalize or codify it. Externalization

Table 3
Costs for knowledge management infrastructure

Company	Costs
British Petroleum [34]	Spent US\$ 12 million dollars on pilot-program in 1995 About one-third of the money was spent to help people learn how to work efficiently in this pilot program
Mitre Corp [131]	To date, Mitre has invested US\$ 7.2 million in the Mitre Information Infrastructure
Delphi Group [27]	Survey on KM implementation and perspectives shows that almost half of 575 companies expect to invest more than US\$ 500,000 into technology for knowledge management
Arthur D. Little [59]	A team of 20–30 consultants provides service Smaller engagement runs US\$ 30K to 40K. For a large corporation, service as costs as much as US\$ 10 million
Arthur Andersen [59]	Offering ‘Knowledge Management Assessment’ tool For the initial assessment, it needs US\$ 10K to 50K depending on company size After initial assessment, if the company is found to be a knowledge-hoarding company, it requires from US\$ 1–2 million for a typical complete consultancy
Ernst & Young [59]	Offering from assessment of knowledge-sharing level to setting up procedures and practices to keep improving knowledge-sharing efforts US\$ 2–3 million is typical for this service

may help organizations to share knowledge [79]. Consideration is needed to decide whether to invest in detaching knowledge from sources (e.g., an employee who has the knowledge), and to share knowledge easily by externalization because knowledge made widely available could easily be acquired by competitors who could, with the distinctive knowledge they gained, and at little cost to themselves, imitate the improvements in performance that had been gained by much effort. If this happens, scarcity rents by such knowledge decrease. To avoid this situation, organizations may operate with a high degree of tacit knowledge rather than attempting to externalize or codify it. However, in return for keeping a high degree of tacit knowledge, organizations may not achieve the desired level of economies of scope and scale because sharing such tacit knowledge needs costly methods like an apprenticeship.

The tension between the benefits and risks arising from knowledge-sharing efforts can be relaxed by the presence of factors in the organization that make resources difficult to imitate. Although a large number of factors have been identified in the literature, they can generally be broken into four major classes: characteristics of knowledge, time, company size, and legal sanction. Among these, *company size* is mainly related to capital requirements; but as regards the importance of personal or organizational creativity in KM, it may not be important. Company size is

considered briefly with respect to network economies. These classes with their implications and relevant items are summarized in Table 4.

From the perspective of knowledge classification, task type is an element to be considered. By extending the work of Van de Van and Delbecq [122], Poole [93] formulated three dimensions for task typology: availability (how obtainable and suited to its needs is the knowledge), uniformity (how stable work units accomplish their goals using the knowledge), and independence (the degree of control a work unit has over the knowledge required to complete its task). Among Poole’s dimensions, availability and uniformity are explained clearly by Ouchi’s study [86].

Ouchi’s first dimension is knowledge of the transformation process. This is the means by which inputs are transformed into outputs as a result of the operations. A large quantity of knowledge about the transformation process means that the work process is relatively easy to analyze and replicate for both the company and the competitor. According to Ouchi’s scheme, such tasks as those of clerks, assembly line workers, or pilots show considerable knowledge of the transformation process. For this kind of task, it is easier to externalize and reuse tacit knowledge, because there is low risk in knowledge-sharing and a low requirement in costs. Such tasks as those of salespersons and researchers involve less knowledge of the transformation process. For this kind of task, it

Table 4
Categories from resource-based perspective and relevant items

Class	Implications and items
Characteristics of knowledge	Characteristics of knowledge such as tacitness (inability to articulate the procedure linking inputs to outcomes [80] or inability to articulate principles affecting the level of performance [77]), intricacy (the degree to which the cause–effect links are dynamically changing [129]) and the contextual value of knowledge (the degree to which knowledge generates its values in a specific organizational or operational context [90]) not only prevent competitors from imitating distinctive knowledge, but also may slow sharing of knowledge in an organization
Items	Task type (availability of knowledge of transformation process, availability of performance measurements, independence) Causal ambiguity (link between knowledge and performance gain) Absorptive capacity (organizations' abilities to understand new external knowledge, assimilate it, and apply it to commercial ends) Complementary knowledge (experience in or existence of similar business infrastructure) Industry type (whether knowledge accumulation and creation is a function of market share)
Time	Organizations' dynamic capabilities, created by temporal factors, may sustain knowledge heterogeneity and, thus, prevent competitors from imitating distinctive knowledge
Items	Path dependency (the degree to which distinctive knowledge obtained at an earlier point in time affects the possible outcomes of a sequence of events occurring at a later point in time) Time compression diseconomies (an organization cannot possibly accumulate the same stock of knowledge, e.g., about managing outsourcing, in 1 year as in two, even if all other inputs are doubled, if it is learning from experience that is required) Inertia (management's abilities for strategic variety)
Legal sanction	The possession of legal control (e.g., restrictive rules or compensation) over specific knowledge not only prevents competitors from imitating knowledge but also may bring substantial managerial costs and slow sharing of knowledge in an organization
Items	Restrictive rules (limiting access to codified knowledge by confidential level) Structural isolation (limiting access to codified knowledge by job classification) Compensation (financial incentives like bonuses or share option)

is harder to externalize and reuse tacit knowledge because they are attended by high risk and high cost. The other dimension is the availability of performance measures to justify set-up costs for KM infrastructures. For this purpose, tasks are classified in a different way. With tasks such as those undertaken by salespeople, clerks, or assembly line workers it is easy to measure performance; for those undertaken by pilots or researchers it is difficult to measure performance and, thus, difficult to justify set-up costs for KM infrastructures.

Considering these three dimensions (knowledge of transformation process, availability of performance measures, independence), it is arguable that the risk involved with knowledge-sharing can be avoided if the efforts focus on those tasks that involve much knowledge of the transformation process, high availability of performance measures, and low independence. That is, the level of risk incurred when an organization launches knowledge-sharing efforts for a task is posi-

tively correlated with the level of independence required to carry out the task, and negatively correlated with the level of transformation process knowledge required to carry out the task and with the availability of performance measures for the task.

As regards the benefits of knowledge-sharing, however, knowledge-sharing efforts should focus on the tasks with a high level of independence, low level of transformation process knowledge, and high level of performance measure, as benefits of knowledge-sharing would come from the speedier and more inexpensive replication and reuse of valuable and scarce knowledge.

From a knowledge-class perspective, the relationship between risks and benefits of knowledge-sharing may be relaxed in the case where there is an information asymmetry compared with competitors, such as that brought about by causal ambiguity. This factor, which is ambiguity about the link between organizational resources and sustained competitive advantage,

protects resources from competitive imitation [98], since “when the links between a firm’s resources and its sustained competitive advantage are poorly understood, it is difficult for firms that are attempting to duplicate a successful firm’s strategies through imitation of its resources to know which resources it should imitate”. Secondly, when competitors lack both absorptive capacity [19] and institutionalization of new knowledge applications [115], the risk of knowledge-sharing can be reduced. This may be summarized by the remark ‘we know what to do, but we don’t know how to do it’. The relationship can be further relaxed where competitors have no complementary assets such as similar business infrastructure. Another factor may arise from the economies of scale and degree of richness of a market. Where the rate of knowledge accumulation and creation is a function of market share, such as in the telecommunications industry, the costs of obtaining useful business knowledge can reduce significantly as the organization increases in size and penetration.

From the time-class perspective, an organization’s dynamic capabilities created by temporal factors in the determination of ‘resource heterogeneity can also relax the tension between the risk and benefit of knowledge-sharing [108,117]. The literature has identified three ways this can occur: path dependency, time compression diseconomies, and inertia. Path dependency [107] can protect the competitive advantage of the organization from quick erosion; as Teece et al argue: “Thus, not only do firms in the same industry face ‘menus’ with different costs associated with particular technological choices, they also are looking at menus containing different choices”. This phenomenon is evident where early entrants into an industry show superior performance to late entrants [42,94]. Time compression diseconomies [32] may prevent competitors from replicating scarce resources of other companies. This argument is based on the proposition that increasing inputs to create an asset does not lead to the target level of accumulation of asset in a proportionately reduced time. However, if, as with much equipment, knowledge becomes obsolete during a period of time, it is very difficult for an organization to sustain knowledge asymmetries. To avoid this kind of matter, organizations need to invest maintenance expenditure to keep knowledge working effectively.

Many researchers (e.g., [95]) argue that the ability of top management to respond to innovation is the key determinant in realizing rents, although there is much evidence that the above factors hinder imitation. Prahalad and Bettis argue that the top management’s cognitive ability to understand strategic variety is a significant factor affecting opportunities for competitors to imitate resources. Such an ability is constrained by five kinds of friction: distorted perception, dulled motivation, failed creative response, political deadlock, and action disconnectedness [104].

Finally, from the legal sanction perspective, the risk arising from knowledge-sharing may be decreased by possession of legal control over certain knowledge. Liebeskind [74] suggests restrictive rules (limiting access to codified knowledge by confidential level), structural isolation (limiting access to codified knowledge by job classification), and compensation (bonuses or share options), as legal sanctions. These mechanisms may protect knowledge to some extent; however, they are costly to implement. Moreover, they may also decrease benefits of knowledge-sharing as they may limit the wide dissemination of knowledge between employees. On the basis of the assessment of costs required for these mechanisms, the organization can decide whether to stay at a high degree of tacit knowledge and reduce the risk of knowledge-sharing, or to accept the advantage of widely spread knowledge by specific knowledge-sharing efforts and admit related risk.

2.2. *Transaction costs*

Davenport and Prusak argue that the price mechanism in a market may effectively coordinate knowledge exchange between buyers and sellers. Nonaka [83] argues that the middle manager should coordinate knowledge exchange because they are located at the intersection of the vertical and horizontal flows of knowledge in an organization. Occupying this position, they are “the true knowledge engineers of the knowledge-creating organization”. This implies that knowledge does not flow freely in organizations and that invention of an appropriate mechanism is required for effective knowledge-sharing.

Transaction costs theory has explained vertical integration by means of institutional comparison. Williamson acknowledges that, to some extent, inter-

nal transaction costs are not fully explained in transaction costs theory. From the KM perspective, internal transaction costs are those associated with searching, storing, distributing, and applying knowledge. Searching costs are those associated with finding useful knowledge for given tasks. Storing costs are those associated with individuals adding their knowledge to organizational knowledge-base. Distributing costs are associated with the activity by which individuals transfer their knowledge to others. Applying costs are costs associated with the activity by which knowledge, once found, is put to use in actually carrying out the task.

Implementing KM infrastructures requires substantial financial and non-financial investment. The KM infrastructure is a medium facilitating knowledge-sharing in organizations. That is, the KM infrastructure supports knowledge-transactions, but it does not, itself, provide an effective knowledge-transaction process that influences the ease of searching, storing, distributing, and applying knowledge. Implementing an effective knowledge-transaction process lowers internal knowledge-transaction costs. To minimize internal transaction costs, organizations should identify factors that keep such costs high. By removing obstacles of this kind organizations can realize greater benefits from knowledge-sharing.

Knowledge exchange in an organization is fundamentally driven by structural communication processes. Communication can be defined as the use, adaptation and creation of languages, symbols and signs to conduct activities that satisfy human needs and wants [99]. Communication serves as a means of control and coordination of both people and resources. Through it individuals are able to adjust and react to the dynamic flow of knowledge, ultimately providing for organizational survival through adaptive learning. Indeed, communication may be viewed as the social glue that ties members, subunits, and organizations together [97]. Structural communication processes refer to naturally evolving patterns of communication through which information flows in the organization [58]. Therefore, analyzing communication processes may reveal items that should be considered from a transaction costs perspective.

Analyzing communication processes, Krone et al. [65] observe that all communication systems consist of a sender (source), a message, a receiver, a channel

and coding/decoding schemes. Some researchers (e.g., [71,123]) suggest that knowledge-sharing is probably influenced by four factors: knowledge transferred, source, recipient, and the context in which knowledge-sharing takes place. On the other hand, some researchers exclusively emphasize the characteristics of the knowledge transferred as the most influential factor (e.g., [128,132]), or the context (e.g., [3]). However, Von Hippel and Szulanski's studies indicate that all four factors relate to knowledge-sharing, although to varying degrees of statistical importance. Thus, this study adopts all four factors as a framework to find barriers which prevent effective knowledge-sharing.

Barriers to knowledge-sharing are summarized in Table 5.

These barriers prevent individuals from understanding what knowledge is needed and selecting and adapting knowledge to a given situation. Many researchers have noted the difficulties of knowledge-sharing under conditions of weak co-location [2]. This involves the sharing of a working place. In a co-location environment, individuals meet each other relatively easily and enjoy face-to-face communication, which enables frequent response to actions. As a result, individuals can understand each other's actions and the background relatively easily. By sharing context and working place, individuals may develop common language (verbal and non-verbal) and achieve high levels of understanding [15,33]. Then, individuals may enjoy relatively less immobility of knowledge-based resources [114].

Some organizations have developed a virtual place (e.g. Anderson Consulting's Knowledge Xchange[®]) which builds global electronic communities. The object of this effort is to simulate a co-location environment by developing effective systems for the storage and transfer of knowledge over geographically dispersed branches. However, this kind of effort may not achieve the object due to attributes of knowledge, such as "tacitness" and contextual value. By developing communication channels, organizations assume that individuals understand transferred knowledge well enough to make decisions based on it. Knowledge, specifically tacit knowledge, resides inside the individual or organizational units. Thus, what flows is representation of knowledge. Knowledge recipients try to interpret knowledge in their contexts. Thus,

Table 5
Barriers preventing effective knowledge-sharing

Entity	Barriers preventing effective knowledge-sharing
Source	Fear for loss of hegemony [115,123] Lack of up-to-date knowledge [31] Lack of commitment, or negligence [57,71]
Context	Weaker co-location [2,35,63] Unfriendly relationships between source and recipient [43,83] Limitations in individuals' network of knowledge or doubt about the network [54,102] Cultural incompatibility [66] Knowledge diversity due to lack of common experience or to environment [88]
Knowledge transferred	Limitation in interpretative ability [33] Immobility (tacitness) of knowledge [45,114] Causal ambiguity [92,115]
Recipient	Limited knowledge-processing capacity [19,32,116] No information on knowledge existence or limitations in pre-existing knowledge [19,57] 'Not invented here' syndrome [56,71] Limitations in the capacity to institutionalize new knowledge application [71,115]

there is no guarantee that recipients' and senders' interpretations of knowledge are the same [14]. To maximize the extent to which the context attached to transferred knowledge is understood, a formal methodology should be developed. This should facilitate the matching of knowledge with recipient requirements, thus increasing the probability of correct interpretation. One possible direction for methodology development is to investigate how to break down complex knowledge requirements and map causal relationships among the resultant components. Individuals' abilities to be aware of what knowledge is needed may be improved by building a tool that locates domains of knowledge and traces utility of knowledge to given problems.

Barriers to understanding prevent individuals from filtering out valuable from less valuable knowledge. Sharing all knowledge between all individuals would be inefficient, not to say impossible. Even if the exact knowledge required is transferred to the recipient there are still numerous potential barriers to the recipient's correct interpretation. Cognitive psychologists have concluded that the amount of information processed by humans under varying information-processing loads actually follows an inverted U-shaped curve [116]. As noted in many decision-making studies, decision-makers often face the trade-offs between quality knowledge and accessible knowledge. When there is time pressure, the decision-makers tend to

accept lower quality knowledge that is more accessible [119]. One of the goals of KM in an organization would be to provide rapid access to quality knowledge.

Barriers also prevent organizations from implementing a favorable culture in which individuals are motivated to share their knowledge and to absorb any knowledge received. Knowledge is produced via an iterative process of idea generation, brought about by continuous investment in innovation, and idea validation through experiential tests of proof. Because such investment and tests are costly the resultant valuable knowledge is unlikely to be shared. Liebeskind [73] argues that Ricardian rents in the modern world can be generated from knowledge because organizations or individuals with superior knowledge can produce unique or better products. Due to the rents generated by knowledge, the implementation of a favorable culture for knowledge-sharing is important. Simonin [110] also finds that a favorable culture for knowledge-sharing contributes to minimizing ambiguity of context and transferred knowledge and to facilitating the flow of knowledge between source and recipient.

2.3. Agency costs

The cultural aspect of knowledge-sharing from the transaction costs perspective overlaps with the cultural

aspect of the agency costs perspective. While the transaction costs perspective focuses on costs associated with all four components—source, context, knowledge transferred, and recipient—of knowledge-transaction structure, agency perspectives focus more on employees' opportunistic behavior.

When one party (the principal; the company) delegates work to another (the agent; the employee), the welfare of the principal is affected by the decision of the self-interested agent [8]. Agency theory (e.g., [55,60]) deals with the relationship developed in this situation. When the principal and the agent have incongruent goals and different risk preferences (e.g., regarding the implementation of information systems for automation) between them, an agency problem arises.

It is not easy to coordinate the gap between the principal and the agent, because the agent's goal is not only improving financial welfare (e.g., income) but also improving non-financial terms (e.g., satisfaction), while the principal focuses usually on financial welfare [130]. Different risk preferences between the principal and the agent also deepen the agent problem. Eisenhardt [37] argues that the agents take a risk-averse decision, because they cannot diversify their employment, while the principal may take a proactive action in a risk-related decision, because he or she is able to diversify the investment across various assets or organizations.

When the principal knows what the agent is doing and has done, the principal may limit the problems by making a contract based on the agent's behavior [38]. By doing this, the principal may transfer risks to the agent. However, when the principal does not know what the agent is doing and has done, it is difficult to make a contract that makes the performance of the self-interested agent predictable. In this situation the principal may have two choices [28]: (1) constantly monitoring the agent's behavior or (2) making a contract based on the probable outcomes of the agent's behavior.

The first choice involves significant cost. In addition, in complicated situations where the job consists of tasks that are difficult to structure or where incumbents direct their own work, such as executives [120] or salespeople, it is difficult to monitor the agent's behavior, especially as the agent tends to have a higher level of managerial discretion or more specialized

knowledge about the tasks than does the principal [96]. In these circumstances the agent may engage in self-serving behavior, such as using work time or organizational resources for personal gain [44]. The more independence the agent enjoys and the greater the specialized knowledge required to perform the task, the more significant 'moral hazard' becomes [54]. Another problem of the agents owning specialized knowledge is that they may feel apprehensive about the risk of being redundant once that knowledge is codified and shared [91]. Thus, the agent tends not to share specialized knowledge.

The second choice of making a contract may govern the relationship between the principal and the agent: however, they are rarely adequate [16,49]. Grossman and Hart [46] argue that employment contracts in the real world are usually 'incomplete' as there are always some unforeseen contingencies that are often too expensive to enumerate. Thus, an organization can create only quasi-property rights to govern knowledge of employees, and the right to sell is a particular problem. Because knowledge, in particular tacit knowledge, resides in the individual and is difficult to protect legally, an individual always has a latent incentive to reject knowledge-sharing and to sell knowledge by leaving an organization.

Both monitoring and contract involve unavoidable agency costs that reduce the benefit potentially gained by knowledge-sharing. Recently, motivating individuals to share knowledge by pecuniary compensation has become important as another choice [48,75].

Traditional behavioral theories of motivation have discussed extensively how pecuniary compensation motivates individuals to show expected behavior [68]. However, empirical evidence on the motivational effect of compensation is inconclusive. While some researchers have found supportive evidence [4,22,50], others have failed [61,76,101]. Balkin and Gomez-Mejia [5] indicate that inconclusive findings come from ignoring contingencies that are likely to affect the motivational role of compensation. Some researchers (e.g., [85,121]) indicate the importance of the social-psychological processes of agents in obtaining the effect of compensation. Gomez-Mejia and Balkin also argue that one of the important factors to be considered is cultural distance: that is, the degree to which there are differences in cultural

Table 6
Causes and methods in agency costs

Causes	
Incongruent goals	The agent's goal is not only improving financial welfare (e.g., income), but also improving non-financial terms (e.g., satisfaction) while the principal focuses usually on financial welfare
Different risk preferences	The agent tends to be risk-averse while the principal tends to be risk-neutral
Methods to minimize agency problems	
Monitoring the agent's behavior	Monitoring requires significant costs. In a complicated situation where the agent has an unstructured job or enjoys managerial direction, it is difficult to monitor. Moreover, when the agent has a more specialized knowledge than the principal, it is quite difficult
Contract based on the agent's behavior or outcome	In the real world, employment contracts are almost always incomplete. In particular, knowledge residing in an individual cannot be protected legally
Motivation	Traditional behavioral theories of motivation have focused on pecuniary compensation; however, the effect is inconclusive. To gain the expected effect, it needs to consider social-psychological process of the agent and the cultural distance between the principal and the agent
Alternative methods	Case for corporate spirit, inspirational leadership intrinsic motivation, peer recognition, empowerment

characteristics between the principal and the agent. These debates imply that it is imperative for the principal to implement a favorable culture for knowledge-sharing as well as developing good reward mechanisms.

To create favorable circumstances for knowledge-sharing, a variety of methods have been suggested, such as inspirational leadership [9], care (to enhance corporate spirit) [20], peer recognition, intrinsic motivation [25], and empowerment [13,69]. These methods aim to compensate the agent for undertaking risk and for their knowledge. Table 6 summarizes the cause of the agency problem and methods to minimize it. Researches in agency theory have identified many factors to be considered when the principal develops compensation strategies including: (1) the characteristics of the organization (e.g., the extent and process of diversification, organizational size or life-cycle stage) [39,41,78]; (2) the characteristics of industries (e.g., technological focus and variation in product demand) [41]; (3) strategic and operational roles of the agent (e.g., if the agent is a single part of a worldwide system or has a worldwide responsibility for a complete set of value-adding activities [in this situation, knowledge-holding by the agent is increased]) [103]; (4) bargaining power (e.g., the extent to which the agent resists the principal's policy) [18] and (5) information technology efficiency (e.g., the extent to which an agent feels the need for new business processes or methodologies for KM) [6].

3. An integrated framework

So far, KM efforts have been analyzed from three economic perspectives. Unifying these perspectives creates an integrated framework composed of the major subsections of: resource characteristics, knowledge-transaction structure, and organizational culture. Employee's attitudes or behavior regarding knowledge-sharing is expressed by organizational culture, which is recognized as an ordering characteristic as it is reflected in the employees' attributes and takes into account their work, and organizational policies and practices implemented [106]. Resource characteristics explain variables varying from knowledge characterized according to task types to possible legal sanctions. When the use of knowledge achieves economies of scale and scope, then rents accrue from the knowledge increase and these can justify substantial costs in setting up the knowledge-sharing infrastructure. However, economies of scale and scope can be decreased by the presence of competitors with KM abilities, such as absorptive capacity, by the attitude of top management, and by the existence of complementary assets. On the other hand, this risk in knowledge-sharing can also be decreased by the company's ability to retain resource heterogeneity by protective mechanisms, path dependency, and time compression diseconomies.

Efficiency of the knowledge-transaction structure depends on how effectively an organization administers knowledge communication, i.e., how well it

removes barriers that increase the internal transaction costs involving the knowledge communication entities, knowledge transferred, source, recipient, and context. The final component is organizational culture, whose importance has been recognized by many researchers: for example managerial actions and norms [26], atmosphere and collective spirit, abuse of organizational power [89], and care [124]. A favorable culture for knowledge-sharing facilitates socialization that helps individuals to become members of a community of practice.

These three subsections are interrelated. The extent to which an organization makes an effort to implement effective knowledge-transaction structures is influenced by target tasks and resource characteristics. If most tasks need high levels of expertise, then it needs more effort to implement effective knowledge-transaction structures and at the same time it may bring a high risk of knowledge-sharing with competitors. This risk can be reduced if an organization has a high level of resource heterogeneity. This implies that the effort to implement knowledge-transaction structures is affected by competitors' status. Protective mechanisms increase internal transaction costs and thus affect the effort to remove barriers for an effective knowledge-transaction structure. Thus, based on consideration of the organizational environment and knowledge, an organization decides the extent of its knowledge-sharing efforts. This then affects the extent to which a knowledge-transaction structure is implemented. Knowledge ownership has an influence on knowledge-transaction structures as employees perceive the risk of being made redundant and also affects the costs of protective mechanisms. The relationships between these three economic perspectives are shown in Fig. 2.

The three economic perspectives have implications for the process of knowing in organizations. This concept has been developed due to the limits of the previous approaches to the understanding of knowledge. In one such approach (for example, hierarchical differentiation among data, information, and knowledge), knowledge is regarded as universally held beliefs or individual representations of truth. Here, the primary goal is to systematically capture and store such knowledge and it can be described as a codification strategy [47]. Although this approach is well-founded in academic analysis and definition, it has a

weakness in that it is unable to explain knowledge in the context of its flow in organizations.

In the approach of the process of knowing, knowledge is contextualized and remains a social construct. This is a collective and dynamic conception of knowledge [17] where the emphasis is on ways to encourage or guide a social communication process in which certain knowledge or technological know-how develops [67]. Nonaka posits the notion that knowledge is created by the interaction between tacit and explicit knowledge. Tacit knowledge resides in the individual's experience and action. Explicit knowledge is codified and communicated in symbolic form or language. For example, once explicit knowledge is received, the individual tests it against his or her experience or understanding of its context. In doing this, the individual integrates explicit knowledge into his or her own knowledge pool and thus the tacit knowledge grows. In the *process of knowing* approach, individual knowledge is developed in response to the social system in which the individual is engaged [21] and this subsequently becomes a collective knowledge of the social system through interactions between the individual and that system. Social systems are viewed as interpretation systems.

In the process of knowing approach, some researchers (e.g., [11,40,112]) suggest a matrix of knowledge based on such criteria as tacit, explicit, individual (created by and resides in an individual), and social (created by and resides in social interaction) knowledge. For example, Spender suggests four types of knowledge in the process of knowing: automatic (instinctive skills or techniques of individual); conscious (syntax of individual speech or individually recognized knowledge); collective (tacit knowledge of social system or corporate culture); objectified (explicit knowledge of social system or operation manual). He argues that automatic-type knowledge can be transformed into objectified knowledge through an organizational process, though sources of objectified knowledge are primarily individuals. In other words, automatic-type knowledge gains a meaning and status through organizational process, principally made up of "the interaction between the individual's conscious activity and the collective's institutionalized practices". This implies that in the process of knowing the boundary between conscious- and collective-type knowledge is both porous and flexible. Based on these,

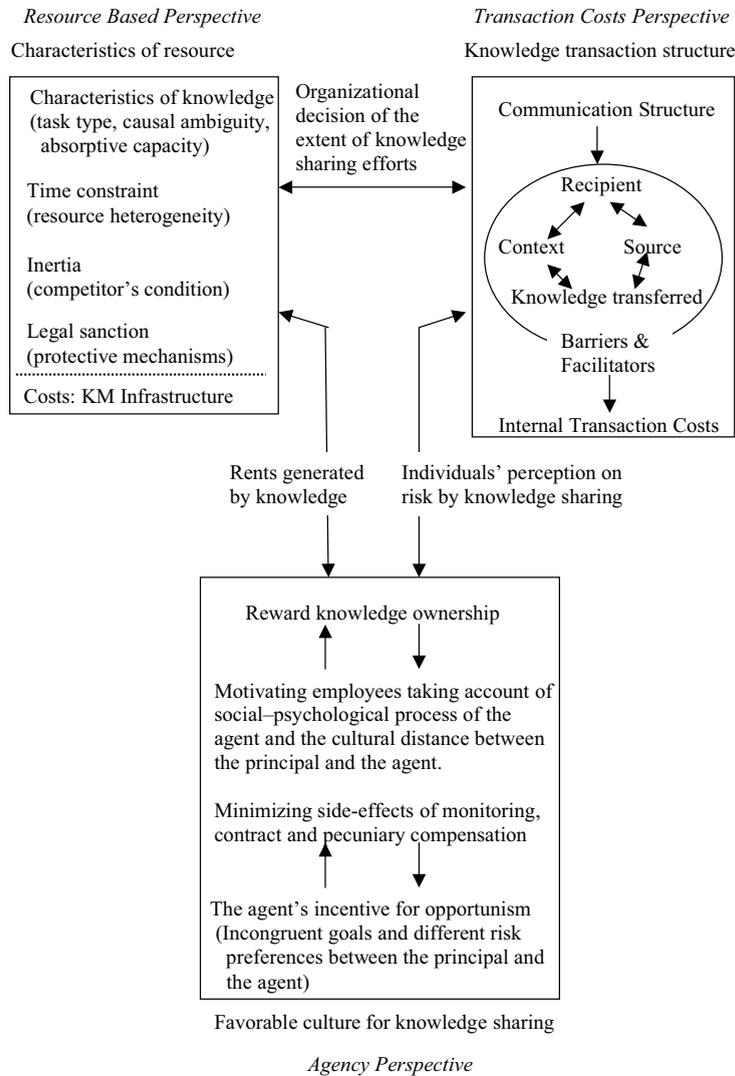
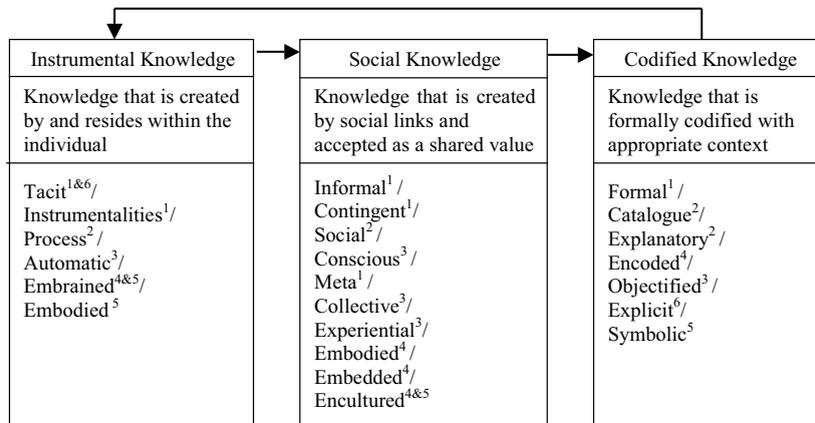


Fig. 2. An integrated framework of three economic perspectives.

three types of knowledge in the process of knowing can be developed by integrating relevant researchers' taxonomies, as shown in Fig. 3: instrumental knowledge (automatic-type knowledge), social knowledge (conscious- and collective-type knowledge) and codified knowledge (objectified knowledge). Here, social knowledge is created by and inherent in inter-individual/group communication.

Instrumental knowledge is rooted in personal experience and skills. Personal cognitive abilities and relations have an influence over how quickly

and how substantially appropriate knowledge is built to solve a problem. Social knowledge includes operational routines and practices that are accepted as justified knowledge and this can be transferred through working in a particular context. Codified knowledge is 'information-like'. When the context information appropriate to an item of social knowledge is evaluated to solve a problem and its value for problem-solving measured, social knowledge becomes codified. This kind of knowledge is then readily applied to decisions or to other actions.



1: [40], 2: [79], 3: [112], 4: [11], 5: [20], 6: [92]

Fig. 3. Classification of knowledge in the process of knowing.

The ultimate goal of KM is to facilitate the virtuous circle of the process of knowing from instrumental knowledge to codified knowledge. The three economic perspectives may contribute to obtaining the ultimate goal of KM, as shown in Fig. 4.

To facilitate the process of transforming instrumental knowledge into social knowledge, organizations need to focus on factors from an agency perspective. By managing employees' unwanted behavior for knowledge-sharing, organizations may facilitate employees' participation in the organizational process of knowing. Factors from a transaction cost perspective, in particular, contribute to developing social knowledge as they are related to how individuals can be helped to become aware of what knowledge

is needed and then adapt it to a given problem. Factors from a resource-based perspective affect organizational decisions when developing codified knowledge and storing it on databases or in documents.

4. Conclusions and discussion

KM research and practice is exploring the development and use of tools to facilitate creation, distribution, and application of individual and collective knowledge. This paper identifies important variables and relationships from the point of view of economics, KM, and organizational learning and presents those them in a framework for integrating the three economic perspectives. It also identifies relationships between the perspectives and their implications for the process of knowing in organizations.

The main argument concerns how knowledge-sharing initiatives are related with value creation. First, by extending the result of prior research on the trade-off between replication and imitation [63], this paper explains when knowledge should be shared to create rents. Second, by identifying barriers that prevent effective knowledge-sharing between knowledge-transaction entities, the important issues that must be resolved for there to be a fluent flow of knowledge in organizations are presented. Third, this paper shows the importance of the balance between organizational investments into human resources and increased

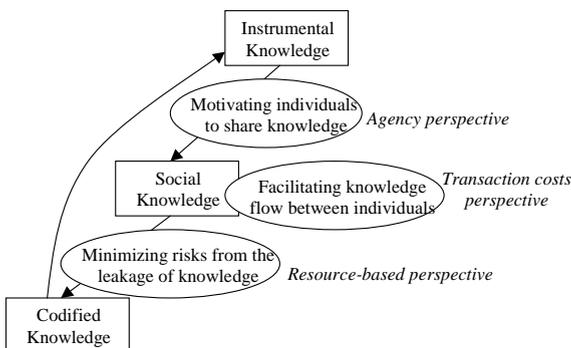


Fig. 4. The process of knowing and contributions of the three economic perspectives.

knowledge ownership and argues that consideration should be given as to how to implement a favorable culture for knowledge-sharing. Ignoring this last consideration may cause knowledge-sharing efforts to fail, even if all other economic benefits are available.

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