

## A FRAMEWORK FOR ASSESSING THE IMPACT OF KNOWLEDGE ON FIRM PERFORMANCE

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### ABSTRACT

Economists have argued that economic growth comes from sourcing and applying superior knowledge, implying that competitive advantage comes primarily from what the firm knows, not from what it owns or makes. Although it makes sense to expect that firms that know more than their competitors would enjoy a competitive advantage, no research of which we are aware has examined the entire *knowledge* → *competitive advantage* → *performance* link at the level of the individual firm in a systematic way. This paper introduces a conceptual framework for studying the extent to which different sources and types of knowledge are significant factors of firm-level business performance. We develop several propositions from that framework addressing the influence of knowledge source on three strategic characteristics of knowledge (viz., uniqueness, immobility and value); the influence of those knowledge characteristics on the strategic value of that knowledge; and the relationship between strategic value and firm performance.

### 1 INTRODUCTION

In contrast to traditional management principles that economic growth results from ownership of superior land, labour and capital, some economists have argued that economic growth comes from acquiring and applying superior knowledge (Romer 1992, Teece 1998). The underlying premise is that firms need to know something before they can produce something. Most firms have access to similar traditional resources such as buildings, equipment, energy or raw materials. What differentiates them is what they know about how to arrange those existing resources in novel ways to more efficiently and effectively produce better products and services (Romer 1992, Penrose 1959). The more a firm knows about using a particular class of resources, the greater value it will see in those resources and the better chance it has of realizing above normal returns on those resources (Barney 1986). Therefore competitive advantage comes primarily from what the firm *knows*, not from what it *owns or makes* (Zack 1999).

Taking knowledge, rather than tangible resources, as the platform from which all products, services, and competitive activities derive (Kogut and Kulatilaka 1994, Zack 1999); strategy becomes a matter of choosing and defending *knowledge* positions, not product-market positions (Zack 2005). For example, even though food processing companies and

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pharmaceutical companies are considered to be in different industries based on product (SIC codes), the knowledge they hold is not significantly different based on patents held (Patel and Pavitt 2000). Food processing companies and pharmaceutical companies share similar knowledge positions since they each ‘know what the other knows’. This can be an important distinction because if pharmaceutical companies were to define their competitors as those firms who make what they make rather than those who know what they know, pharmaceutical firms might not take into account the emerging "stealth" competition from food processing companies regarding cholesterol-lowering foods and other “edible drugs.”

Sustainability of an asset position depends on how easily the asset can be replicated by competitors. If the asset cannot be purchased, then rivals must either accumulate their own asset stock or substitute for it with other assets (Dierickx and Cool 1989). Barriers to asset accumulation or substitution therefore provide a mechanism to sustain a resource-based advantage. Applying this logic to knowledge-based assets suggests that knowledge positions are potentially more defensible and their advantage more sustainable than for traditional product-market positions. Knowledge, especially that which is context-specific and held within the heads of organization members, cannot be readily purchased in the market. Further, unlike traditional physical assets that exhibit diminishing returns, knowledge provides increasing returns (Arthur 1996): the more a firm applies what it knows, the more it learns, and the more it learns, the more it knows. A superior knowledge position is sustainable because to accumulate similar knowledge, competitors must engage in similar experiences over similar timeframes. Further, the learning time cannot be significantly compressed regardless of the level of investment, referred to as time-compression diseconomies (Dierickx and Cool, 1989). Organizations that start off knowing more than competitors enjoy a greater absorptive capacity (Cohen and Levinthal, 1990) and therefore can learn more and learn it more efficiently than competitors who undergo similar learning experiences (Dierickx and Cool, 1989, Postrel 2002). Thus, being smarter than competitors provides a knowledge advantage, and having an ability to manage, apply and enhance that knowledge that is at least as good as one’s competitors can sustain that competitive advantage (Nevis, et al., 1995; Zack, 1999).

In light of these knowledge-based dynamics, remaining competitive in today's knowledge economy requires many organizations to transition from traditional forms of organizing to the so-called "knowledge-based" organization (Zack 2005). They are striving to manage their knowledge and learning as key strategic resources. They are treating the ability to bring that knowledge to bear on problems and opportunities as a strategically important capability. Creating, integrating, and transferring knowledge efficiently has even been proposed as the reason firms exist, referred to in the strategic management literature as the knowledge-based view of the firm (KBV) (e.g. Grant 1996a, Grant 1996b, Connor and Prahalad 1996, Kogut and Zander 1992, Teece 1980).

Although intuitively it makes sense to expect that firms that know more than their competitors would enjoy a competitive advantage, no research of which we are aware has examined the *knowledge* → *competitive advantage* → *performance* linkage at the level of the individual firm in a systematic way. First, the economic research in this and related areas is typically performed at the macro level using proxies such as patent counts or investment in R&D for measuring knowledge (e.g. Patel and Pavitt 2000). Treating knowledge as a monolithic proxy construct ignores the characteristics of knowledge that confer its strategic value (which we discuss below). Second, while the literature has

focused on testing the extent to which different sources of knowledge significantly affect business performance, it again has not directly addressed characteristics of the knowledge provided by those sources that confer strategic value or advantage on a firm (Eisenhardt and Santos 2002).

The significant “missing link” between sources of knowledge and their impact on performance is some measure of how strategically valuable the knowledge provided by those sources is. The Resource Based View (RBV) of the firm (Wernerfelt 1984), which addresses the notion of strategically valuable resources, can be helpful here. RBV, together with KBV, which proposes that knowledge is the most strategic resource, provides some guidance in describing the extent of strategic value to be gained by various knowledge sources. In this paper we introduce a conceptual framework based on RBV and KBV that addresses the extent to which different sources and types of knowledge are significant factors of firm-level business performance. By unpacking the knowledge construct into several strategic components, we develop hypotheses as to how the sources of that knowledge affect its strategic value, and its strategic value, in turn, affects firm performance.

Use of the term knowledge varies widely in the literature, and often is treated as being synonymous with information. We draw an explicit distinction between them. Knowledge resides in and is utilized by a “knower”, and as such is something held and used by human individuals and groups. Information is knowledge made explicit and articulated via messages that can be communicated or recorded, for example in documents or computer systems (Zack, forthcoming). Information can inform someone, thereby increasing one’s knowledge, but information and knowledge are not the same. As the saying goes, a library may be filled with informative books, but the books know nothing. We adopt the following definition of knowledge from the strategic management literature as:

*“...a mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information...”* (Davenport and Prusak 1997).

## **2 RESEARCH MODEL AND PROPOSITIONS**

We present a research framework (Figure 1) and set of propositions that address:

- The relationship between firm performance and the strategic value of a firm’s knowledge.
- The relationship between the strategic value of a firm’s knowledge, and the strategic characteristics of the firm’s knowledge.
- The relationship between the strategic characteristics of a firm’s knowledge and the knowledge source

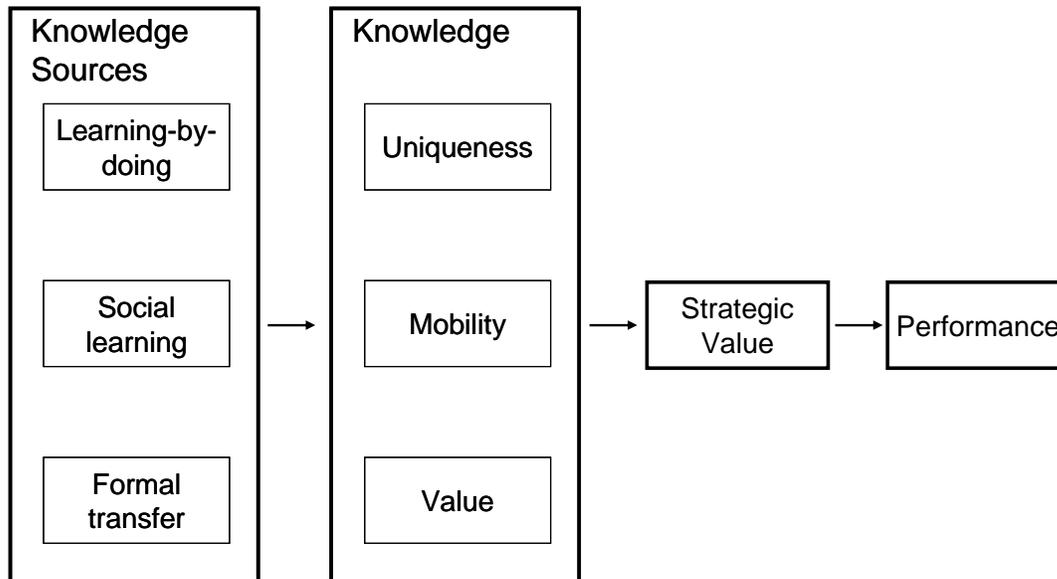


Figure 7

## 2.1 Strategic Value Influences Firm Performance

Research shows that the primary source of firm-level profits is the difference in resource endowments among firms, rather than the shared industry environment as posited by industrial organization economics (Grant 1991, Nelson 1991). RBV proposes that competitive advantage leading to superior firm performance derives from controlling “strategic” resources (Grant 1991). Strategic resources are those that are rare (or unique), immobile and valuable (Barney 1991).

The KBV considers knowledge to be the primary strategic resource. While traditional resources may confer a competitive advantage per the RBV, the knowledge an organization has about how to coordinate, combine and apply those resources (and the ability to acquire, integrate, store, share, apply and improve that knowledge) may be the most unique and inimitable resource (Grant, 1996). Knowing more than competitors can provide a strategic advantage, even if the organization’s underlying tangible resources are not unique (Penrose, 1959; Romer, 1992). Focusing specifically on the knowledge resource, per KBV, we propose that:

*Proposition 1: The greater the strategic value of a firm’s knowledge the greater the firm’s relative performance.*

## 2.2 Knowledge Characteristics Influence Strategic Value

The RBV posits that a resource must be rare, immobile, and valuable to provide strategic value (Barney 1991). Therefore, the more unique, immobile and valuable the firm’s knowledge, the greater its strategic value.

### 2.2.1 Uniqueness

Knowledge in a particular domain can range in uniqueness from being commonly held by all or most firms in an industry (common knowledge) to more advanced knowledge shared by clusters of firms in an industry (niche or shared knowledge) to that held by only one firm (unique knowledge) (Zack 1999).

- *Common knowledge* is the minimum scope and level of knowledge required of a firm merely to participate in an industry. Common knowledge is commonly held by members of an industry and therefore provides little competitive advantage (other than as a knowledge-based entry barrier to those not in the industry).
- *Niche knowledge* supports strategic differentiation and thus enables a firm to be competitively viable. Firms sharing a strategic niche will tend to have advanced knowledge that is similar, yet generally different than firms occupying other niches. Moving from one niche to another would require a firm to acquire or accumulate the knowledge necessary to enable it to operate successfully in that new niche. This learning requirement represents the knowledge-based analog of mobility barriers among strategic clusters (Caves and Porter 1977). Within a niche, the specific content of each firm's advanced knowledge may vary across firms, although less than across niches, enabling some degree of knowledge differentiation within the niche, however two firms could find themselves engaged in head-on competition for the same knowledge position. The moderate amount of differentiation available through advanced niche knowledge might therefore be expected to provide a modest amount of strategic advantage to individual firms.
- *Unique knowledge* is knowledge held by one firm, enabling the firm to significantly differentiate itself from its competitors based on what it knows. Unique knowledge, assuming it can be profitably exploited, should offer the greatest strategic advantage.

*Proposition 2: The more unique the knowledge to a firm, the greater the strategic value of that knowledge.*

### 2.2.2 Immobility

Immobility refers to barriers to resource mobility among firms (Rumelt 1984). Mobility refers to the ease by which a resource can be transferred to, imitated or replicated by a competing firm. Regarding knowledge, the form in which that knowledge is held has a significant influence over its mobility. Knowledge is commonly categorized as being either tacit or explicit (Polanyi 1961, Nonaka 1991). Tacit knowledge is knowledge that is typically developed or acquired via situated, personal and direct learning experiences within a specific context. It is difficult to articulate or make explicit, therefore it cannot effectively be recorded or distributed other than by face-to-face conversation and shared experience. Explicit knowledge (and what we might more precisely refer to as information) is knowledge that can be articulated sufficiently enough to be communicated to and utilized by others, typically in a codified and documented form. The more codifiable the knowledge, the easier it is to transfer (Teece 1998, Winter 1987). Knowledge that is hard to codify represents a strategic platform for expanding into new markets. It is usually novel, inimitable and immobile and therefore represents the firm's advantage for growth (Kogut and Zander 1993; Cyert, Kumar and Williams 1993). The more tacit a firm's knowledge, then, the more immobile or inimitable it is; therefore:

*Proposition 3: The greater the tacitness of a firm’s knowledge, the greater the strategic value of that knowledge.*

### **2.2.3 Value**

Per RBV, effective strategies require firm-specific assets, not undifferentiated inputs (Dierickx and Cool 1989). The more immediately and directly a resource can be applied to a firm’s particular operational and strategic context (i.e., the more context-specific), the more strategically valuable it is (Black and Boal 1994). Likewise, the more immediately and directly knowledge resources can be applied to a firm’s operations or support its strategy, the greater its strategic value, therefore:

*Proposition 4a: The more specific a firm’s knowledge to its strategy or operations, the greater the strategic value of that knowledge.*

A given strategy requires a firm to know a particular set of things in order to execute that strategy; and what the firm knows, in turn, limits the set of strategies that it can effectively execute (Zack 1999). The greater the degree of fit between the knowledge the firm actually holds and the knowledge required to execute its strategy, the greater the strategic value of that knowledge (Zack 2005). Therefore:

*Proposition 4b: The greater the fit between a firm’s knowledge and the knowledge needed to execute its strategy, the greater the strategic value of that knowledge*

In summary, then, knowledge resources that are unique, tacit, context-specific and which closely support the strategy of the firm will provide the greatest strategic value. Conversely, knowledge resources that are common, explicit, non-specific, and which do not directly support the strategy of the firm offer the least strategic value.

### **2.3 Knowledge Sources Influence Knowledge Characteristics**

The literature identifies three primary sources of knowledge. Learning-by-doing (LBD) represents knowledge gained through the organization’s direct experiences in specific environments and contexts (Adler and Clark, 1991; Arrow, 1962; Hatch and Mowery, 1998; Nelson and Winter, 1982; Tyre and von Hippel, 1997). No firm, however, has all of the knowledge it needs internally. Innovation requires access to external knowledge and capabilities, and therefore firms must participate in knowledge networks that transcend its organizational boundaries (Teece 1989, Venkatraman and Subramaniam 2002). Thus internal learning is a necessary but not sufficient source of strategic knowledge.

Social learning and formal knowledge transfer represent two mechanisms available to a firm for acquiring external knowledge. Social learning (SL) represents knowledge gained by observing and interacting with others outside the firm (Wenger 2000). Social learning may be voluntary or involuntary from the perspective of the firm sharing its knowledge. There may be times when it is strategically useful for a competitor to let other firms imitate its resources, for example situations where having the members of an industry copy some aspect of what a firm is doing would change the nature of competition in the industry to be in that firm’s favor (e.g., creating a de facto standard) (Teng and Cummings 2002). Knowledge may also be exchanged based on social or professional relationships (e.g.,

communities of practice) between members of different organizations (Inkpen and Tsang 2005, Muthusamy and White 2005). Competitive intelligence and industrial espionage represent forms of involuntary social or vicarious learning (Metayer 1999). Formal Knowledge transfer (KT) represents knowledge gained through formal transfer mechanisms such as training and education programs (Gruber 1998, Killingworth 1982) or through strategic alliances created for the purpose of knowledge exchange (Mowery, Oxley, and Silverman 1996, Koput, Powell, and Smith-Doerr 1996). Each source affects the three characteristics of knowledge differently.

### 2.3.1 Uniqueness:

Idiosyncratic firm-specific assets are not tradable on open markets, rather they must be accumulated internally (Diereickx and Cool 1989). LBD creates the most unique firm-specific knowledge because each firm undergoes unique experiences in developing that knowledge (Diereickx and Cool 1989, Connor 1991, Daniele 1998), and those experiences are further made unique based on the firm’s path dependence (Nelson and Winter 1982). The knowledge gained via SL is less unique as, by definition, it is sharable and shared by more than one firm. Formal learning (KT) is potentially available to all firms, or at least is captured in a format and embedded in a transfer process with the intention of minimizing firm-specificity. The knowledge transferred is general, rather than firm-specific, and its primary value is its ability to support or enhance a firm’s ability to accumulate or develop firm-specific knowledge (Zack 1999, Daniele 1998). While some firms have partnered with external institutions to create firm-specific training, in reality the opportunity to customize programs is typically made available to all firms, and the provided content tends not to be predominantly firm-specific. Therefore, we propose:

*Proposition 5a: LBD produces the most unique knowledge.*

*Proposition 5b: SL produces knowledge that is more unique than KT but less unique than LBD.*

*Proposition 5c: KT produces the least unique knowledge.*

### 2.3.2 Mobility:

LBD is experienced based, situated in specific contexts, and produces knowledge exhibiting the greatest degree of tacitness. As discussed above this limits its mobility. Knowledge from SL is less tacit as it has to be articulated to be shared. In fact it is this mobility that enables the learning to be defined as social learning. Its mobility is limited however to direct social contact and is therefore less scalable and the scope of transfer more constrained than for formal KT. KT is the least tacit and is intentionally codified and configured to be the most mobile and easy to transfer. Therefore, we propose:

*Proposition 6a: LBD produces the most immobile knowledge.*

*Proposition 6b: SL produces knowledge that is more immobile than KT but less immobile than LBD.*

*Proposition 6c: KT produces the least immobile knowledge.*

### 2.3.3 Value:

LBD, because it occurs as a direct by-product of actions or behaviors within a specific context, produces the most directly and immediately applicable firm-specific knowledge. SL is less firm-specific in that it must be adapted to fit the specific context of the firms who are sharing that knowledge. KT is typically intentionally configured to be applicable across a wide range of firms and therefore the least specific to a particular firm's immediate strategy or operations. Therefore, we propose:

*Proposition 7a: LBD produces the most directly valuable knowledge.*

*Proposition 7b: SL produces knowledge that is more directly valuable than KT but less directly valuable than LBD.*

*Proposition 7c: KT produces the least directly valuable knowledge.*

## 2.4 Moderating Effects

We anticipate moderators to influence each stage of our research model (Figure 2). A key aspect of our research model is the acquisition of knowledge from external sources. Perhaps the most significant characteristic of the firm affecting knowledge acquisition is its absorptive capacity (Cohen and Levinthal, 1990). Absorptive capacity refers to a firm's ability to absorb external knowledge and to apply that knowledge to productive purposes. The firm's ability to absorb new knowledge is a function of its existing knowledge. That is, a firm must know something to learn something. Existing knowledge forms a basis for making sense of newly acquired knowledge. The “smarter” the organization, the more effectively it can absorb new related knowledge, and this provides a foundation for the increasing returns to learning discussed above, and which enables a knowledge advantage to be sustained. However, merely holding or controlling a resource does not guarantee that it will be exploited effectively to create value for a firm. Creating new knowledge requires the firm to have some level of combinatorial capability – the ability to combine existing knowledge (possibly with new knowledge) in new ways (Kogut and Zander 1992). Additionally it must have the ability to exploit that knowledge within products and services valued by the market. Pfeffer and Sutton (2000) refer to this as the knowing-doing gap. Generally, the firm must have the knowledge management (KM) capabilities that enable it to effectively and efficiently source, refine, store, share and apply knowledge within the firm (Davenport and Prusak 1998, McKeen, Zack and Singh 2005).

We expect the influence of each of the sources on the knowledge ultimately held by a firm (and thus its strategic characteristics) to be moderated by the firm's absorptive capacity and its KM capability.

In addition to these internal moderators, we expect that the volatility of knowledge in the industry in general will moderate the knowledge-strategic value relationship. In industries where the knowledge volatility is high knowledge becomes obsolete more rapidly and the value of uniqueness and immobility is diminished. The ability to learn by doing and to absorb external knowledge rapidly effectively becomes more important (Zack 1999).

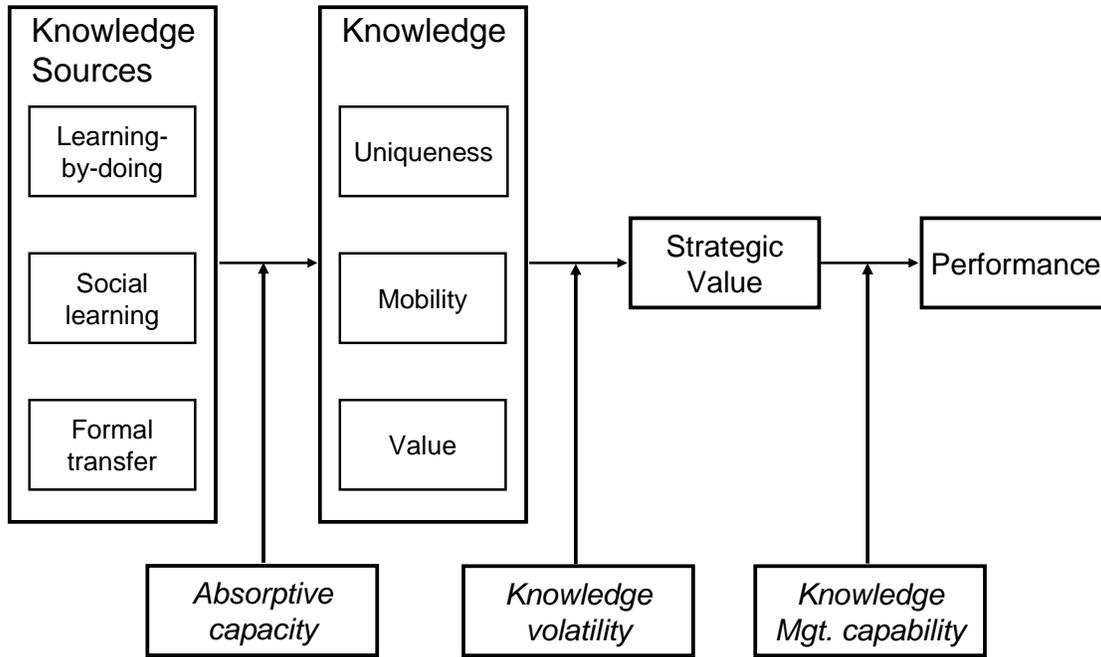


Figure 8

### 3 IMPLICATIONS

#### 3.1 Theoretical

Our research framework unpacks the knowledge-resource construct to better understand the nature and antecedents of the competitive advantage an organization might derive from the knowledge held within the organization. Also, by providing a framework for examining the link between strategic resources and firm performance at the firm level of analysis, we offer guidance for performing research that will enable a more in-depth test of these theories.

#### 3.2 Managerial

Our framework will help practicing managers to think strategically about the characteristics of knowledge their organization needs to compete, and the appropriate mix of sources for that knowledge. Further, research based on this framework can provide evidence that superior knowledge makes a difference regarding competitive advantage, and thus there is a strategic value proposition for engaging in knowledge management.

#### 3.3 Economic policy

At the level of economic policy, findings based on our framework will shed light on which sources of knowledge innovation and learning might provide the greatest impact for the public funds invested. Specifically, it might help to differentiate the value of subsidizing R&D within the individual firm, vs. supporting commercial or industrial consortia and other mechanisms for social learning, vs. supporting programs for formal education.

#### 4 CONCLUSION

Firms in today’s knowledge economy must revise how they think about strategy and competitive advantage to encompass knowledge and learning. There is a dearth of research specifically directed towards understanding the strategic impact of knowledge at the firm level. Our research framework provides one step in that direction.

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