

Knowledge Management as the Basis of Sustained High Performance

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All knowledge capabilities are resources.

We use Grant's (2002) [definition of 'capabilities'](#) as any combination of skills and resources by which an organization accomplishes all or a portion of a task. Capabilities are layered, so more complex capabilities can be built from combinations of simpler capabilities

The firm's ability to produce new knowledge, its ability to build on that knowledge The basis for sustained competitive advantage is a firm's ability to develop rare and valuable knowledge through learning, and to subsequently build upon, and spread, that rare knowledge throughout the organization (Dierickx and Cool, 1989; Lei et al., 1996; Nonaka, 1994).

More recent theory development has focused on the dynamics of ongoing, firm-level learning The knowledge-based view focuses on creating value. value creation is significantly impacted by *how* new knowledge creation is pursued. Firms can pursue [two different aspects of intellectual capital](#): [the resource](#) of knowledge and [the process](#) of knowing a significant gap in the resource-based view because without a better understanding of the genesis of rare and valuable resources, the role of the manager is confined to that of a steward rather than a creator of valuable of resources.

[The knowledge-based view](#) suggests that new knowledge creation processes are the key; in turn, raising questions about what managerial choices need to be made to best manage these processes, conclude that our results support the knowledge-based argument that creating new knowledge is the genesis of the competitive advantage

Term 'knowledge' to indicate an outcome of any form of learning '[New knowledge](#)' refers to knowledge [that is new and rare](#); 'rare' is conceptualized here as it is in the resource-based view of the firm (Barney, 1997). New knowledge is distinguished from knowledge that is only newly learned by the firm or its members, but which already exists in the environment.

the term ‘new knowledge development’ to refer to the larger, complex capability by which existing knowledge resources and learning capabilities are combined to produce new knowledge. The capability to develop new knowledge focuses on the social knowledge and the processes of knowing that exist in a firm, not an individual (Nahapiet and Ghoshal, 1998).

This capability constitutes a portion of the firm’s dynamic capabilities (Eisenhardt and Martin, 2000). Perspective on intellectual capital as both ‘the knowledge and [the] knowing capability of a ‘social collectivity’ This combination of process and resource perspectives is helpful in understanding new knowledge, new knowledge development and the link between the knowledge-based view and the resource-based view of the firm.

We believe that new knowledge is the focus of the knowledge-based view’s argument that these processes are at the root of the firm’s sustained and evolving competitive advantages (Spender, 1996). When seen as both the output of the learning process and an input to the resource base, new knowledge forms the conceptual bridge between these two theoretical views. Thus, processes captured in the knowledge-based view tie firm performance to the resource based view’s traits of value, scarcity, inimitability and non-substitutability (Barney, 1997). Similarly, new knowledge development processes explain how rent-creating resources emerge in the resource-based view in the absence of luck or opportunism.

Dynamic capabilities are ‘learned and stable pattern[s] of collective activity through which the organization systematically generates and modifies its operating routines’ (Zollo and Winter, 2002, p. 340); they are the routines by which managers ‘acquire and shed resources, integrate them together, and recombine them’ (Eisenhardt and Martin, 2000, p. 1107). Dynamic capabilities encompass a broad range of processes through which firms evolve, adapt and survive.

Two complex capabilities that are necessary for the ongoing process of building new knowledge: **creation and sharing** Creating new knowledge, captures an ongoing series of learning activities wherein the new knowledge developed from each learning event is a rare input for future learning (Helfat and Raubitschek, 2000; Lei et al., 1996; Prahalad and Hamel, 1990).

Knowledge sharing, transforms and exploits the new knowledge throughout the organization, eventually converting and incorporating value-creating resources into operating routines (Nonaka, 1994; Szulanski, 1996; Zahra and George,

2002; Zollo and Winter, 2002). Both these capabilities overlap the concept of dynamic capabilities, and thus how research within one framework or view can also inform other views.

Above-average performance is linked to consistent, impactful new knowledge creation.

The inventing firm understands the learning processes that led to the new knowledge, not just the outcome. The firm is also aware of how the new knowledge interacts with other aspects of the firm's dynamic capabilities, particularly assimilation and transformation (Helfat and Raubitschek, 2000). This improves the firm's knowledge and the capacity for knowing, that contributes in identifying future opportunities. The conclusion, then, seems straightforward: the more significant the new knowledge that is created, the greater will be both of these impacts.

It is common lore that less significant incremental innovation that builds on others' inventions is more efficient, and that inventor of major breakthroughs in a field 'go broke' (e.g. Gordon, 2002).

Knowledge impact. The technology studies also suggest that the strength of the linkage between new knowledge and performance is parallel to the meaningfulness of the new knowledge in the general environment.

Hypothesis 1: New knowledge with a higher knowledge impact will be associated with higher firm performance than new knowledge with a lower knowledge impact.

Our second hypothesis focuses on the subsequent use of new knowledge as an input in the new knowledge development process.

Capability internal knowledge management and define it as the firm's capability to develop new knowledge by building on its own earlier discoveries. The key question here is whether a firm will be more successful in developing new knowledge by focusing internally on its own existing inventions as a foundation for future inventions, or by looking externally at the inventions of others. We argue the former because these are valuable and rare inputs that are well understood by the firm and are more likely to produce valuable and rare outputs in the future.

We begin by asserting that firms should have rare, in-depth understanding of the strengths and limitations of their earlier innovations, inventions, products or skills. This understanding, in turn, enables the firm to identify richer fields of future opportunity in which to conduct its new knowledge search processes this understanding enables the firm to more richly perceive a larger range potential impacts and interactions of any new knowledge discovered with the firm's existing knowledge, and to assess these impacts and interactions more accurately.

There are many aspects to the learning embedded in such shared experience. They include the specific meanings and understandings subtly and extensively negotiated in the course of social interaction. They also include an appreciation of the ways in which action may be coordinated. (Nahapiet and Ghoshal, 1998, p. 248)

Dierickx and Cool (1989) found that firms that invent systematically by building new knowledge upon old will outperform those that do not. This is a self-reinforcing process. The extent a firm 'builds on a foundation of expertise that is largely tacit. May be a source of enduring competitive advantage'

Additionally, external knowledge: firms should search more broadly because new knowledge with the highest degree of impact comes from external searches that capture resource inputs from a wide range of sources. The argument posits that simple searches usually seek only to satisfice (Cyert and March, 1963), and thus never explore 'distant' knowledge resources in the external environment.

Broader, external searches bring in more variables; the greater the number of variables, and complex interactions among them, the higher the peaks. Importantly however, high peaks are rare and the random average outcome of the various highpoints of this more-complex terrain is actually lower than the average of Knowledge Management the simpler search.

Both internally and externally focused new knowledge development capabilities are directed by knowledgeable researchers who can favourably bias the direction of the search.

Hypothesis 2: A stronger internal knowledge management capability will be associated with higher firm performance than a weaker internal knowledge management capability.

Encashing on Knowledge: the appropriation of rents from a firm's new knowledge development, a process that we term *knowledge management capture*.

A firm's new knowledge development capability represents an element in a firm's regime of appropriation, even though it does not directly impact the exploitation of previous new knowledge outcomes.

Some actions that are believed to aid in appropriating rents are obtaining patents, enforcing secrecy, exploiting first-mover advantages with the learning curve and establishing a dominant design (Levin et al. (1987)

Due to this the marginal increase in future performance is properly seen as part of the rent stream generated by the earlier new knowledge. Thus, a firm's ability to sustain competitive advantage will require that it not only build on its existing knowledge, but also that it does so more effectively than its rivals.

there is always spill over, but the stronger the regime of appropriation, the less spill over and the higher the firm's return on its new knowledge (Teece, 1986). In the conventional view, competitors, vertically-linked firms, firms in other industries and the general public can all benefit from a firm's new knowledge by capturing some of the marginal rents from spill over

Knowledge spill overs do not occur randomly; they follow the same path-dependent process of new knowledge development that is captured in a sequential string of cited patents

Conclusion:

New knowledge outcomes not only represent a source of appropriable rents in and of themselves, they also enable rent appropriation from future new knowledge. Each outcome of the new knowledge development process has particular value to the inventing firm that others lack; a largely rare resource that can foster future rare inventions (Reed and DeFillippi, 1990). All of this is true provided the firm can be the primary producer of the subsequent new knowledge, rather than others.

Stated in the negative, if other firms are the primary beneficiaries of subsequent new knowledge that is built, in part, on current new knowledge, then those other firms will appropriate large portions of the subsequent streams of rents that flow from that new knowledge.

The sophistication of the copying rivals' absorptive capacity (Zahra and George, 2002) determines the extent of the spill over that actually occurs. The above arguments are well supported by multiple researches.

Hypothesis 3: A higher knowledge management capture rate will be associated with higher firm performance than a lower knowledge management capture rate.

METHODS

To develop a strong measure of new knowledge creation we focused on inventions. An invention is distinguished from an innovation by Grant (2002, p. 333):

Invention is the creation of new products and processes through the development of new knowledge or the combination of existing knowledge. Innovation is the initial commercialization of invention by producing and marketing a good or service or by using a new method of production.

We used patents and patent citations to measure invention. Approved patent applications must be unique and non-obvious; however, they can vary considerably in their significance. Patent applications permit knowledge development to be traced by invention, over time, because the application must cite all prior relevant patents. Forward-looking citation counts are good proxies for the impact of a patent

Forward-looking citation counts are good proxies for the impact of a patent. As mentioned, technology researchers have correlated large citation counts with a variety of outcomes including social gain (Trajtenberg, 1990), important technological advances (Carpenter et al., 1981), high estimates of an invention's economic impact (Harhoff et al., 1999) and increases in firm sales and profits (Narin et al., 1987).

Forward citation counts measure the quality of a firm's invention and R&D capabilities. This measure 'rewards a company with important discoveries and lessens the computed strength of a company whose patents tend to be minor variations of old inventions' (Narin, 1993, p. 20). In recent years, studies with citation-weighted patents have associated citation counts with increases in market value, after controlling for R&D expenditures (Hall et al., 2000), and with sales increases, after a lag period (Ernst, 2001).

Mapping Patents as Artefacts of Knowledge Management

Firms generally seek patents as soon as practical in the product development process. As a result, knowledge flows leave behind what Jaffe et al. (1993) call a 'paper trail'. Similarly, Podolny et al. (1996) see patents as nodes in a technological network.

Some of the citing patents will be held by the firm that owns the original cited patent, others will be citations by other firms. Further, some subsequent patents may spin-off from a citing patent of the original cited patent. These patents will be included in the patent count as a citing patent as long as they cite the original cited patent. By counting all of the citing patents tied to the original cited patent, we capture how widely the original insight has diffused. If that patent represents an invention with significant knowledge impact, then there will likely be an exponential increase in citations over time.

There are some limitations in using patents in knowledge research. One concern is that firms may aggressively patent 'around' an invention and that can lead to several patent applications arising from the same creative insight. This is common in, for example, the pharmaceutical industry (Bogner, 1996).

A second concern is that some innovative firms may avoid patenting so that they do not disclose knowledge outcomes, or give insights into their learning processes (Rogers and Larsen, 1984) or allow rivals to infer their technology strategy from their pattern of patent applications over time (Mintzberg, 1998).

Knowledge Impact = Number of citing patents (c) divided by Number of cited patents (p) Equation (1)

This measure reflects the average impact of a firm's patents in influencing the production of subsequent patents over a period of time.

Internal Knowledge Management = Number of own citing patents (oc) divided by the Number of cited patents (p) Equation (2)

Knowledge Management Capture = Number of own citing patents (oc) divided by Number of cited patents (c) Equation (3)

Dependent variables: To measure firm performance, we used two separate measures: ROE to measure profitability and year-over-year percent change in sales to measure firm growth, over the period from 1976 to 1995.

Control variables. We included three control variables. The first was R&D intensity. Prior research has shown that firms that spend more on R&D will also innovate more (Hitt et al., 1991). To ensure that the variable did not measure absolute spending levels, but accounted for the size of the firm, we used R&D intensity (R&D expenditures divided by sales).

Lags and weights. Although patents have a long legal life, Schumpeterian creative destruction argues that the ability to reap economic profits for that period diminishes as new products are superseded by subsequent inventions.

If a long lag exists between two significant inventions, then the advantage the original innovator has from their distinctive knowledge about how the initial product was developed is likely to have dissipated long before the subsequent patent. We needed a time cut-off point and weighting scheme to account for these issues.

Data Analysis

We used ordinary least squares (SPSS) to analyse the data

The results for Hypothesis 1 support the idea that the quality of a firm's knowledge outcomes is a valuable resource that can impact firm performance. This goes beyond simply spending more on R&D and producing more patents. By investigating the number of subsequently citing patents, we found that *quality* innovation outcomes were valuable resources that translated into higher sales growth and return on equity. The data also support our arguments that knowledge management based on exploiting past innovations motivates higher growth and profitability.

The strong support for Hypothesis 2 and the measure of Internal Knowledge Management suggests that developing new knowledge internally by aggressively leveraging prior innovations into new discoveries will positively impact performance.

As with Hypothesis 1, the significance of both the sales growth and the ROE measure in Hypothesis 2 suggests that any incremental costs of operating an effective knowledge management system are more than offset by additional profit gains.

Combined, the results of Hypotheses 1 and 2 offer a richer understanding of the

mutually reinforcing elements of an effective knowledge management system and their relationship to performance.

The results from Hypothesis 2 suggest that models of dynamic competitive advantage need to further emphasize the value of intermediate knowledge outcomes in the process of developing end goods and services.

In Makadok's (2001) model of rent creation, there are two sources of above-average returns: resource picking and capability-building. Building upon prior distinctive knowledge is a process that fits well with Makadok's second category. These capabilities are dynamic because they capture a process of bundling existing resources into a distinctive, value-creating outcome. These capabilities are dynamic because they capture a process of bundling existing resources into a distinctive, value-creating outcome. knowledge (facts and traits) not disclosed, but known to the inventors, is a unique and valuable resource input to the subsequent process. This level of higher understanding, no matter how slight, represents a unique input resource – assuming knowledge is, in fact, seen as a resource that, like a capability, has some degree of non-transferability value. Instead, these resources are produced from the same knowledge-building process into which they will be re-inserted.

In successful firms, a dynamic capability such as new knowledge development is repeated over time.

The economic rents that patents generate may well be a critical ingredient in sustaining the aggressive innovator's advantage. Indeed, our results suggest that patenting is a better choice than not patenting and simply hoping that rivals will have difficulty reverse engineering, expanded our understanding of the relationships among knowledge outcomes, knowledge processes and performance, there are some limitations that need to be kept in mind.

Have not included a risk dimension: Returns have to be calibrated against the risk that is undertaken in earning those returns. In open markets, investors require firms to earn returns consistent with the level of risk their invested capital faces. Thus, it could be possible that more aggressive research strategies that produced significant positive returns constitute riskier competitive strategies.

The absorptive capacity literature lays out a wide range of processes that lie between the initial encounter with new knowledge in a search process and

exploitation of that new knowledge (Zahra and George, 2002; Zahra et al., 2006). The performance of the firm depends on the interaction of the search process with these other capabilities.

One of the motivations of this paper was to enrich our understanding of how new knowledge develops into new, rare and valuable resources. The many other elements of the knowledge creation process

CONCLUSION

- a) The ability to both create and transfer knowledge is important.
- b) Research and theory that focuses too tightly on one element of the relationship will capture only part of the concept. This study shows that the search for competitive advantage based on knowledge is not a choice between ‘content’ or ‘process’, but rather requires both.
- c) Consistent with many views of competitive dynamics, sustaining advantage is really the case of sustaining the lead in a never-ending learning race.
- d) The race never produces a final winner and understanding how to stay ahead is as critical as gaining that precarious lead. Managers need to understand how both knowledge outcomes and learning processes are necessary for implementing successful competitive strategies.
- e) The trend to shift R&D expenses toward incremental, applied research should stop. While spending on R&D, especially on significant innovations, introduces uncertainty and increases time to- market, we found that it also generally raises returns and allows firms to build on those innovations and maintain leadership.