

The Process of Knowledge Creation in Organizations

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The Process of Knowledge Creation in Organizations

Executive Summary

Knowledge creation has been widely recognized to be strategically important for organizational learning and innovation. Nonaka and Takeuchi's (1995) book *The Knowledge Creating Company* crystallized the intricacy of knowledge creation and its importance in the organization's long term success and survival. However, the lack of empirical work in this area has limited our understanding of this important phenomenon. Previous studies have focused on limited aspects of the overall knowledge creation process, such as interorganizational knowledge transfer, knowledge flows within the firms and the interplay of tacit and explicit knowledge. As a result, our understanding of knowledge creation is limited to certain micro-level aspects, rather than understanding the process in its entirety. This study is a comprehensive analysis of the knowledge creation chain, incorporating both environmental and organizational factors that play a role in the overall process.

The hallmark of our research is that we present and test a comprehensive beginning-to-end model of knowledge creation. Specifically, our model examines five important dimensions of the knowledge creation and application process: (1) the acquisition of information and knowledge from networks of interaction; (2) the integration of external and internal knowledge; (3) the creation of new knowledge from the application of information and knowledge to problem solving; (4) the impact of new knowledge on firm innovation and performance; and, (5) the role of specific individual and organization factors play in the overall process.

Major findings. Our results reveal what is important for effective knowledge creation in organizations. Specifically, we show that:

- Formal networking is not as important as informal networking as a source of information acquisition for organizations;
- Know-how is not acquired directly but synthesized from the acquisition of information;
- Know-how synthesis is strongly determined by the ability of the individual employee to absorb new knowledge and the incentives and systems of the firm that encourage knowledge acquisition;

- This know-how contributes to the performance of the firm through the level of creativity in problem solving which, in combination with comprehensiveness and consensus, is the key contributing factor to the level of new knowledge created by the firm; and,
- New knowledge impacts directly on firm innovative output, which, in turn, is a positive influence on financial performance.

Implications. Our research is relevant to managers interested in leveraging the knowledge of their organizations to improve innovative output and financial performance. Not only does it provide solid information against which to benchmark a firm's performance, it also guides managers toward the key factors that affect the process of knowledge creation and innovation. Our findings suggest that managers must pay careful attention to: (1) cultivating opportunities for inter-firm and intra-firm informal networking, (2) encouraging absorptive capacity amongst employees (and providing supporting policies and procedures), and (3) sustaining high levels of creativity in organizational problem solving as a means of generating new knowledge. As one of the first studies to examine the knowledge creation process empirically, we have lifted the lid off the black box of knowledge management.

A Model of Knowledge Creation in Organizations

Knowledge is being acknowledged as a strategic asset (Winter, 1987) and a source of competitive advantage (Quinn, 1992; Nonaka and Takeuchi, 1995). As goods and services become more sophisticated in content and production, the foundation of competition becomes intensively knowledge based, with the focus on developing valuable and hard-to-imitate knowledge that yields sustainable competitive advantage. With the development of information technologies, the networked form of organization, and the need for innovation, the main concern is on the generation, management and utilization of knowledge in such a way that produces long-term advantages. According to Quinn (1992: 241), "the capacity to manage human intellect—and to transform intellectual output into a service or a group of services embodied in a product—is fast becoming the critical executive skill of this era". Despite its importance, knowledge management in organizations has remained a black box for both scholars and practitioners.

The focus of our work is the process of *creating new knowledge* in organizations, an area that has received little attention in empirical research. Although scholars have written about knowledge, as a subject, from the

perspective of a wide range of disciplines, there has yet to be any theory of knowledge developed. In their book *The Knowledge-Creating Company*, Nonaka and Takeuchi (1995: 49) argued that “even though many of the new management theories since the mid-1980s have pointed to the importance of knowledge to society and organizations in the coming era, there are very few studies on how knowledge is created within and between business organizations”.

In formulating and executing the current research our objective was to present a comprehensive theoretical and empirical investigation of organizational knowledge creation and its impact on firm performance. The basic model is presented in Figure 1 and the definitions for its constructs are outlined in Table 1.

Figure 1: Model of knowledge creation and innovative and financial performance

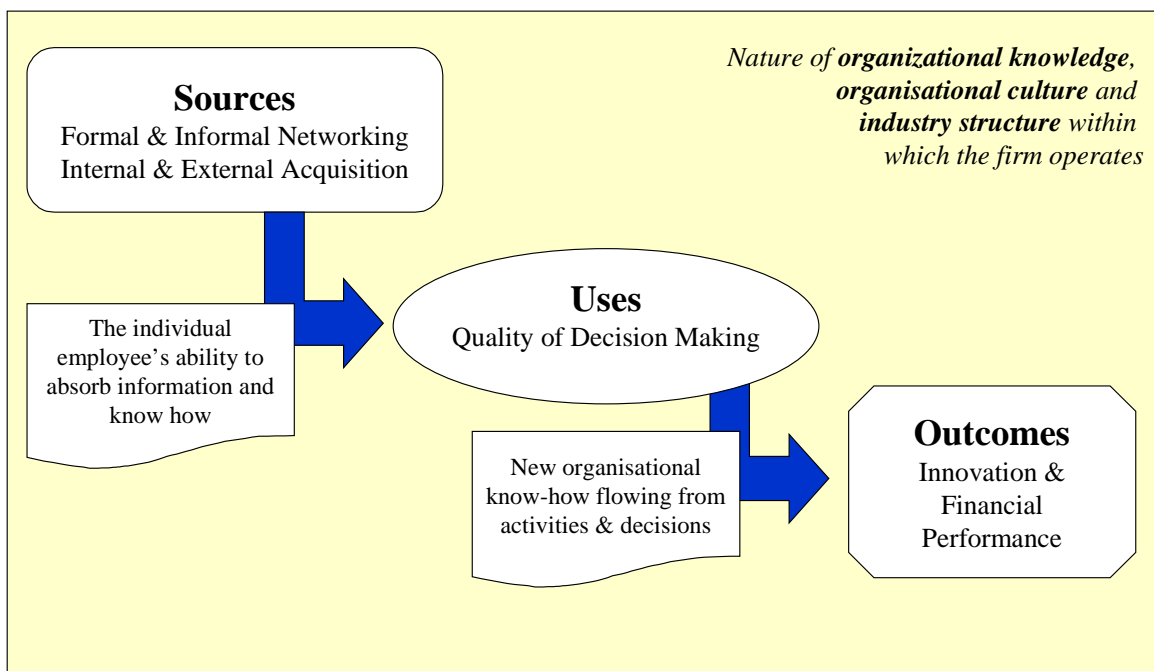


Table 1: Definitions of constructs in the model

Construct	Construct Definition
Sources	
Formal networking (Formal)	Formal collaboration (e.g., joint ventures, licensing agreements, joint R&D, etc.) between two organizations
Informal networking (Informal)	Informal interpersonal “social networking” between individuals
Information acquisition (Information index)	Information that is acquired by the individual through interactions with other parties (i.e., customers, suppliers, competitors, etc.)
Know-how acquisition (Knowledge index)	Know-how that is acquired by the individual through interactions with other parties (i.e., customers, suppliers, competitors, etc.)
Absorptive Capacity	
Individual absorptive capacity (Ind AC)	The ability of the individual to absorb, share and apply information and knowledge
Organizational absorptive capacity (Org AC)	Organization policies and procedures that encourage absorptive capacity amongst employees
Uses—Quality of Decision Making	
Comprehensiveness	The extent to which the problem solving team is exhaustive in investigating and testing alternative solutions to a problem
Creativity	The extent to which the problem solving team adopts creative or novel solutions to a problem
Consensus	The extent to which there is shared consensus and commitment among the problem solving team in implementing the chosen solution to a problem
Outcomes	
New knowledge creation (New knowledge (Klge))	New ideas, insights, processes and new ways of thinking that arise from a particular problem solving situation
Innovative output (Innovation index)	The extent to which a firm generates new products, services, process, or scientific/research output
Financial performance	The firm’s performance in terms of ROI, market share, profits and increase in sales
Nature of Knowledge—Control for Industry Structures	
Codifiability	The extent to which a firm’s manufacturing/service processes can be codified in manuals, software, procedures, etc
Teachability	The extent to which a firm’s manufacturing/service processes can be easily taught to new employees
Complexity	The extent to which employees are skilled in different specializations
System dependence	The extent to which different areas of specializations within the firm need to work together
Observability	The extent to which a firm’s products/services can be imitated by competitors

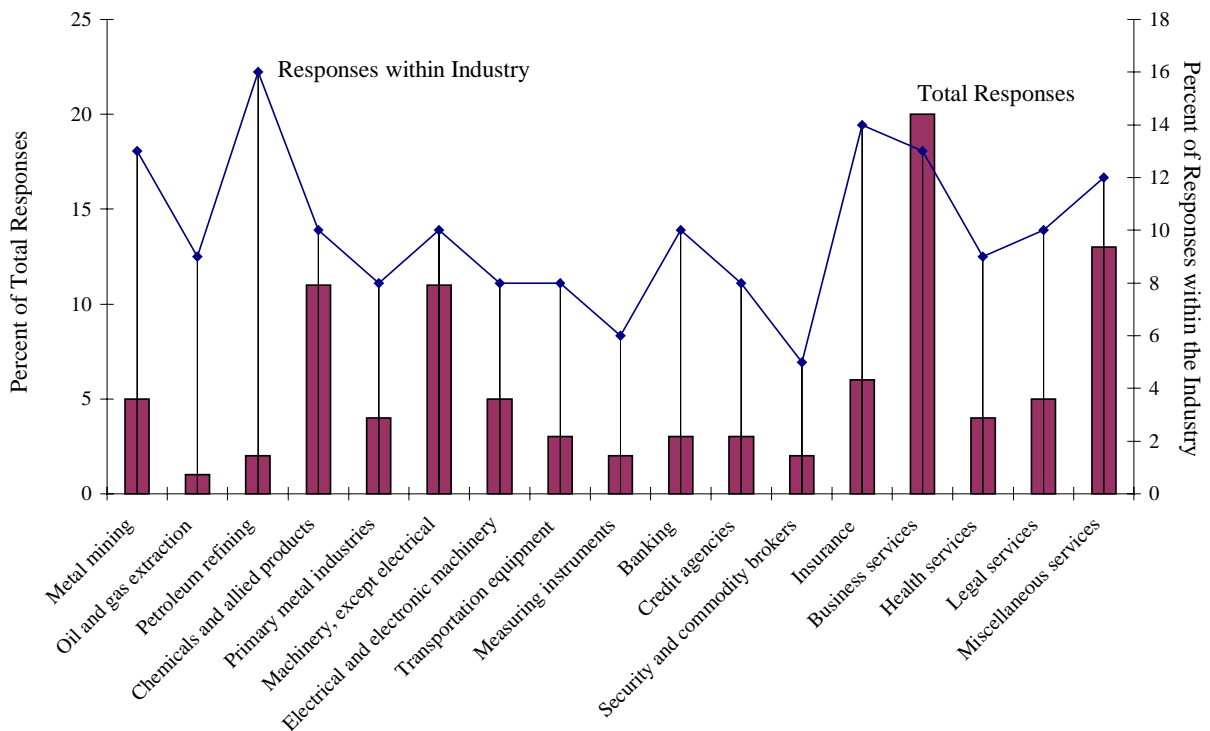
In the most simplistic terms, the model looks as innovative and financial performance as the *outcomes* associated with the learning and knowledge that flows from *decision making processes*, which themselves are aided by information and know-how that is *absorbed by the firm and its employees* through its internal and external *networks*. All of this occurs with an informational and industry *environment*.

This model takes into account five major factors in the knowledge creating process:

1. *The role of the firm's network of interactions* as a source of important information and knowledge. Such networks can possess formal and informal characteristics and the relevance of each turns out to be critical.
2. *The integration of information and knowledge that is acquired with that currently existing in the organization.* Building upon Leonard-Barton's (1994) findings that knowledge creation is dependent on four learning activities, one of them being shared and creative problem solving processes, we focused on the capitalization of knowledge within the activities of the firm.
3. *High quality problem solving processes.* A critical weakness in knowledge research has been the measurement of created knowledge. Utilizing Dretske's (1981) idea that knowledge is justified belief that leads to action we measure knowledge creation as the output of the firm's decision making processes.
4. *The impact of specific organization factors.* Prior research has shown that the nature of organizational knowledge (Zander and Kogut, 1995) and the ability of the individual and organization to absorb ideas (Cohen and Levinthal, 1990) are critical to understanding innovation.
5. *The output of the knowledge creation process.* All too often work in this field fails to get to the bottom line. We argue that the knowledge creation process is the antecedent to the innovation (broadly defined) and that is a necessary precursor to financial performance.

Who was Studied?

A questionnaire survey was developed to test the validity of the model presented in Figure 1. The survey was sent to 2,137 organizations (addressed to the CEO or managing director) in 17 industries. The industries included in the study are listed in Figure 2. Attention was given to ensuring that we targeted industries where issues of information and knowledge transfer, knowledge creation and innovation were *important and relevant*. Specifically, the study targeted industries facing dynamic and competitive environments and, hence, the need for continuous knowledge creation and learning.

Figure 2: Distribution of survey respondents across industries

345 executives responded to the questionnaire survey (yielding a 16 per cent response rate). After eliminating 28 surveys due to large proportions of missing data, the final number of observations used in the analysis totaled 317. The distribution of responses by industry and the response rate within each industry are given in Figure 2. The responses were fairly evenly distributed across manufacturing (44 per cent) and service (56 per cent) industries, as well as across the 17 industry subgroups included in the survey. Figure 2 also indicates that each of the 17 industries included in the sample population is represented in the final set of responses, with response rates ranging from 5 per cent to 16 per cent.

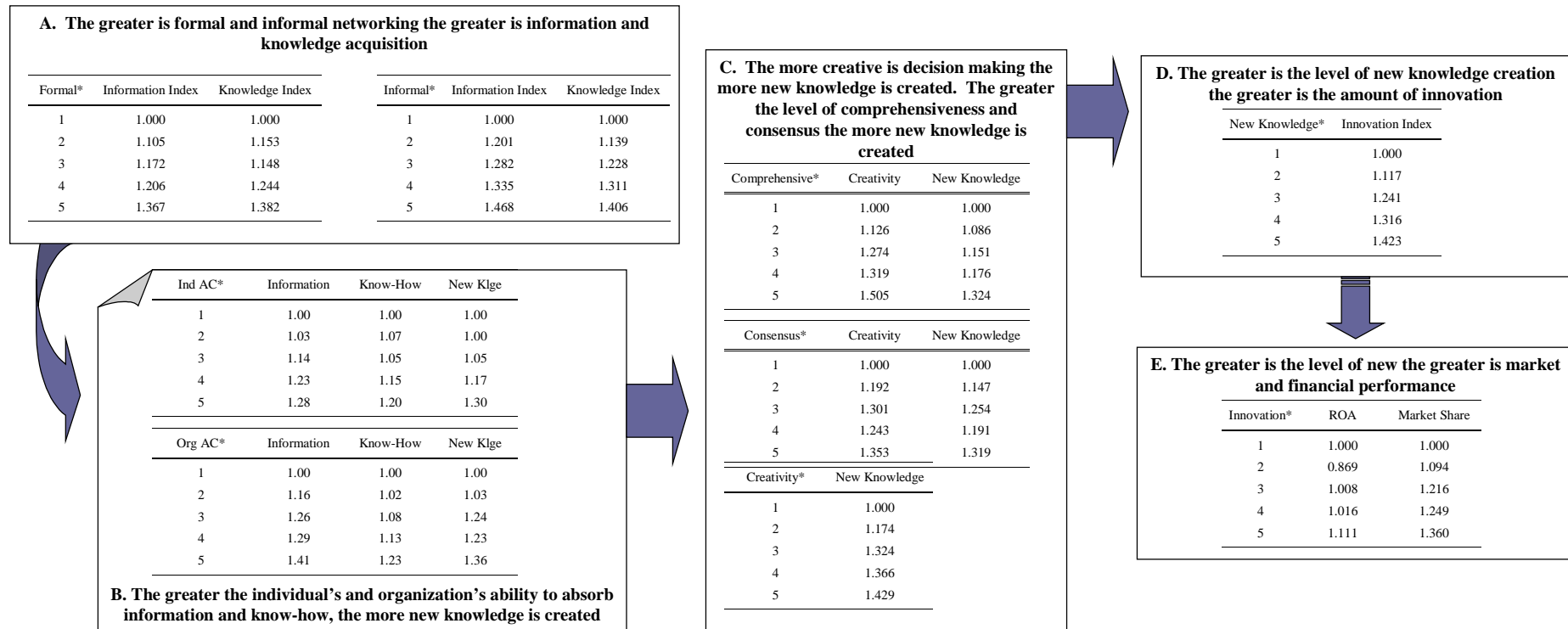
The Bottom Line

The statistical analysis provides strong confirmation for the model presented in Figure 1. The general findings are that: (1) information is sourced from internal and external networks and (2) converted in to know-how that is (3) acted upon by decision makers in their daily activities that (4) leads to new knowledge, which (5) increases innovative output and, hence, (6) performance. A more detailed description of the path of the results is given in Figure 3.

The specific managerial insights emerging from the results are as follows:

- *The both formal and informal networks are important sources of information* (see box A in Figure 3). The twenty percent of firms with the broadest and deepest formal networks were forty percent higher in information acquisition than the bottom twenty percent of firms. The twenty percent of firms with the broadest and deepest informal networks were fifty percent higher in information acquisition than the bottom twenty percent of firms.
 - ✦ *Know-how is not acquired directly from the network, but indirectly via information acquisition.* This leads to two interesting potential conclusions. First, firms do not acquire knowledge externally. They acquire information. Second, formal systems that focus on knowledge acquisition are doomed to fail since they are attempting to acquire the unachievable. Hence, firms may be better off setting their sights lower when they talk about knowledge acquisition; i.e., they should stick to distinguishing between formal information systems and informal know-how systems
- *The propensity for information and know-how acquisition is augmented by both individual and organizational absorptive capacity.* That is, the more individuals engage in information seeking, storing and sharing, and investments in knowledge development, the more likely they are to absorb information and know-how from their network of interactions. As box B in Figure 3 (Ind AC) shows the top twenty percent of individuals acquire approximately twenty to thirty percent more information and know-how and convert this into new knowledge. Similarly, firms with the better incentives for absorbing information and know-how (Org AC in box B) show consistently larger amounts of information, know-how and new knowledge acquired and created.
- *Knowledge acquired through network interaction influences the effectiveness of the organization's internal processes.* Specifically, the level of know-how acquisition directly affects the level of creativity in problem solving. More formal analysis shows that knowledge impacts creativity in problem solving, which is a quality measure, and not comprehensiveness, which is a quantity measure.

Figure 3: The process of knowledge creation—a detailed breakdown



* The numbers in each column represent the mean indexed measure for each construct. The five rows represent the bottom to the top 20 percentiles of firms. Hence 1=lowest 20%, 2 21%–40%, 3=41%–60%, 4=61%–80%, and 5=81%–100%. All measures are indexed against bottom one-fifth of the firms.

The constructs are given in Table 1 but are summarized here:

Formal: Formal networking; *Informal*: Informal networking; *Information index*: Information acquisition from networking; *Knowledge index*= Knowledge acquisition from networking; *Ind AC*: Individual absorptive capacity; *Org AC*: Organizational absorptive capacity; *Comprehensiveness*: Comprehensiveness of decision making; *Consensus*: Consensus used in decision making; *Creativity*: Creativity brought to bear in the decision making process; *New Knowledge (Klge)*: New knowledge created from decision making; *Innovation Index*: Index of innovative outputs. Two performance measures are presented—*ROA*=Return on Assets relative to competitors and *Market Share*.

For example, in reading the last box it indicates that the bottom one-fifth of innovators has a market share 36 per cent below that of the top one-fifth.

- ➔ *Effective problem solving processes* (i.e., where creative solutions are devised and organizational members are committed towards their implementation) *contributes to new knowledge creation*, in terms of improved productivity, new ways of doing things, new ideas, new ways of thinking, and improved problem solving ability. The creation of new knowledge in turn generates higher levels of innovative output, which is then manifested in financial performance. Box C in Figure 3 shows that greater comprehensiveness and creativity in decision-making lead to greater generation of new knowledge. Firms using more consensus-driven decision making are slightly better than those having more autocratic structures but the results here are not as clear or consistent.
- ➔ *The more new knowledge created the greater is the organization's innovative, financial and market performance.* Boxes D and E show that firms creating the most new knowledge are forty percent higher in innovation than those creating the least new knowledge. In addition, firm's with the highest levels of innovation have eleven percent higher return on assets (ROA) and almost forty percent higher relative market share when compared to the poorest performing firms.

A Final Wrap

The key contribution of this study is that it paints a picture of what matters in the knowledge creation process. More detailed results (available from the Centre for Corporate Change) show these results to be stable and consistent across a variety of industries. This work also highlights the complex nature of knowledge creation by showing the inter-play of acquired and existing knowledge, as well as necessary individual and organizational capabilities needed to transform acquired knowledge to new knowledge. Finally, and perhaps most convincingly, it shows the link between knowledge and financial performance.

This study has given us a small but significant step forward towards understanding the intricacies of organizational knowledge. Related case research on five companies (spanning, consulting, transport, legal, advertising and human resource services) show the normative and prescriptive value of the research. We are able to understand the respective roles played by various environmental and organizational factors and drive solutions that lead to better innovative performance. Findings of the case research reveal a number of interesting and compelling findings:

- ➔ There is an over-reliance on formal IT systems when dealing with knowledge management. Our research shows that good IT systems are an absolute necessity but are hardly sufficient to serve as a basis of a knowledge management strategy. However, even then most IT systems are inadequate technically and fail to mesh with the organization's strategic needs.
- ➔ Senior managers have more positive perceptions on the role of the organization's incentives for the absorption of knowledge than do middle- or lower-level managers. Across all organizations we find that senior managers feel that their knowledge management incentive policies (e.g., the incentives to use, codify and store information and knowledge) are effective but non-senior managers feel they do a good job in spite of the policies and systems!
- ➔ Senior managers have difficulty in understanding the payoff from knowledge management. This is most notably driven by an inability to measure knowledge and its impact. Most are afraid to get involved with something that they perceive to be little more than a fad.

Although our work has obvious academic benefit, when we link the survey and case research we find that we have a powerful explanatory and diagnostic tool. For example, the finding that new knowledge creation is a crucial determinant of innovative output (and hence financial performance) is a powerful compelling force for managers. Before all they could hope for was that what the gurus were telling them was true. What we are able to show is that new knowledge needs to be manifested in innovation (i.e., new products, service, process, patents, etc) in order to produce financial outcomes. Similarly, it is one thing to talk about the relationship between knowledge and innovation without showing how the relationship between the two is to be operationalized. Our results show that this is managed through the creativity, consensus and comprehensiveness of the firm's problem solving. Changing these three factors to positive effect helps a firm achieve greater innovative output.

As we look further back into the knowledge creation process we see that informal networking is crucial. However, senior managers are uncomfortable with things that cannot be managed. Hence, it is important to understand that although informal networking is critical there is a link between formal and informal networking. The meaning is simple, to achieve effective informal networking the organization must have formal structures in place that enhance and build up informal interactions. This leads to the final critical factor, absorptive capacity. The better the incentives, both monetary and social,

driving the individual to interact both formally and informally with internal and external constituencies, the more effectively will information be acquired and synthesized into effective know-how.

The strength of the present work is the comprehensiveness of the investigation of the complete information → knowledge → decision making → innovation → performance chain along with the exactness of its empirical measurement. However, it goes beyond positive investigation and provides managers with powerful theoretical guidance backed by effective benchmarking.

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