

Absorptive Capacity: A Review, Reconceptualization, and Extension
Author(s): Shaker A. Zahra and Gerard George
Source: *The Academy of Management Review*, Vol. 27, No. 2 (Apr., 2002), pp. 185-203
Published by: Academy of Management
Stable URL: http://www.jstor.org/stable/4134351
Accessed: 09-03-2017 16:46 UTC

REFERENCES
Linked references are available on JSTOR for this article:
http://www.jstor.org/stable/4134351?seq=1&cid=pdf-reference#references_tab_contents
You may need to log in to JSTOR to access the linked references.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at
http://about.jstor.org/terms



Academy of Management is collaborating with JSTOR to digitize, preserve and extend access to *The Academy of Management Review*

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

© Academy of Management Review
2002, Vol. 27, No. 2, 185–203.

ABSORPTIVE CAPACITY: A REVIEW, RECONCEPTUALIZATION, AND EXTENSION

SHAKER A. ZAHRA
Georgia State University

GERARD GEORGE
University of Wisconsin–Madison

Researchers have used the absorptive capacity construct to explain various organizational phenomena. In this article we review the literature to identify key dimensions of absorptive capacity and offer a reconceptualization of this construct. Building upon the dynamic capabilities view of the firm, we distinguish between a firm's potential and realized capacity. We then advance a model outlining the conditions when the firm's potential and realized capacities can differentially influence the creation and sustenance of its competitive advantage.

In recent years researchers have used absorptive capacity (ACAP) in their analyses of diverse, significant, and complex organizational phenomena. The importance of ACAP has been noted across the fields of strategic management (Lane & Lubatkin, 1998; Nahapiet & Ghoshal, 1998), technology management (Schilling, 1998), international business (Kedia & Bhagat, 1988), and organizational economics (Glass & Saggi, 1998). Despite growing use of the construct, the study of ACAP remains difficult because of the ambiguity and diversity of its definitions, components, antecedents, and outcomes. These issues highlight a need for greater clarity about the domain and operationalization of this construct (Joglekar, Bohl, & Hamburg, 1997; Matusik & Heeley, 2001).

In this article we propose a reconceptualization of ACAP as a dynamic capability pertaining to knowledge creation and utilization that enhances a firm's ability to gain and sustain a competitive advantage. Research on the dynamic capabilities of the firm (Eisenhardt & Martin, 2000; Raff, 2000) offers new insights into the study of ACAP. Researchers argue that dynamic capabilities are embedded in organizational processes and are directed toward enabling organizational change and evolution (Zott, 2001). These capabilities enable the firm to reconfigure its resource base and adapt to changing market conditions in order to achieve a competitive advantage.

Here we suggest that ACAP exists as two subsets of potential and realized absorptive capacities. Potential capacity comprises knowledge acquisition and assimilation capabilities, and realized capacity centers on knowledge transformation and exploitation. Reviewing prior research, we observe that most empirical studies show significant relationships between ACAP and innovative output and other outcomes that pertain to creating a competitive advantage. These outcomes reflect a firm's realized capacity. The potential capacity component, however, has received disproportionately less empirical scrutiny when compared with realized capacity. In this article we posit that potential capacity provides firms with the strategic flexibility and the degrees of freedom to adapt and evolve in high-velocity environments. By doing so, potential capacity allows firms to sustain a competitive advantage even in a dynamic industry context.

We make three contributions to the literature in this article. First, we recognize ACAP as a dynamic capability that influences the nature and sustainability of a firm's competitive advantage. This distinction facilitates analysis of

An earlier, abridged version of this paper was published in the *Best Paper Proceedings* of the annual meeting of the Academy of Management (2000), in Toronto. We express our gratitude to Bert Cannella and three anonymous *AMR* reviewers for their developmental feedback. We thank Pam Barr, Steve Floyd, Mike Hitt, Mike Lubatkin, and Patricia H. Zahra for their comments, which strengthened the manuscript. Gerard George acknowledges the support of the Weinert Center for Entrepreneurship at the University of Wisconsin–Madison.

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

ACAP by enabling researchers to explore its different antecedents and consequences. Viewing ACAP as a dynamic capability also makes it amenable to change through managerial actions that effectively redefine and deploy the firm's knowledge-based assets (Floyd & Lane, 2000). Also, we broaden the theoretical interpretation of the ACAP construct by presenting it as a dynamic capability that influences the creation of other organizational competencies and provides the firm with multiple sources of competitive advantage (Barney, 1991), thereby improving economic performance.

Second, we recognize the roles and importance of different components of a firm's ACAP, setting the stage for future research on the relationships among these components and their influence on a firm's strategic choices. By specifying and examining these dimensions, we clarify the development and evolution of dynamic capabilities that determine the pathways of organizational change.

Third, by identifying conditions under which the components of ACAP create value, we provide some insights into the questions "What drives performance differences within the same industry?" and "How do firms sustain such differences over time?" These issues are central to the analysis of a firm's evolution, knowledge management, and development of dynamic capabilities.

PAST RESEARCH ON ACAP

Researchers have used the ACAP construct to explain organizational phenomena that span multiple levels of analysis by invoking the organizational learning (Huber, 1991; Kim, 1998), industrial economics (e.g., Cockburn & Henderson, 1998), resource-based (Lane & Lubatkin, 1998), and dynamic capabilities (Mowery, Oxley, & Silverman, 1996) perspectives. Table 1 summarizes representative empirical studies using ACAP, showing that researchers have studied the effects of ACAP at different levels of analysis while adopting multiple measures of this construct. However, it is unclear if these measures converge to capture similar attributes of the same construct, indicating a much-needed dialogue on the definition and dimensions of ACAP. Below we address both these issues.

Past research indicates an implicit consensus of the role and outcomes of ACAP as a set of firm abilities to manage knowledge. Yet definitions and operationalizations of this construct vary widely. Some researchers have used the term *ACAP* without a definition (e.g., Glass & Saggi, 1998; Keller, 1996), whereas others have invoked the term broadly to indicate a firm's receptivity to technological change (Kedia & Bhagat, 1988) or to gauge the ability of a firm to use outside knowledge (Koza & Lewin, 1998). Analysis of past research reveals three definitions that have dominated the literature on ACAP. These definitions converge to some extent but also differ in major ways and highlight different dimensions, as summarized in Table 2.

Cohen and Levinthal (1990) have offered the most widely cited definition of ACAP, viewing it as the firm's ability to value, assimilate, and apply new knowledge. Mowery and Oxley (1995) offer a second definition of ACAP as a broad set of skills needed to deal with the tacit component of transferred knowledge and the need to modify this imported knowledge. Kim (1997a,b, 1998) offers a third definition of ACAP as the capacity to learn *and* solve problems. As Table 2 indicates, there is agreement that ACAP is a multidimensional construct involving the ability to value, assimilate, and apply knowledge (Cohen & Levinthal, 1990) or is a combination of effort and knowledge bases (Kim, 1998; Mowery & Oxley, 1995). However, as summarized in Table 1, empirical studies do not always capture the rich theoretical arguments and the multidimensionality of the ACAP construct. To improve future measures, we need to reconceptualize the various dimensions of ACAP and clearly define each.

A RECONCEPTUALIZATION OF ACAP

Building upon the research summarized in Tables 1 and 2, we define ACAP as a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability. We believe that these four capabilities represent four dimensions of ACAP and play different but complementary roles in explaining how ACAP can influence the organizational outcomes reported in Table 1. Our definition departs from past research in two ways. First, ACAP is viewed as a dynamic capability embedded in a firm's routines and processes, making it possible to analyze the stocks and

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

TABLE 1
ACAP: Conceptualization and Operationalization Issues[a]

Unit of Analysis	Study	Sample/Data	Theoretical Lens	Treatment/Modeling	Measurement	Outcome/Effects
Country	Mowery & Oxley (1995)	Conceptual (illustrated with statistical data)	Comparison of inward technology transfer channels and national innovation systems	National ACAP as moderator of inward technology transfer and national innovation systems	Investments in scientific and technical training and economic policies that enforce competition	National innovation and productivity are greater for countries that invest in building their ACAP
	Keller (1996)	Conceptual/economic modeling	Transitional dynamics and sustainable long-run growth dependent upon rate of human capital development	ACAP allows exploitation of technology	(1) Engineering students as percentage of total postsecondary educated population; (2) scientists and engineers per million of population; (3) scientists and engineers in R&D per million of population	Switch in government policy toward an outward orientation (policy liberalism) gives a country only the information part of technology; implementation, however, requires ACAP (or skilled human capital)
	Liu & White (1997)	145 firms from 29 manufacturing industries in China	Innovation in developing economies	ACAP as predictor of innovative output	Investments in R&D personnel	Innovation is driven by synergy between investments in ACAP and investment in sources of new knowledge (foreign technology imports)
Interorganization	Lane & Lubatkin (1998)	69 R&D nonequity alliances between 48 pharmaceutical and 22 biotechnology firms	Organizational learning theory; resource-based theory	ACAP as predictor of organizational learning in an alliance dyad	8 total measures based on valuing new knowledge (2), assimilating new knowledge (5), and commercializing new knowledge (1)	ACAP best measured at the dyadic unit of analysis; relative similarities between two firms' knowledge and knowledge-processing systems are more important than one firm's knowledge base
Organization	Cohen & Levinthal (1990)	1,719 business units from 318 firms in 151 lines of business in U.S. manufacturing sector	Organizational learning; economic theory	ACAP is used as predictor of innovative activity	R&D intensity; responsiveness of R&D to learning incentives (relevance, ease, and appropriability)	R&D creates a capacity to assimilate and exploit new knowledge
	Boynton, Zmud, & Jacobs (1994)	132 units with similar information technology (IT) mainframe systems	Organizational learning	ACAP as a predictor of the extent of managerial IT use	(1) Managerial IT knowledge of business processes and the value of information technology; (2) managerial IT process effectiveness	Managerial IT knowledge was found to influence an organization's extent of IT use; IT management process effectiveness did not influence extent of use; also, higher levels of IT management climate positively influenced both dimensions of ACAP
	Szulanski (1996)	271 respondents comment on 122 transfers of 38 practices/ technologies	Organizational learning/ strategic management	ACAP as predictor of effective transfer of best practices within the firm	9 measures that capture the ability to value, assimilate, and apply new technology	Lack of ACAP of the recipient is a major source of "stickiness," defined as difficulties in imitating best practices within a firm
	Veugelers (1997)	290 Flemish firms with active R&D units	Organizational learning/ innovation	ACAP is a moderator of level of innovative activity	ACAP as (1) R&D department fully staffed; (2) R&D departments with doctorates; (3) R&D departments engaged in fundamental research	When ACAP is present, external sources of R&D (e.g., from alliance partner) stimulate internal R&D spending; there is no similar effect when capacity is not present
	Cockburn & Henderson (1998)	68,186 publications in scientific journals	Industrial/organization economics	ACAP as predictor of research productivity	Not a direct operationalization of ACAP but is reflected by number of scientific publications	Developing ACAP is not adequate; connectedness to scientific community is a key factor in driving a firm's ability to recognize and use upstream research and findings
	Kim (1998)	Case study of a manufacturing firm (Hyundai Motor Co.)	Organizational learning theory; organizations as learning systems	Organizational learning is a function of ACAP; it is the capacity to assimilate knowledge (for imitation) and create new knowledge (for innovation)	Changes in firm orientation toward use of assimilated technology; transition from technology assimilation to imitate to development of internal R&D functions to innovate	ACAP is integral part of a learning system; creation of crises keeps firm on forefront of knowledge development through investment in learning and increased intensity of efforts to learn

[a] The studies listed are representative rather than exhaustive. We have chosen some original studies and some recent studies representing the three units of analysis for illustrative pruposes.

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

TABLE 2
Past Conceptualization of ACAP

Definition	Dimensions	Illustrative Studies
The ability to value, assimilate, and apply new knowledge (Cohen & Levinthal, 1990)	Ability to value knowledge through past experience and investment Ability to assimilate • based on knowledge characteristics • based on organizational or alliance dyad characteristics • based on technological overlap Ability to apply • based on technological opportunity (amount of external relevant knowledge) • based on appropriability (ability to protect innovation)	Boynton, Zmud, & Jacobs (1994); Cohen & Levinthal (1989, 1990); Cockburn & Henderson (1998); Lane & Lubatkin (1998); Mowery, Oxley, & Silverman (1996); Szulanski (1996)
A broad array of skills, reflecting the need to deal with the tacit components of transferred technology, as well as the frequent need to modify a foreign-sourced technology for domestic applications (Mowery & Oxley, 1995)	Human capital: • skill level of personnel • trained R&D personnel as percent of population • trained engineering graduates • R&D spending	Glass & Saggi (1998); Keller (1996); Kim & Dahlman (1992); Liu & White (1997); Luo (1997); Mowery & Oxley (1995); Veugelers (1997)
ACAP requires learning capability and develops problem-solving skills; learning capability is the capacity to assimilate knowledge—for imitation—and problem-solving skills to create new knowledge—for innovation (Kim, 1998)	Prior knowledge base; intensity of effort	Kim (1995, 1997a,b); Matusik & Heeley (2001); Van Wijk, Van den Bosch, & Volberda (2001)

flows of a firm's knowledge and relate these variables to the creation and sustainability of competitive advantage. Second, this definition suggests that the four capabilities that make up ACAP are combinative in nature and build upon each other to produce a dynamic organizational capability.

It is important to distinguish between capabilities and dynamic capabilities in order to appreciate the merits of our proposed definition. Winter views a capability as "a high level routine that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type" (2000: 983). Winter also notes that a capability is reflected in an activity that produces outputs that clearly matter to the organization's survival and prosperity. Examples of capabilities are Dell's streamlined production capabilities and Coca-Cola's global marketing capabilities. Dynamic capabilities, however, are geared toward effecting organizational change; they are essentially strategic in nature (Teece, Pisano, & Shuen, 1997) and, therefore, define the firm's path of evolution and development. Our definition suggests that the four organizational capabilities of knowledge acquisition, assimilation, transformation, and exploitation build on each other to yield ACAP—a dynamic capability that influences the firm's ability to create and deploy the knowledge necessary to build other organizational capabilities (e.g., marketing, distribution, and production). These diverse capabilities give the firm a foundation on which to achieve a competitive advantage that yields superior performance (Barney, 1991).

Thus, our definition subsumes the three definitions reported earlier in Table 2 and accounts for all their subcomponents. Mowery and Oxley

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

(1995) and Kim (1998) stress the importance of importing new knowledge, which forms the acquisition dimension. Cohen and Levinthal's (1990) definition highlights the assimilation and exploitation dimensions. Kim (1998) suggests that the ability to solve problems comes from modified knowledge, which is the basis for the transformation dimension. In Table 3 we relate each of the four dimensions that compose ACAP to its respective components, roles, and importance. These dimensions are discussed next.

Dimensions of ACAP

Table 3 highlights four distinct but complementary capabilities that compose a firm's ACAP: acquisition, assimilation, transformation, and exploitation. Following Eisenhardt and Martin (2000), we argue that although these capabilities have some commonalities across different firms and attain equifinality, they are idiosyncratic in the specific ways firms pursue, develop, and employ them. This variability gives firms a basis to develop different types of competitive advantage. Below we explain each capability and how they are combined to produce a firm's ACAP.

Acquisition. Acquisition refers to a firm's capability to identify and acquire externally generated knowledge that is critical to its operations. Effort expended in knowledge acquisition routines has three attributes that can influence ACAP: intensity, speed, and direction. The intensity and speed of a firm's efforts to identify and gather knowledge can determine the quality of a firm's acquisition capabilities. The greater the effort, the more quickly the firm will build requisite capabilities (Kim, 1997a,b). Obviously, there are limits to a firm's ability to achieve this speed, because learning cycles cannot be shortened easily and some of the resources needed to build ACAP are not quickly assembled (Clark & Fujimoto, 1991). The direction of accumulating knowledge can also influence the paths that the firm follows in obtaining external knowledge. These activities vary in their richness and complexity, highlighting a need to have different areas of expertise within a firm to successfully import external technologies (Rocha, 1997).

Assimilation. Assimilation refers to the firm's routines and processes that allow it to analyze, process, interpret, and understand the information obtained from external sources (Kim, 1997a,b; Szulanski, 1996). Ideas and discoveries that fall beyond a firm's search zone are overlooked because the firm cannot easily comprehend them (Cyert & March, 1963; Rosenkopf & Nerkar, 2001). Externally acquired knowledge may embody heuristics that differ significantly from those used by the firm, delaying comprehension of the knowledge (Leonard-Barton, 1995). External knowledge is also context spe-

TABLE 3
Dimensions of ACAP: A Reconceptualization of Components and Corresponding Roles

Dimensions/Capabilities	Components	Role and Importance	Citations
Acquisition	• Prior investments • Prior knowledge • Intensity • Speed • Direction	• Scope of search • Perceptual schema • New connections • Speed of learning • Quality of learning	Boynton, Zmud, & Jacobs (1994); Cohen & Levinthal (1990); Keller (1996); Kim (1998); Lyles & Schwenk (1992); Mowery, Oxley, & Silverman (1996); Van Wijk, Van den Bosch, & Volberda (2001); Veugelers (1997)
Assimilation	Understanding	• Interpretation • Comprehension • Learning	Dodgson (1993); Fichman & Kemerer (1999); Kim (1998); Lane & Lubatkin (1998); Szulanski (1996)
Transformation	• Internalization • Conversion	• Synergy • Recodification • Bisociation	Fichman & Kemerer (1999); Koestler (1966); Kim (1997b, 1998); Smith & DeGregorio (in press)
Exploitation	• Use • Implementation	• Core competencies • Harvesting resources	Cohen & Levinthal (1990); Dodgson (1993); Kim (1998); Lane & Lubatkin (1998); Szulanski (1996); Van den Bosch, Volberda, & de Boer (1999); Van Wijk, Van den Bosch, & Volberda (2001)

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

cific, which often prevents outsiders from understanding or replicating this knowledge (Szulanski, 1996). Comprehension is especially difficult when the value of knowledge depends on the existence of complementary assets that may not be available to the recipient firm (Teece, 1981). Comprehension, however, promotes knowledge assimilation that allows firms to process and internalize externally generated knowledge.

Transformation. Transformation denotes a firm's capability to develop and refine the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge. This is accomplished by adding or deleting knowledge or simply by interpreting the same knowledge in a different manner. Transformation changes the character of knowledge through bisociation, which occurs when a situation or idea is perceived in "two self-consistent but incompatible frames of reference" (Koestler, 1966: 35). Thus, the ability of firms to recognize two apparently incongruous sets of information and then combine them to arrive at a new schema represents a transformation capability. This capability, which arises from the bisociation process, shapes the entrepreneurial mindset (McGrath & MacMillan, 2000) and fosters entrepreneurial action (Smith & DeGregorio, 2002). It yields new insights, facilitates the recognition of opportunities, and, at the same time, alters the way the firm sees itself and its competitive landscape. It is in these varied activities that the genesis of new competencies can be found. Research into strategic change highlights the importance of new knowledge for reframing the firm's definition of the industry and competitive strategy (e.g., Christensen, Suarez, & Utterback, 1998). In research in entrepreneurship and the growth of firms, including new ventures, scholars make a similar claim (e.g., Zahra, Ireland, & Hitt, 2000). Recognizing the transformation component of ACAP, therefore, helps to open the black box that has dominated prior research on organizational transformation and strategic change.

Exploitation. Cohen and Levinthal's (1990) definition of ACAP emphasizes the application of knowledge. We build on this insight by incorporating exploitation as a dimension of ACAP. Exploitation as an organizational capability is based on the routines that allow firms to refine, extend, and leverage existing competencies or to create new ones by incorporating acquired and transformed knowledge into its operations. The primary emphasis is on the routines that allow firms to exploit knowledge. Firms may be able to exploit knowledge serendipitously, without systematic routines. However, the presence of such routines provides structural, systemic, and procedural mechanisms that allow firms to sustain the exploitation of knowledge over extended periods of time. Exploitation reflects a firm's ability to harvest and incorporate knowledge into its operations (Tiemessen, Lane, Crossan, & Inkpen, 1997; Van den Bosch et al., 1999). It requires retrieving knowledge that has already been created and internalized for use (Lyles & Schwenk, 1992). The outcomes of systematic exploitation routines are the persistent creation of new goods, systems, processes, knowledge, or new organizational forms (Spender, 1996). Exploitation is evident, for example, in new ventures that capture knowledge from their market, competition, and customers, and then in which knowledge is used to create new competencies. Similarly, successful established companies are likely to establish routines that target and deploy their knowledge to enhance existing initiatives or encourage new initiatives within a firm (Rumelt, 1987).

The above discussion clarifies the four dimensions of ACAP. We now turn our attention to how these dimensions build upon each other to make ACAP into a coherent dynamic capability that fosters organizational change and evolution. To do so, we posit that acquisition and assimilation capabilities are dimensions of "potential" capacity and that transformation and exploitation capabilities are dimensions of "realized" capacity. We suggest that potential and realized capacities are two components of ACAP. Below we discuss their role and importance.

Potential and Realized ACAP

Potential ACAP (PACAP) makes the firm receptive to acquiring and assimilating external knowledge (Lane & Lubatkin, 1998). It captures Cohen and Levinthal's (1990) description of a firm's capability to value and acquire external knowledge but does not guarantee the exploitation of this knowledge. Realized ACAP (RACAP) is a function of the transformation and exploitation capabilities discussed earlier. RACAP reflects the firm's capacity to leverage the knowledge that has been absorbed.

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

PACAP and RACAP have separate but complementary roles. Both subsets of ACAP coexist at all times and fulfill a necessary but insufficient condition to improve firm performance. For example, firms cannot possibly exploit knowledge without first acquiring it. Similarly, firms can acquire and assimilate knowledge but might not have the capability to transform and exploit the knowledge for profit generation. Therefore, a high PACAP does not necessarily imply enhanced performance. RACAP involves transforming and exploiting the assimilated knowledge by incorporating it into the firm's operations, thereby improving its performance.

We term the ratio of RACAP to PACAP as the *efficiency factor* (η). The efficiency factor suggests that firms vary in their ability to create value from their knowledge base because of variations in their capabilities to transform and exploit knowledge. In firms with a high efficiency factor, RACAP approaches PACAP. Given that profits are created primarily through RACAP (Grant, 1996a,b), firms that achieve or maintain a high efficiency factor are positioned to increase their performance.

Baker, Miner, and Eesley (in press) conclude that firms develop improvisational learning skills that differ from their innovation execution skills. These authors found that some firms possessed a strong ingenuity to understand complex technical problems but were not as effective in translating such knowledge into product innovation strategies. This corroborates the need to distinguish between the capabilities to acquire and assimilate knowledge (PACAP) and the capabilities to transform and exploit this knowledge (RACAP) and to account for the efficiency with which organizations leverage both PACAP and RACAP.

The theoretical distinction between PACAP and RACAP is important in evaluating their unique contributions to a firm's competitive advantage. First, this distinction helps explain why certain firms are more efficient than others in using ACAP. Despite the importance of PACAP, RACAP is the primary source of performance improvements. Distinguishing between PACAP and RACAP shows that some firms are inefficient in leveraging their PACAP and therefore cannot improve performance. It also shows the different ways these two components contribute toward building the firm's competitive advantage. Second, exogenous and endogenous forces, which we discuss later, may differentially influence potential and realized ACAP, indicating that different managerial roles are necessary to nurture and harvest these two components of ACAP. And third, distinguishing between PACAP and RACAP provides a basis for observing and examining the fluid and nonlinear paths that organizations may follow in developing their core competencies. Making the distinction between PACAP and RACAP can allow researchers to study why some firms fail because of changes in the external environments, such as technological lockout or industry shocks (Bower & Christensen, 1995), while others thrive under the same conditions.

A MODEL OF ACAP

Here we advance a model that connects the antecedents, moderators, and outcomes of this construct (Figure 1). This model highlights external sources of knowledge and experience as key antecedents of ACAP. It also suggests when certain triggers activate ACAP. The discussion indicates that both PACAP and RACAP differentially contribute to competitive advantage.

Antecedents of ACAP

External sources and knowledge complementarity. Figure 1 suggests that external knowledge sources, in various forms, significantly influence PACAP. Relevant prior knowledge forms the content of a firm's ACAP (Ford, 1996; Schilling, 1998). External knowledge sources include acquisitions (Chaudhuri & Tabrizi, 1999); purchasing, through licensing and contractual agreements (Granstrand & Sjolander, 1990); and interorganizational relationships, including R&D consortia, alliances, and joint ventures (Vermeulen & Barkema, 2001). A firm's exposure to knowledge within its environment will influence decision making (March & Simon, 1993) and the development of future capabilities (McGrath, MacMillan, & Venkataraman, 1995). Van Wijk and colleagues (2001) confirm that the breadth and depth of knowledge exposure positively influence a firm's propensity to explore new and related knowledge. Clearly, firms acquire knowledge from different sources in their environment, and the diversity of these sources significantly influences the acquisition and

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

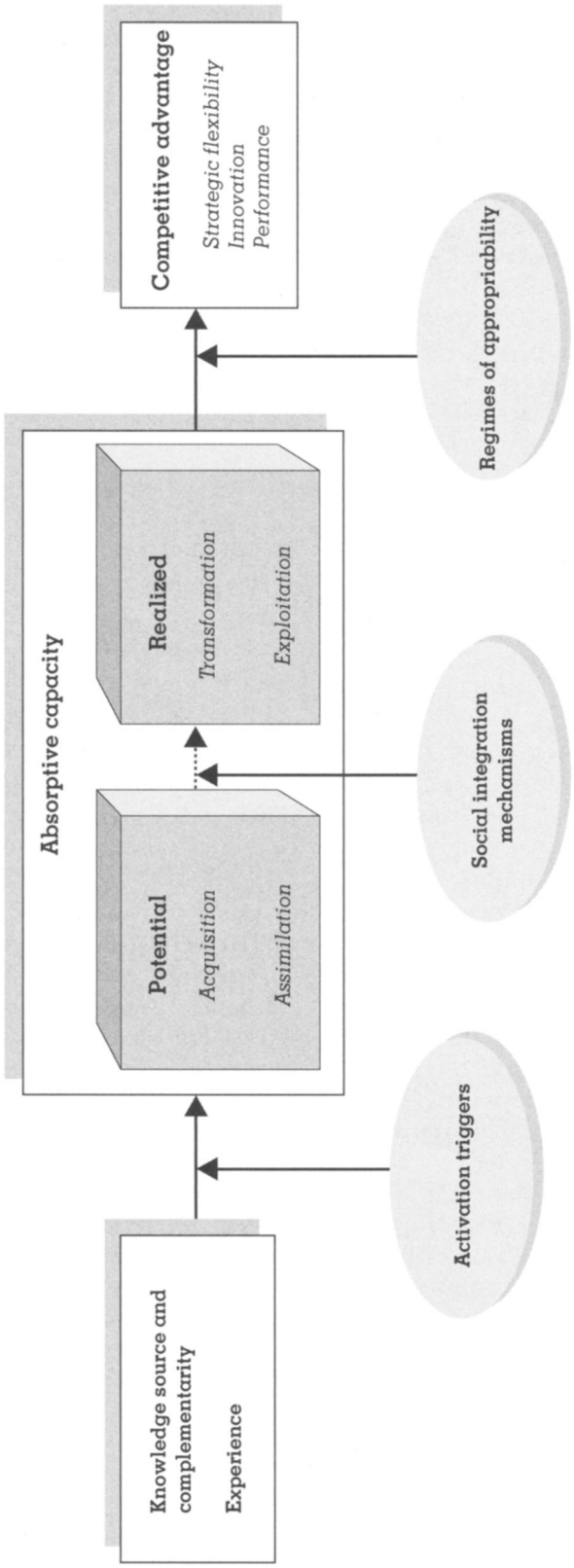


FIGURE 1
A Model of ACAP

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

assimilation capabilities that constitute their PACAP.

Exposure to knowledge per se does not guarantee that a firm will have higher levels of ACAP (Matusik, 2000). Exposure to diverse sources does not necessarily lead to PACAP development, especially if these sources have low knowledge complementarity with the firm. Lofstrom (2000) reports that knowledge complementarity, defined as the extent to which knowledge is related to and at the same time different from the knowledge of contacts in their information networks, is positively related to a firm's learning. This suggests that the diversity of exposure and the degree of overlap between the knowledge bases of the external source and the firm can enhance the firm's PACAP (Cockburn & Henderson, 1998; Lane & Lubatkin, 1998; Matusik & Heeley, 2001). Therefore, we posit the following.

Proposition 1: The greater a firm's exposure to diverse and complementary external sources of knowledge, the greater the opportunity is for the firm to develop its PACAP.

Experience. Past experience defines the locus of a firm's technological search (Rosenkopf & Nerkar, 2001)—firms search for information in areas where they have had past successes (Christensen, 1998; Cyert & March, 1963). By directing knowledge search areas, past experience influences the development of future acquisition capabilities. Firms gain experience through exposure to, impact of, and knowledge of particular skills and capabilities (Hedberg, 1981; Herriot, Levinthal, & March, 1985). Experience is the product of environmental scanning (Fahey, 1999), benchmarking (Garvin, 1993; Stata, 1989), interactions with customers (Nonaka & Takeuchi, 1995), and alliances with other firms (Lane & Lubatkin, 1998). Some experiences are also gained from learning-by-doing (Levitt & March, 1988; Rosenberg, 1982), which enables the firm to develop new routines (Nelson & Winter, 1982) that influence the locus of a firm's future search for knowledge.

Experience is also closely connected to organizational memory (Walsh & Ungson, 1991)—the depository of a firm's knowledge (Herriot et al., 1985). Moorman and Miner (1996), for example, conclude that organizational memory is closely related to new product development and product performance. Consequently, these authors posit that memory affects new product development by influencing the process by which firms interpret incoming information and act upon it. Similarly, Tripsas and Gavetti (2000) observe that experience significantly influences managerial cognition, which eventually determines a firm's ability to manage knowledge. Thus, a firm's PACAP is a path-dependent capability that is influenced by its past experiences that are internalized as organizational memory. As experience reflects a firm's successes and failures over time (Nelson & Winter, 1982), it can also significantly determine how firms acquire and assimilate new knowledge, as well as the locus of their future technological search. An outcome of continued exploration in a firm's search zone is a more developed and refined capability to acquire and assimilate external knowledge, which increases PACAP.

Proposition 2: Experience will influence the development of a firm's PACAP. Specifically, experience influences the locus of search and the development of path-dependent capabilities of acquisition and assimilation of externally generated knowledge.

Activation triggers. As indicated in Figure 1, we expect activation triggers to moderate the impact of knowledge sources and experience on ACAP development. Triggers are events that encourage or compel a firm to respond to specific internal or external stimuli (Walsh & Ungson, 1991; Winter, 2000). Internal triggers could be in the form of organizational crises, such as performance failure, or important events that redefine a firm's strategy (e.g., mergers). Kim (1998) illustrates that a crisis, although a negative event, can intensify a firm's efforts to achieve and learn new skills and to develop new knowledge that increases ACAP. Crises threaten a firm's existence, possibly stimulating learning (Winter, 2000) and leading it to explore, acquire, and internalize external knowledge (Kim, 1997a). External triggers are events that may influence the future of the industry in which the firm operates (Bower & Christensen, 1995). They include radical innovations, technological shifts, emer-

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

gence of a dominant design, and changes in government policy, among others.

Internal and external triggers induce or intensify a firm's efforts to seek external knowledge (Huber, 1991; Winter, 2000). When triggers are wide in their scope and potential impact or are persistent, firms are likely to seek external knowledge. However, some triggers may require a different type of knowledge that is not available within the firm or is not easily acquired on the market (Chaudhuri & Tabrizi, 1999). As the intensity of triggers increases, the firm invests heavily in building its ACAP. For instance, a change in the dominant design within an industry will compel the firm to expend effort in acquiring the information necessary to develop the new technology—a process that will broaden its PACAP. Similarly, Kim (1998) provides the example of Hyundai's creating a sense of crisis as an organizational response to galvanize the effort and investment necessary to acquire knowledge to develop its own innovative lineup of automobiles. Therefore, as the intensity of a trigger increases, firms are likely to allocate additional resources needed to develop the capabilities to acquire and assimilate externally generated knowledge.

The source of a trigger is likely to influence the locus of technological search (Doz, Olk, & Ring, 2000). Radical technological shifts encourage a firm to invest resources in acquiring specific information relevant to the new technology, thereby determining the locus of its search and the content of information sought (Rosenkopf & Nerkar, 2001). The intensity of the trigger will influence a firm's investments in developing the capabilities to acquire and assimilate this knowledge, with the intention of exploiting it to improve firm performance or avoiding a technological lockout (Tegarden, Hatfield, & Echols, 1999). This discussion suggests the following proposition.

> *Proposition 3: Activation triggers will influence the relationship between the source of knowledge and experience and PACAP. Specifically, the source of an activation trigger will influence the locus of search for external sources of knowledge while the intensity of the trigger will influence the investments in developing the requisite acquisition and assimilation capabilities.*

Social Integration Mechanisms and the Efficiency Factor (η) in ACAP

Knowledge exploitation requires the sharing of relevant knowledge among members of the firm (Spender, 1996) in order to promote mutual understanding and comprehension (Garvin, 1993). Social integration mechanisms can facilitate the sharing and eventual exploitation of knowledge. Firms do not always foster the effective sharing or integration of knowledge, however. Structural (Garvin, 1993), cognitive (Garud & Nayyar, 1994), behavioral (David, 1985), and political (Foster, 1986) barriers may stifle knowledge sharing and integration. Nahapiet and Ghoshal (1998) suggest that structural, cognitive, and relational dimensions of social interaction also influence the creation of intellectual capital.

Social integration contributes to knowledge assimilation, occurring either informally (e.g., social networks) or formally (e.g., use of coordinators). Informal mechanisms are useful in exchanging ideas, but formal mechanisms have the advantage of being more systematic. Formal social integration facilitates distributing information within the firm as well as gathering interpretations and identifying trends. For example, Sheremata (2000) observes that certain organizational structures increase employee interaction, promoting problem solving and creative action. Firms that use social integration mechanisms that build such connectedness are therefore positioned to make their employees aware of the types of data that constitute their PACAP. These mechanisms also facilitate the free flow of information (Sheremata, 2000), allowing the firm to transform and exploit this information (Chaudhuri & Tabrizi, 1999). These observations suggest the following.

> *Proposition 4: Use of social integration mechanisms reduces the gap between PACAP and RACAP, thereby increasing the efficiency factor (η). Social integration mechanisms lower the barriers to information sharing while increasing the efficiency of assimilation and transformation capabilities.*

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

ACAP and Sustainable Competitive Advantage

One source of intraindustry performance variations lies in the differences in firms' utilization of organizational resources and capabilities (Spender, 1996; Teece et al., 1997). When resources are valuable, rare, inimitable, and nonsubstitutable, they can give the firm a competitive advantage (Barney, 1991). A firm's capability to effectively create, manage, and exploit knowledge is one such critical resource (Matusik & Hill, 1998). As a bundle of knowledge-based capabilities, therefore, ACAP can be a source of a firm's competitive advantage.

While there are many ways a firm can achieve a competitive advantage, two of the most important in dynamic markets are innovation and strategic flexibility (Barney, 1991). The transformation and exploitation capabilities that RACAP comprises are likely to influence firm performance through product and process innovation. For instance, Kazanjian, Drazin, and Glynn (in press) observe that firms require knowledge leveraging and recombining skills to pursue product line extension or new product development. RACAP includes transformation capabilities, which, through the process of bisociation, help firms to develop new perceptual schema or changes to existing processes. Exploitation capabilities take this a step further and convert knowledge into new products (Kogut & Zander, 1996). Given that RACAP is based on knowledge exploitation (March, 1991), it enhances performance (Liebeskind, 1996) and yields a competitive advantage.

In explaining why firms exhibit performance differences, Eisenhardt and Martin (2000) note that firms begin their capability development from different starting points. Over time, however, these capabilities converge to an industry standard wherein competitor capabilities are similar in key attributes. This equifinality makes sustaining a competitive advantage difficult, because capabilities may be fungible and easily substituted owing to commonalities in their key attributes.

Using a simulation study, Zott (2001) departs from this conclusion by suggesting that the timing of capability deployment and the differential costs associated with organizational change among firms will sustain performance differences across firms. Similarly, in a study of pharmaceutical firms, Cockburn, Henderson, and Stern (2000) conclude that although there may be equifinality in capabilities, the key to a competitive advantage lies in the firm's ability to identify and respond to environmental cues well in advance of performance-oriented payoffs. This indicates that firms may possess similar capabilities, but performance differences arise from the different developmental paths firms follow and the timing of deployment of these capabilities.

In Proposition 2 we note that the development of a firm's PACAP is path dependent and influenced by its past experience. This path dependence in developing capabilities can determine a firm's success or failure. For instance, Ahuja and Lampert (2001) observe that firms may fall into three types of competence traps: familiarity, maturity, and propinquity. Familiarity traps result from an overemphasis on refining and improving existing knowledge, preventing the firm from exploring alternate knowledge sources and limiting the organization's cognitive schemas. Maturity traps result from a need to have reliable and predictable outputs, which can limit knowledge exploration. Propinquity (nearness) traps reflect a firm's disposition to explore knowledge in areas closest to its existing expertise, precluding an examination of radical shifts in the industry. These competence traps cause firms to get blindsided by radical innovations that can transform their industry, leading to the firms' failure (Christensen, 1997; Zajac & Bazerman, 1991). Some scholars have highlighted the importance of overcoming such competence traps in organizational learning or risk missing the window of opportunity during industry upheaval (Tyre & Orlikowski, 1994; Winter, 2000).

Firms with well-developed capabilities of acquisition and assimilation (PACAP) are likely to be more adept at continually revamping their knowledge stock by spotting trends in their external environment and internalizing this knowledge, thus overcoming some of the competence traps discussed above. Being adept has two dimensions: timing and costs. First, a developed PACAP helps firms track changes in their industries more effectively and therefore facilitates the deployment of necessary capabilities, such as production and technological competen-

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

cies, at the opportune moment. For example, Lei, Hitt, and Bettis (1996) argue that core competencies that are grounded in learning form the basis of sustained competitive advantage.

Second, given that capabilities are captured in a firm's routines, as the firm gains experience and manages its routines more effectively, the costs associated with capability development decrease over time. A developed PACAP reduces sunk investments in changing the firm's resource positions and operational routines. The costs of change are likely to be low when firms have accumulated adequate knowledge and prior experience with the new knowledge or skill base (Teece et al., 1997; Zander & Kogut, 1995; Zott, 2001).

PACAP plays an important role in renewing a firm's knowledge base and the skills necessary to compete in changing markets. Firms that are flexible in using their resources and capabilities can reconfigure their resource bases to capitalize upon emerging strategic opportunities (Raff, 2000). These opportunities may help the firms sustain superior performance because of first mover advantages (Ferrier, Smith, & Grimm, 1999), responsiveness to customers (Matusik & Hill, 1998), or other strategic advantages. Thus, the components of ACAP could lead to and sustain a competitive advantage when deployed judiciously and in combination with a firm's other complementary assets and resources.

> *Proposition 5: Firms with well-developed capabilities of knowledge transformation and exploitation (RACAP) are more likely to achieve a competitive advantage through innovation and product development than those with less developed capabilities.*

> *Proposition 6: Firms with well-developed capabilities of knowledge acquisition and assimilation (PACAP) are more likely to sustain a competitive advantage because of greater flexibility in reconfiguring their resource bases and in effectively timing capability deployment at lower costs than those with less developed capabilities.*

One factor that can affect a firm's sustained competitive advantage is the regime of appropriability that dominates its industry. Regime of appropriability refers to the institutional and industry dynamics that affect the firm's ability to protect the advantages of (and benefit from) new products or processes (Antonelli, 1999; Buzzacchi, Colombo, & Mariotti, 1995). When appropriability is low (i.e., there is a high level of knowledge spillovers), investments in ACAP are likely to be low (Spence, 1984). These investments might be unwise, because imitation by rivals might be widespread (Boisot & Griffiths, 1999). However, Cohen and Levinthal (1990) note that the positive absorption incentive associated with spillovers may be sufficiently strong in some cases to offset the negative appropriability incentive. This indicates that when regimes of appropriability are strong, the payoff from RACAP will be high, because firms can protect their knowledge assets and continue to generate profits from such inventions. When strong appropriability regimes exist, firms will patent their innovations and protect revenue streams arising from innovations (Anton & Yao, 2000). These strong regimes imply that imitation is likely to be more difficult because of the increased costs incurred by rivals for knowledge replication, leading to performance differences across firms.

Under weak regimes of appropriability, dynamic capabilities may sustain performance differences in the presence of isolating mechanisms, defined as idiosyncratic features of a firm's management that create impediments to imitation (Rumelt, 1987). Zott (2001) notes that barriers to imitation do not serve to create a competitive advantage. He argues instead that these barriers are purely defensive in nature and contribute to sustaining and possibly reinforcing an already existing competitive advantage.

One such isolating mechanism is secrecy in routines and processes. A survey of manufacturing firms by Cohen, Nelson, and Walsh (2000) shows that some firms prefer secrecy over patenting, which may provide competitors with too much information. Inventions often have limited legal protection, because the information disclosure within patents may provide enabling information for other firms to circumvent the process and yet achieve the desired output (Anton & Yao, 2000). Thus, under weak regimes of appropriability, firms are likely to sustain performance differences by

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

instituting isolating mechanisms, potentially decreasing knowledge spillovers.

Implicit in the definition of ACAP is the notion that such capabilities may be socially complex and difficult to imitate (Teece et al., 1997). The above discussion suggests that firms can sustain performance differences under differing regimes of appropriability when they institute and use isolating mechanisms. In industries with low appropriability regimes, firms have to exert more effort into building their ACAP to develop their own innovation capabilities, rather than depend upon information disclosure and possible knowledge spillovers from other firms. These investments generate positive economic returns over the long run by allowing firms to develop breakthrough inventions.

Proposition 7: The regime of appropriability moderates the relationship between RACAP and sustainable competitive advantage, specifically as described below.

Proposition 7a: Under strong regimes of appropriability, there will be a significant and positive relationship between RACAP and a sustainable competitive advantage because of the higher costs associated with imitation.

Proposition 7b: Under weak regimes of appropriability, there will be a significant and positive relationship between RACAP and a sustainable competitive advantage only when firms protect their knowledge assets and capabilities through isolating mechanisms. If not, such a relationship is likely to be weak or nonexistent.

FUTURE RESEARCH DIRECTIONS

Recent research highlights the role of a firm's dynamic capabilities as a critical source of its competitive advantage (Helfat & Raubitschek, 2000; Teece et al., 1997; Winter, 2000). Eisenhardt and Martin (2000) note that dynamic capabilities are essential, but how such capabilities can help firms reconfigure their resources to changing environmental conditions is more important for sustaining a competitive advantage. Other researchers argue that the timing and costs of capability deployment would help firms create and sustain performance differences (Cockburn et al., 2000; Zott, 2001). We contribute to this growing body of literature by unraveling how a firm's ACAP could be a primary source of creating and sustaining a competitive advantage—opening the black box of the sustainability of competitive advantage in dynamic markets and thereby extending Eisenhardt and Martin's (2000) work.

ACAP provides rich and fruitful avenues for future research. Although researchers have used this construct in previous empirical work, this article provides a foundation for future work using ACAP, based on three primary contributions. First, by reviewing prior research (Tables 1 and 2) and delineating four dimensions, we define and clarify the dimensionality of this complex construct and the dimensions' respective roles and importance (Table 3). Second, the distinction between PACAP and RACAP suggests that externally acquired knowledge undergoes multiple iterative processes before the recipient firm can successfully exploit it to achieve a competitive advantage. Distinguishing between PACAP and RACAP is useful as well in explaining success levels with knowledge management. Although Cohen and Levinthal's (1990) definition emphasizes the application of acquired knowledge, past researchers have overlooked PACAP. Our proposed reconceptualization corrects this oversight. Also, the introduction of the efficiency factor may provide an explanation of why certain firms that possess the potential do not maximize economic value from knowledge management. Third and finally, this article makes clear that in past studies researchers fall short by overlooking the contingent conditions under which ACAP could lead to a competitive advantage. To remedy this situation, we offer a model (Figure 1) that links the components of ACAP to value creation, highlighting potential sources, reasons, and conditions under which the components of ACAP create and sustain performance differences across firms, which is a fundamental question in the field.

Taken together, these three contributions represent a departure from the prevailing view of ACAP. In Table 4 we contrast the traditional view with our proposed reconceptualization. Clearly, we make key distinctions with regard to

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

TABLE 4
Comparing Conceptualizations of ACAP

Issue	Traditional View of ACAP	Reconceptualization of ACAP
Definition	• A firm's ability to value, assimilate, and apply information toward commercial ends • Emphasis on acquiring and exploiting externally generated knowledge	• ACAP is a set of organizational routines and strategic processes by which firms acquire, assimilate, transform, and exploit knowledge for purpose of value creation • Emphasis on dynamic capabilities geared toward strategic change and flexibility wherein firms create and exploit new knowledge by transforming acquired knowledge
Dimensions and components	• Multidimensional definition with three dimensions • Operationalized as a single factor component	• Multidimensional definition with four dimensions • Four dimensions form two distinct components (potential and realized capacities)
Evolution and development	• Dependent on a firm's prior knowledge base and skills • Unidirectional and patterned developmental path (prior knowledge defines firm's ability to value, assimilate, and apply information)	• Dependent on multiple factors, including a firm's past experience, knowledge complementarity, and diversity of knowledge sources • Multidirectional and nonpatterned (fluid) developmental path (locus of search is continually redefined)
Contingent factors and managerial roles	• Exogenous (industry conditions influence firm's investment in R&D) • Managerial roles restricted to environmental scanning and R&D investment	Multiple exogenous and endogenous contingencies: • Exogenous contingencies (appropriability, external triggers) • Endogenous contingencies (internal triggers, social integration mechanisms) • Broader managerial roles in influencing knowledge search patterns, activation of organizational triggers, and transformation of organizational knowledge
Value creation	Value creation through innovation	Value creation differentially derived from the dimensions that comprise the two components; realized capacity allows creation of a competitive advantage; potential capacity provides strategic flexibility to change and reconfigure firm operations, providing means to sustain such performance differences; presence of efficiency factor between potential and realized capacity

ACAP definition, dimensions, evolution and development, contingent factors and managerial roles, and value creation. A key difference lies in our definition of ACAP as a set of knowledge-based capabilities embedded within the firm's routines and strategic processes. We adopt a dynamic view by suggesting that ACAP follows a multidirectional and fluid path, rather than a patterned trajectory of knowledge acquisition and exploitation. We also suggest that past experience, knowledge complementarity, and diversity of knowledge sources influence PACAP development. However, activation triggers may redefine a firm's locus of search, reconfiguring

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

its PACAP over time and making developmental paths fluid and multidirectional. This proposition moves us one step closer to understanding the sustainability of competitive advantage over time.

Table 4 also highlights the influence of contingent factors and managerial roles on ACAP development. Although the model highlights exogenous and endogenous variables that may affect ACAP or the value generated from its exploitation, our discussion has not directly addressed the role of managers in ACAP development. Prior prescriptions of managerial roles for developing ACAP have emphasized environmental scanning and changes in R&D investments (e.g., Cohen & Levinthal, 1989, 1990). However, the proposed definition and model of ACAP offer a more inclusive and broader role of managers in developing ACAP. Viewing ACAP as a dynamic capability suggests that it can be formulated and implemented with the specific intent to acquire, assimilate, transform, and exploit knowledge. The process of bisociation also suggests that knowledge transformation occurs when managers combine two incongruous frames of reference to arrive at new knowledge that can be exploited for generating profits. This discussion is consistent with empirical research by Hitt, Bierman, Shimizu, and Kochhar (2000), who highlight the importance of having the requisite human capital necessary to harvest and exploit the firm's knowledge base—a process that gives the firm a competitive advantage that improves performance. Floyd and Lane (2000) also discuss the various activities managers at different organizational levels can undertake to exploit the knowledge that resides in the firm's operations, aiming to bring about strategic renewal that improves firm performance.

Through the definition, dimensions, and model of ACAP advanced in this article, we identify opportunities for future research. First, there is a clear need to capture the individual capabilities that constitute a firm's ACAP. Our review of empirical work indicates that measures have been rudimentary and do not fully reflect the richness of the construct (Table 1). Clarifying and describing each dimension allow future researchers to isolate and capture underlying dimensions. Second, researchers need to recognize the temporal aspects of capability development. As capabilities develop over time, examining the origins, timing, and pacing of such development would enrich the literature. Third, researchers modeling ACAP would better serve us if they considered the contingencies and boundary conditions of ACAP development. Although this issue has been partially addressed in past work, we need to further expand our understanding of this construct. Finally, researchers need to measure and relate the potential and realized capacities to multiple outcomes. Payoffs from PACAP and RACAP offer interesting combinations to investigate over time, as illustrated in studies on capability development at Barnes & Noble (Raff, 2000) or at Hyundai (Kim, 1998).

Future research needs to address the specific operationalization of the capabilities that ACAP comprises. Substantial differences exist among these dimensions, which allow them to coexist and be measured and validated independently. Table 3 highlights the underlying rationale for each dimension and could be a useful tool to help develop measures. It is important to focus on the routines and processes that organizations use to acquire, assimilate, transform, and exploit knowledge. To complement the focus on underlying capabilities, researchers might use additional measures of these dimensions. For example, researchers might employ "years of experience of the R&D department" or "amount of R&D investment" as measures of knowledge acquisition. Assimilation can be measured by "the number of cross-firm patent citations" or "the number of citations made in a firm's publications to research developed in other firms" (Cockburn & Henderson, 1998). Transformation could be captured as "the number of new product ideas" or "new research projects initiated" (Leonard-Barton, 1995). Finally, exploitation could include intermediate outputs, such as "the number of patents," "new product announcements," or "length of product development cycle."

The efficiency factor, presented earlier, also provides new opportunities for research. For instance, researchers might use survey instruments and interview data to capture the four dimensions of ACAP, the magnitude of the efficiency ratio, and its effects on future performance. Archival data can capture historical ac-

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

tivities, whereas survey and interview data can gauge attitudes and ongoing activities. Data collected and analyzed over multiple time horizons may also reveal the relative importance of the efficiency factor at different points in time. Firms with high efficiency ratios are also likely to continually renew their operations and enjoy superior performance, especially in knowledge-intensive industries.

CONCLUSION

Ten years after Cohen and Levinthal's introduction of the notion of ACAP in the management literature, it is prudent to redefine and refocus research on this important construct. We hope that this article encourages future research on the dimensions and contributions of the construct. It is reassuring that researchers in diverse organizational disciplines have recognized the explanatory power of ACAP, and we hope that their future uses of this concept will show greater recognition of its multiple dimensions and their links to creating and sustaining a competitive advantage.

REFERENCES

Ahuja, G., & Lampert, C. 2001. Entrepreneurship in the large corporation: A longitudinal study of how established firms create breakthrough inventions. ***Strategic Management Journal,*** 22: 521–544.

Anton, J. J., & Yao, D. A. 2000. ***Little patents and big secrets: Managing intellectual property.*** Paper presented at the Harvard Business School Strategy Research Conference, New Haven, CT.

Antonelli, C. 1999. The evolution of the industrial organisation of the production of knowledge. ***Cambridge Journal of Economics,*** 23: 243–260.

Baker, T., Miner, A., & Eesley, D. In press. Improvising firms: Bricolage, retrospective interpretation and improvisational competencies in the founding process. ***Research Policy.***

Barney, J. 1991. Firm resources and sustained competitive advantage. ***Journal of Management,*** 17: 771–792.

Boisot, M., & Griffiths, D. 1999. Possession is nine tenths of the law: Managing a firm's knowledge base in a regime of weak appropriability. ***International Journal of Technology Management,*** 17: 662–676.

Bower, J., & Christensen, C. 1995. Disruptive technologies: Catching the wave. ***Harvard Business Review,*** 73(1): 43–53.

Boynton, A., Zmud, R., & Jacobs, G. 1994. The influence of IT management practice on IT use in large organizations. ***MIS Quarterly,*** 18: 299–320.

Buzzacchi, L., Colombo, M. G., & Mariotti, S. 1995. Technology regimes and innovation in services: The case of the Italian banking industry. ***Research Policy,*** 24: 151–168.

Chaudhuri, S., & Tabrizi, B. 1999. Capturing the real value in high-tech acquisitions. ***Harvard Business Review,*** 77(5): 123–130.

Christensen, C. 1997. ***The innovator's dilemma: When new technologies cause great firms to fail.*** Cambridge, MA: Harvard Business School Press.

Christensen, C. 1998. Why great companies lose their way. ***Across the Board,*** 35(9): 36–41.

Christensen, C., Suarez, F., & Utterback, J. 1998. Strategies for survival in fast changing industries. ***Management Science,*** 44(12): S207–S220.

Clark, K. B., & Fujimoto, T. 1991. ***Product development performance.*** Boston: Harvard Business School Press.

Cockburn, I., & Henderson, R. 1998. Absorptive capacity, coauthoring behavior, and the organization of research in drug discovery. ***Journal of Industrial Economics,*** 46: 157–183.

Cockburn, I., Henderson, R., & Stern, S. 2000. Untangling the origins of competitive advantage. ***Strategic Management Journal,*** 21: 1123–1146.

Cohen, W. M., & Levinthal, D. A. 1989. Innovation and learning: The two faces of R&D. ***Economic Journal,*** 99: 569–596.

Cohen, W. M., & Levinthal, D. A. 1990. Absorptive capacity: A new perspective on learning and innovation. ***Administrative Science Quarterly,*** 35: 128–152.

Cohen, W. M., Nelson, R. R., & Walsh, J. 2000. ***Protecting their intellectual assets: Appropriability conditions and why manufacturing firms patent (or not).*** Working paper No. 7552, National Bureau of Economic Research, Cambridge, MA.

Cyert, R., & March, J. 1963. ***A behavioral theory of the firm.*** Englewood Cliffs, NJ: Prentice-Hall.

David, P. A. 1985. Clio and the economics of QWERTY. ***American Economic Review,*** 75: 332–337.

Dodgson, M. 1993. Organizational learning: A review of some literature. ***Organization Studies,*** 14: 375–394.

Doz, Y. L., Olk, P. M., & Ring, P. S. 2000. Formation processes of R&D consortia: Which path to take? Where does it lead? ***Strategic Management Journal,*** 21: 239–266.

Eisenhardt, K. M., & Martin, J. A. 2000. Dynamic capabilities: What are they? ***Strategic Management Journal,*** 21: 1105–1121.

Fahey, L. 1999. ***Outwitting, outmaneuvering, and outperforming competitors.*** New York: Wiley.

Ferrier, W., Smith, K. A., & Grimm, C. 1999. The role of competitive action in market share erosion and industry dethronement: A study of industry leaders and challengers. ***Academy of Management Journal,*** 42: 372–388.

Fichman, R., & Kemerer, C. 1999. The illusory diffusion of innovation: An examination of assimilation gaps. ***Information Systems Research,*** 10: 255–275.

Floyd, S. W., & Lane, P. J. 2000. Strategizing throughout the

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

organization: Management role conflict in strategic renewal. ***Academy of Management Review,*** 25: 154–177.

Ford, C. 1996. A theory of individual creative action in multiple social domains. ***Academy of Management Review,*** 21: 1112–1142.

Foster, R. 1986. ***The attacker's advantage.*** New York: Summit Books.

Garud, R., & Nayyar, P. 1994. Transformative capacity: Continual structuring by intertemporal technology transfer. ***Strategic Management Journal,*** 15: 365–385.

Garvin, D. 1993. Building a learning organization. ***Harvard Business Review,*** 73(4): 78–91.

Glass, A. J., & Saggi, K. 1998. International technology transfer and the technology gap. ***Journal of Development Economics,*** 55: 369–398.

Granstrand, O., & Sjolander, S. 1990. The acquisition of technology and small firms by large firms. ***Journal of Economic Behavior & Organization,*** 3: 367–386.

Grant, R. M. 1996a. Toward a knowledge-based theory of the firm. ***Strategic Management Journal,*** 17: 109–122.

Grant, R. M. 1996b. Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. ***Organization Science,*** 7: 375–387.

Hedberg, B. L. 1981. How organizations learn and unlearn. In P. Nystrom & W. Starbuck (Eds.), ***Handbook of organization design,*** vol. 1: 1–27. New York: Oxford University Press.

Helfat, C. E., & Raubitschek, R. S. 2001. Product sequencing: Co-evolution of knowledge, capabilities, and products. ***Strategic Management Journal,*** 21: 961–980.

Herriot, S. R., Levinthal, D., & March, J. G. 1985. Learning from experience in organizations. ***AEA Papers and Proceedings,*** 75: 298–302.

Hitt, M. A., Bierman, L., Shimizu, K., & Kochhar, R. 2001. Direct and moderating effects of human capital on strategy and performance in professional service firms: A resource-based perspective. ***Academy of Management Journal,*** 44: 13–28.

Huber, G. 1991. Organizational learning: The contributing processes and the literature. ***Organization Science,*** 2: 88–115.

Joglekar, P., Bohl, A. H., & Hamburg, M. 1997. Comments on "Fortune favors the prepared firm." ***Management Science,*** 43: 1455–1468.

Kazanjian, R. K., Drazin, R., & Glynn, M. A. In press. Implementing structures for corporate entrepreneurship: A knowledge-based perspective. In M. Hitt, D. Ireland, M. Camp, & D. Sexton (Eds.), ***Strategic entrepreneurship: Creating an integrated mindset.*** Oxford: Blackwell.

Kedia, B. L., & Bhagat, R. S. 1988. Cultural constraints on transfer of technology across nations: Implications for research in international and comparative management. ***Academy of Management Review,*** 13: 559–571.

Keller, W. 1996. Absorptive capacity: On the creation and acquisition of technology in development. ***Journal of Developmental Economics,*** 49: 199–210.

Kim, L. 1995. Absorptive capacity and industrial growth: A conceptual framework and Korea's experience. In B. Koo & D. Perkins (Eds.), ***Social capability and long term economic growth:*** 266–287. London: St. Martin's Press.

Kim, L. 1997a. The dynamics of Samsung's technological learning in semiconductors. ***California Management Review,*** 39(3): 86–100.

Kim, L. 1997b. ***From imitation to innovation: The dynamics of Korea's technological learning.*** Cambridge, MA: Harvard Business School Press.

Kim, L. 1998. Crisis construction and organizational learning: Capability building in catching-up at Hyundai Motor. ***Organization Science,*** 9: 506–521.

Kim, L., & Dahlman, C. 1992. Technology policy for industrialization: An integrative framework and Korea's experience. ***Research Policy,*** 21: 437–453.

Koestler, A. 1966. ***The act of creation.*** London: Hutchinson.

Kogut, B., & Zander, U. 1996. What do firms do? Coordination, identity, and learning. ***Organization Science,*** 7: 502–518.

Koza, M. P., & Lewin, A. Y. 1998. The co-evolution of strategic alliances. ***Organization Science,*** 9: 255–264.

Lane, P. J., & Lubatkin, M. 1998. Relative absorptive capacity and interorganizational learning. ***Strategic Management Journal,*** 19: 461–477.

Lei, D., Hitt, M., & Bettis, R. 1996. Dynamic core competences through meta-learning and strategic context. ***Journal of Management,*** 22: 549–570.

Leonard-Barton, D. 1995. ***Wellsprings of knowledge.*** Boston: Harvard Business School Press.

Levitt, B., & March, J. 1988. Organizational learning. ***Annual Reviews, Inc.,*** 14: 319–340.

Liebeskind, J. P. 1996. Knowledge, strategy, and the theory of the firm. ***Strategic Management Journal,*** 17: 93–107.

Liu, X., & White, R. S. 1997. The relative contributions of foreign technology and domestic inputs to innovation in Chinese manufacturing industries. ***Technovation,*** 17: 119–125.

Lofstrom, S. M. 2000. ***Absorptive capacity in strategic alliances: Investigating the effects of individuals' social and human capital on inter-firm learning.*** Paper presented at the Organization Science Winter Conference, Keystone, CO.

Luo, Y. 1997. Partner selection and venturing success: The case of joint ventures with firms in People's Republic of China. ***Organization Science,*** 8: 648–662.

Lyles, M. A., & Schwenk, C. R. 1992. Top management, strategy and organizational knowledge structures. ***Journal of Management Studies,*** 29: 155–174.

March, J. 1991. Exploration and exploitation in organizational learning. ***Organization Science,*** 2: 71–87.

March, J., & Simon, H. 1993. ***Organizations.*** Oxford: Blackwell.

Matusik, S. F. 2000. ***Absorptive capacity and firm knowledge: Separating the effects of public knowledge, flexible firm boundaries, and firm absorptive abilities.*** Paper pre-

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

sented at the Organization Science Winter Conference, Keystone, CO.

Matusik, S. F., & Heeley, M. 2001. ***Absorptive capacity and firm knowledge: Separating the multiple components of the absorptive capacity construct.*** Paper presented at the annual meeting of the Academy of Management, Washington, DC.

Matusik, S., & Hill, C. 1998. The utilization of contingent work, knowledge creation, and competitive advantage. ***Academy of Management Review,*** 23: 680–697.

McGrath, R. G., & MacMillan, I. C. 2000. ***The entrepreneurial mindset.*** Cambridge, MA: Harvard Business School Press.

McGrath, R. G., MacMillan, I. C., & Venkataraman, S. 1995. Defining and developing competence: A strategic process paradigm. ***Strategic Management Journal,*** 16: 251–275.

Moorman, C., & Miner, A. S. 1996. The impact of organizational memory on new product development. ***Journal of Marketing Research,*** 34: 91–106.

Mowery, D. C., & Oxley, J. E. 1995. Inward technology transfer and competitiveness: The role of national innovation systems. ***Cambridge Journal of Economics,*** 19: 67–93.

Mowery, D. C., Oxley, J. E., & Silverman, B. S. 1996. Strategic alliances and interfirm knowledge transfer. ***Strategic Management Journal,*** 17: 77–91.

Nahapiet, J., & Ghoshal, S. 1998. Social capital, intellectual capital, and the organizational advantage. ***Academy of Management Review,*** 23: 242–266.

Nelson, R., & Winter, S. 1982. ***An evolutionary theory of economic change.*** Cambridge, MA: Harvard University Press.

Nonaka, I., & Takeuchi, H. 1995. ***The knowledge-creating company: How Japanese companies create the dynamics of innovation.*** New York: Oxford University Press.

Raff, D. M. 2000. Superstores and the evolution of firm capabilities in American bookselling. ***Strategic Management Journal,*** 21: 1043–1060.

Rocha, F. 1997. ***Inter-firm technological cooperation: Effects of absorptive capacity, firm-size and specialization.*** Discussion paper series No. 9707, United Nations University, Institute for New Technology, Maastricht, Netherlands.

Rosenberg, N. 1982. ***Inside the black box: Technology and economics.*** Cambridge: Cambridge University Press.

Rosenkopf, L., & Nerkar, A. 2001. Beyond local search: Boundary spanning, exploration and impact in the optical disk industry. ***Strategic Management Journal,*** 22: 287–306.

Rumelt, R. 1987. Theory, strategy, and entrepreneurship. In D. J. Teece (Ed.), ***The competitive challenge: Strategies for industrial innovation and renewal:*** 137–159. Cambridge, MA: Ballinger.

Schilling, M. 1998. Technological lockout: An integrative model of the economic and strategic factors driving technology success and failure. ***Academy of Management Review,*** 23: 267–284.

Sheremata, W. A. 2000. Centrifugal and centripetal forces in radical new product development under time pressure. ***Academy of Management Review,*** 25: 389–408.

Smith, K. A., & DeGregorio, D. D. In press. Bisociation, discovery, and entrepreneurial action. In M. Hitt, D. Ireland, M. Camp, & D. Sexton (Eds.), ***Strategic entrepreneurship: Creating an integrated mindset.*** Oxford: Blackwell.

Spence, A. M. 1984. Cost reduction, competition, and industry performance. ***Econometrica,*** 52: 102–122.

Spender, J.-C. 1996. Making knowledge the basis of a dynamic theory of the firm. ***Strategic Management Journal,*** 17: 45–62.

Stata, R. 1989. Organizational learning—the key to management innovation. ***Sloan Management Review,*** 30(3): 63–74.

Szulanski, G. 1996. Exploring internal stickiness: Impediments to the transfer of best practice within the firm. ***Strategic Management Journal,*** 17: 27–43.

Teece, D. J. 1981. The multinational enterprise: Market failure and market power considerations. ***Sloan Management Review,*** 22(3): 3–17.

Teece, D. J., Pisano, G., & Shuen, A. 1997. Dynamic capabilities and strategic management. ***Strategic Management Journal,*** 18: 509–533.

Tegarden, L. F., Hatfield, D. E., & Echols, A. E. 1999. Doomed from the start: What is the value of selecting a future dominant design? ***Strategic Management Journal,*** 20: 495–518.

Tiemessen, I., Lane, H. W., Crossan, M., & Inkpen, A. C. 1997. Knowledge management in international joint ventures. In P. W. Beamish & J. P. Killing (Eds.), ***Cooperative strategies: North American perspective:*** 370–399. San Francisco: New Lexington Press.

Tripsas, M., & Gavetti, G. 2000. Capabilities, cognition, and inertia: Evidence from digital imaging. ***Strategic Management Journal,*** 21: 1147–1162.

Tyre, M. J., & Orlikowski, M. J. 1994. Windows of opportunity: Temporal patterns of technological adaptation in organizations. ***Organization Science,*** 5: 98–118.

Van den Bosch, F., Volberda, H., & de Boer, M. 1999. Coevolution of firm absorptive capacity and knowledge environment: Organizational forms and combinative capabilities. ***Organization Science,*** 10: 551–568.

Van Wijk, R., Van den Bosch, F., & Volberda, H. 2001. ***The impact of knowledge depth and breadth of absorbed knowledge on levels of exploration and exploitation.*** Paper presented at the annual meeting of the Academy of Management, Washington, DC.

Vermeulen, F., & Barkema, H. 2001. Learning through acquisitions. ***Academy of Management Journal,*** 44: 457–476.

Veugelers, R. 1997. Internal R&D expenditures and external technology sourcing. ***Research Policy,*** 26: 303–315.

Walsh, J. P., & Ungson, G. R. 1991. Organizational memory. ***Academy of Management Review,*** 16: 57–91.

Winter, S. 2000. The satisficing principle in capability learning. ***Strategic Management Journal,*** 21: 981–996.

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms

Zahra, S., Ireland, D., & Hitt, M. 2000. International expansion by new venture firms: International diversity, mode of market entry, technological learning, and performance. ***Academy of Management Journal,*** 43: 925–950.

Zajac, E., & Bazerman, M. 1991. Blind spots in industry and competitor analysis. ***Academy of Management Review,*** 16: 37–57.

Zander, U., & Kogut, B. 1995. Knowledge and the speed of transfer and imitation of organizational capabilities. ***Organization Science,*** 6: 76–92.

Zott, C. 2001. ***Dynamic capabilities and the emergence of intra-industry differential firm performance. Insights from a simulation study.*** Working paper No. 2000/86/ENT, INSEAD, Paris.

Shaker A. Zahra is professor of strategy and entrepreneurship in the Department of Management and eCommerce Institute at J. Mack Robinson College of Business at Georgia State University. His research centers on the dynamics of entrepreneurship in high-technology industries, the role of technology in global industries, and technological learning in global markets.

Gerard George is an assistant professor of entrepreneurship and an associate of the Weinert Center for Entrepreneurship at the University of Wisconsin–Madison. He received his Ph.D. from Virginia Commonwealth University. His research interests include the study of contextual and structural factors affecting innovation and entrepreneurship.

This content downloaded from 165.132.14.104 on Thu, 09 Mar 2017 16:46:29 UTC
All use subject to http://about.jstor.org/terms