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DYNAMIC CAPABILITIES AND STRATEGIC MANAGEMENT

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The dynamic capabilities framework analyzes the sources and methods of wealth creation and capture by private enterprise firms operating in environments of rapid technological change. The competitive advantage of firms is seen as resting on distinctive processes (ways of coordinating and combining), shaped by the firm's (specific) asset positions (such as the firm's portfolio of difficult-to-trade knowledge assets and complementary assets), and the evolution path(s) it has adopted or inherited. The importance of path dependencies is amplified where conditions of increasing returns exist. Whether and how a firm's competitive advantage is eroded depends on the stability of market demand, and the ease of replicability (expanding internally) and imitatability (replication by competitors). If correct, the framework suggests that private wealth creation in regimes of rapid technological change depends in large measure on honing internal technological, organizational, and managerial processes inside the firm. In short, identifying new opportunities and organizing effectively and efficiently to embrace them are generally more fundamental to private wealth creation than is strategizing, if by strategizing one means engaging in business conduct that keeps competitors off balance, raises rival's costs, and excludes new entrants. © 1997 by John Wiley & Sons, Ltd.

INTRODUCTION

The fundamental question in the field of strategic management is how firms achieve and sustain competitive advantage.[1] We confront this question here by developing the dynamic capabilities approach, which endeavors to analyze the sources of wealth creation and capture by firms. The development of this framework flows from a recognition by the authors that strategic theory is replete with analyses of firm-level strategies for sustaining and safeguarding extant competitive advantage, but has performed less well with respect to assisting in the understanding of how and why certain firms build competitive advantage in regimes of rapid change. Our approach is especially relevant in a Schumpeterian world of innovation-based competition, price/performance rivalry, increasing returns, and the 'creative destruction' of existing competences. The approach endeavors to explain firm-level success and failure. We are interested in both building a better theory of firm performance, as well as informing managerial practice.

In order to position our analysis in a manner that displays similarities and differences with existing approaches, we begin by briefly reviewing accepted frameworks for strategic management. We endeavor to expose implicit assumptions, and identify competitive circumstances where each paradigm might display some relative advantage as both a useful descriptive and normative theory of competitive strategy. While numerous theories have been advanced over the past

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[1] For a review of the fundamental questions in the field of strategy, see Rumelt, Schendel, and Teece (1994).

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two decades about the sources of competitive advantage, many cluster around just a few loosely structured frameworks or paradigms. In this paper we attempt to identify three existing paradigms and describe aspects of an emerging new paradigm that we label dynamic capabilities.

The dominant paradigm in the field during the 1980s was the competitive forces approach developed by Porter (1980). This approach, rooted in the structure–conduct–performance paradigm of industrial organization (Mason, 1949; Bain, 1959), emphasizes the actions a firm can take to create defensible positions against competitive forces. A second approach, referred to as a strategic conflict approach (e.g., Shapiro, 1989), is closely related to the first in its focus on product market imperfections, entry deterrence, and strategic interaction. The strategic conflict approach uses the tools of game theory and thus implicitly views competitive outcomes as a function of the effectiveness with which firms keep their rivals off balance through strategic investments, pricing strategies, signaling, and the control of information. Both the competitive forces and the strategic conflict approaches appear to share the view that rents flow from privileged product market positions.

Another distinct class of approaches emphasizes building competitive advantage through capturing entrepreneurial rents stemming from fundamental firm-level efficiency advantages. These approaches have their roots in a much older discussion of corporate strengths and weaknesses; they have taken on new life as evidence suggests that firms build enduring advantages only through efficiency and effectiveness, and as developments in organizational economics and the study of technological and organizational change become applied to strategy questions. One strand of this literature, often referred to as the 'resource-based perspective,' emphasizes firm-specific capabilities and assets and the existence of isolating mechanisms as the fundamental determinants of firm performance (Penrose, 1959; Rumelt, 1984; Teece, 1984; Wernerfelt, 1984).[2] This perspective recognizes but does not attempt to explain the nature of the isolating mechanisms that enable entrepreneurial rents and competitive advantage to be sustained.

Another component of the efficiency-based approach is developed in this paper. Rudimentary efforts are made to identify the dimensions of firm-specific capabilities that can be sources of advantage, and to explain how combinations of competences and resources can be developed, deployed, and protected. We refer to this as the 'dynamic capabilities' approach in order to stress exploiting existing internal and external firm-specific competences to address changing environments. Elements of the approach can be found in Schumpeter (1942), Penrose (1959), Nelson and Winter (1982), Prahalad and Hamel (1990), Teece (1976, 1986a, 1986b, 1988) and in Hayes, Wheelwright, and Clark (1988): Because this approach emphasizes the development of management capabilities, and difficult-to-imitate combinations of organizational, functional and technological skills, it integrates and draws upon research in such areas as the management of R&D, product and process development, technology transfer, intellectual property, manufacturing, human resources, and organizational learning. Because these fields are often viewed as outside the traditional boundaries of strategy, much of this research has not been incorporated into existing economic approaches to strategy issues. As a result, dynamic capabilities can be seen as an emerging and potentially integrative approach to understanding the newer sources of competitive advantage.

We suggest that the dynamic capabilities approach is promising both in terms of future research potential and as an aid to management endeavoring to gain competitive advantage in increasingly demanding environments. To illustrate the essential elements of the dynamic capabilities approach, the sections that follow compare and contrast this approach to other models of strategy. Each section highlights the strategic

[2] Of these authors, Rumelt may have been the first to self-consciously apply a resource perspective to the field of strategy. Rumelt (1984: 561) notes that the strategic firm 'is characterized by a bundle of linked and idiosyncratic resources and resource conversion activities.' Similarly, Teece (1984: 95) notes: 'Successful firms possess one or more forms of intangible assets, such as technological or managerial know-how. Over time, these assets may expand beyond the point of profitable reinvestment in a firm's traditional market. Accordingly, the firm may consider deploying its intangible assets in different product or geographical markets, where the expected returns are higher, if efficient transfer modes exist.' Wernerfelt (1984) was early to recognize that this approach was at odds with product market approaches and might constitute a distinct paradigm of strategy.

insights provided by each approach as well as the different competitive circumstances in which it might be most appropriate. Needless to say, these approaches are in many ways complementary and a full understanding of firm-level, competitive advantage requires an appreciation of all four approaches and more.

MODELS OF STRATEGY EMPHASIZING THE EXPLOITATION OF MARKET POWER

Competitive forces

The dominant paradigm in strategy at least during the 1980s was the competitive forces approach. Pioneered by Porter (1980), the competitive forces approach views the essence of competitive strategy formulation as 'relating a company to its environment . . . [T]he key aspect of the firm's environment is the industry or industries in which it competes.' Industry structure strongly influences the competitive rules of the game as well as the strategies potentially available to firms.

In the competitive forces model, five industry-level forces—entry barriers, threat of substitution, bargaining power of buyers, bargaining power of suppliers, and rivalry among industry incumbents—determine the inherent profit potential of an industry or subsegment of an industry. The approach can be used to help the firm find a position in an industry from which it can best defend itself against competitive forces or influence them in its favor (Porter, 1980: 4).

This 'five-forces' framework provides a systematic way of thinking about how competitive forces work at the industry level and how these forces determine the profitability of different industries and industry segments. The competitive forces framework also contains a number of underlying assumptions about the sources of competition and the nature of the strategy process. To facilitate comparisons with other approaches, we highlight several distinctive characteristics of the framework.

Economic rents in the competitive forces framework are monopoly rents (Teece, 1984). Firms in an industry earn rents when they are somehow able to impede the competitive forces (in either factor markets or product markets) which tend to drive economic returns to zero. Available strategies are described in Porter (1980). Competitive strategies are often aimed at altering the firm's position in the industry *vis-à-vis* competitors and suppliers. Industry structure plays a central role in determining and limiting strategic action.

Some industries or subsectors of industries become more 'attractive' because they have structural impediments to competitive forces (e.g., entry barriers) that allow firms better opportunities for creating sustainable competitive advantages. Rents are created largely at the industry or subsector level rather than at the firm level. While there is some recognition given to firm-specific assets, differences among firms relate primarily to scale. This approach to strategy reflects its incubation inside the field of industrial organization and in particular the industrial structure school of Mason and Bain[3] (Teece, 1984).

Strategic conflict

The publication of Carl Shapiro's 1989 article, confidently titled 'The Theory of Business Strategy,' announced the emergence of a new approach to business strategy, if not strategic management. This approach utilizes the tools of game theory to analyze the nature of competitive interaction between rival firms. The main thrust of work in this tradition is to reveal how a firm can influence the behavior and actions of rival firms and thus the market environment.[4] Examples of such moves are investment in capacity (Dixit, 1980), R&D (Gilbert and Newberry, 1982), and advertising (Schmalensee, 1983). To be effective, these strategic moves require irreversible commitments.[5] The moves in question will have no effect if they can be costlessly undone. A key idea is that by manipulating the market environment, a firm may be able to increase its profits.

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[3] In competitive environments characterized by sustainable and stable mobility and structural barriers, these forces may become the determinants of industry-level profitability. However, competitive advantage is more complex to ascertain in environments of rapid technological change where specific assets owned by heterogeneous firms can be expected to play a larger role in explaining rents.

[4] The market environment is all factors that influence market outcomes (prices, quantities, profits) including the beliefs of customers and of rivals, the number of potential technologies employed, and the costs or speed with which a rival can enter the industry.

[5] For an excellent discussion of committed competition in multiple contexts, see Ghemawat (1991).

This literature, together with the contestability literature (Baumol, Panzar, and Willig, 1982), has led to a greater appreciation of the role of sunk costs, as opposed to fixed costs, in determining competitive outcomes. Strategic moves can also be designed to influence rivals' behavior through signaling. Strategic signaling has been examined in a number of contexts, including predatory pricing (Kreps and Wilson, 1982a, 1982b) and limit pricing (Milgrom and Roberts, 1982a, 1982b). More recent treatments have emphasized the role of commitment and reputation (e.g., Ghemawat, 1991) and the benefits of firms simultaneously pursuing competition and cooperation[6] (Brandenburger and Nalebuff, 1995, 1996).

In many instances, game theory formalizes long-standing intuitive arguments about various types of business behavior (e.g., predatory pricing, patent races), though in some instances it has induced a substantial change in the conventional wisdom. But by rationalizing observed behavior by reference to suitably designed games, in explaining everything these models also explain nothing, as they do not generate testable predictions (Sutton, 1992). Many specific game-theoretic models admit multiple equilibrium, and a wide range of choice exists as to the design of the appropriate game form to be used. Unfortunately, the results often depend on the precise specification chosen. The equilibrium in models of strategic behavior crucially depends on what one rival believes another rival will do in a particular situation. Thus the qualitative features of the results may depend on the way price competition is modeled (e.g., Bertrand or Cournot) or on the presence or absence of strategic asymmetries such as first-mover advantages. The analysis of strategic moves using game theory can be thought of as 'dynamic' in the sense that multiperiod analyses can be pursued both intuitively and formally. However, we use the term 'dynamic' in this paper in a different sense, referring to situations where there is rapid change in technology and market forces, and 'feedback' effects on firms.[7]

We have a particular view of the contexts in which the strategic conflict literature is relevant to strategic management. Firms that have a tremendous cost or other competitive advantage *vis-à-vis* their rivals ought not be transfixed by the moves and countermoves of their rivals. Their competitive fortunes will swing more on total demand conditions, not on how competitors deploy and redeploy their competitive assets. Put differently, when there are gross asymmetries in competitive advantage between firms, the results of game-theoretic analysis are likely to be obvious and uninteresting. The stronger competitor will generally advance, even if disadvantaged by certain information asymmetries. To be sure, incumbent firms can be undone by new entrants with a dramatic cost advantage, but no 'gaming' will overturn that outcome. On the other hand, if firms' competitive positions are more delicately balanced, as with Coke and Pepsi, and United Airlines and American Airlines, then strategic conflict is of interest to competitive outcomes. Needless to say, there are many such circumstances, but they are rare in industries where there is rapid technological change and fast-shifting market circumstances.

In short, where competitors do not have deep-seated competitive advantages, the moves and countermoves of competitors can often be usefully formulated in game-theoretic terms. However, we doubt that game theory can comprehensively illuminate how Chrysler should compete against Toyota and Honda, or how United Airlines can best respond to Southwest Airlines since Southwest's advantage is built on organizational attributes which United cannot readily replicate.[8] Indeed, the entrepreneurial side of strategy—how significant new rent streams are created and protected—is largely ignored by the game-theoretic approach.[9] Accordingly, we find that the approach, while important, is most relevant

[6] Competition and cooperation have also been analyzed ouside of this tradition. See, for example, Teece (1992) and Link, Teece and Finan (1996).

[7] Accordingly, both approaches are dynamic, but in very different senses.

[8] Thus even in the air transport industry game-theoretic formulations by no means capture all the relevant dimensions of competitive rivalry. United Airlines' and United Express's difficulties in competing with Southwest Airlines because of United's inability to fully replicate Southwest's operation capabilities is documented in Gittel (1995).

[9] Important exceptions can be found in Brandenburger and Nalebuff (1996) such as their emphasis on the role of complements. However, these insights do not flow uniquely from game theory and can be found in the organizational economics literature (e.g., Teece, 1986a, 1986b; de Figueiredo and Teece, 1996).

when competitors are closely matched[10] and the population of relevant competitors and the identity of their strategic alternatives can be readily ascertained. Nevertheless, coupled with other approaches it can sometimes yield powerful insights.

However, this research has an orientation that we are concerned about in terms of the implicit framing of strategic issues. Rents, from a game-theoretic perspective, are ultimately a result of managers' intellectual ability to 'play the game.' The adage of the strategist steeped in this approach is 'do unto others before they do unto you.' We worry that fascination with strategic moves and Machiavellian tricks will distract managers from seeking to build more enduring sources of competitive advantage. The approach unfortunately ignores competition as a process involving the development, accumulation, combination, and protection of unique skills and capabilities. Since strategic interactions are what receive focal attention, the impression one might receive from this literature is that success in the marketplace is the result of sophisticated plays and counterplays, when this is generally not the case at all.[11]

In what follows, we suggest that building a dynamic view of the business enterprise—something missing from the two approaches we have so far identified—enhances the probability of establishing an acceptable descriptive theory of strategy that can assist practitioners in the building of long-run advantage and competitive flexibility. Below, we discuss first the resource-based perspective and then an extension we call the dynamic capabilities approach.

MODELS OF STRATEGY EMPHASIZING EFFICIENCY

Resource-based perspective

The resource-based approach sees firms with superior systems and structures being profitable not because they engage in strategic investments that may deter entry and raise prices above long-run costs, but because they have markedly lower costs, or offer markedly higher quality or product performance. This approach focuses on the rents accruing to the owners of scarce firm-specific resources rather than the economic profits from product market positioning.[12] Competitive advantage lies 'upstream' of product markets and rests on the firm's idiosyncratic and difficult-to-imitate resources.[13]

One can find the resources approach suggested by the earlier preanalytic strategy literature. A leading text of the 1960s (Learned *et al.*, 1969) noted that 'the capability of an organization is its demonstrated and potential ability to accomplish against the opposition of circumstance or competition, whatever it sets out to do. Every organization has actual and potential strengths and weaknesses; it is important to try to determine what they are and to distinguish one from the other.' Thus what a firm can do is not just a function of the opportunities it confronts; it also depends on what resources the organization can muster.

Learned *et al.* proposed that the real key to a company's success or even to its future development lies in its ability to find or create 'a competence that is truly distinctive.'[14] This literature also recognized the constraints on firm behavior and, in particular, noted that one should not assume that management 'can rise to any occasion.' These insights do appear to keenly anticipate the resource-based approach that has since emerged, but they did not provide a theory or systematic framework for analyzing business strategies. Indeed, Andrews (1987: 46) noted that 'much of what is intuitive in this process is yet to be identified.' Unfortunately, the academic literature on capabilities stalled for a couple of decades.

New impetus has been given to the resource-based approach by recent theoretical developments in organizational economics and in the theory of strategy, as well as by a growing

[10] When closely matched in an aggregate sense, they may nevertheless display asymmetries which game theorists can analyze.

[11] The strategic conflict literature also tends to focus practitioners on product market positioning rather than on developing the unique assets which make possible superior product market positions (Dierickx and Cool, 1989).

[12] In the language of economics, rents flow from unique firm-specific assets that cannot readily be replicated, rather than from tactics which deter entry and keep competitors off balance. In short, rents are Ricardian.

[13] Teece (1982: 46) saw the firm as having 'a variety of end products which it can produce with its organizational technology.'

[14] Elsewhere Andrews (1987: 47) defined a distinctive competence as what an organization can do particularly well.

body of anecdotal and empirical literature[15] that highlights the importance of firm-specific factors in explaining firm performance. Cool and Schendel (1988) have shown that there are systematic and significant performance differences among firms which belong to the same strategic group within the U.S. pharmaceutical industry. Rumelt (1991) has shown that intraindustry differences in profits are greater than interindustry differences in profits, strongly suggesting the importance of firm-specific factors and the relative unimportance of industry effects.[16] Jacobsen (1988) and Hansen and Wernerfelt (1989) made similar findings.

A comparison of the resource-based approach and the competitive forces approach (discussed earlier in the paper) in terms of their implications for the strategy process is revealing. From the first perspective, an entry decision looks roughly as follows: (1) pick an industry (based on its 'structural attractiveness'); (2) choose an entry strategy based on conjectures about competitors' rational strategies; (3) if not already possessed, acquire or otherwise obtain the requisite assets to compete in the market. From this perspective, the process of identifying and developing the requisite assets is not particularly problematic. The process involves nothing more than choosing rationally among a well-defined set of investment alternatives. If assets are not already owned, they can be bought. The resource-based perspective is strongly at odds with this conceptualization.

From the resource-based perspective, firms are heterogeneous with respect to their resources/capabilities/endowments. Further, resource endowments are 'sticky:' at least in the short run, firms are to some degree stuck with what they have and may have to live with what they lack.[17] This stickiness arises for three reasons. First, business development is viewed as an extremely complex process.[18] Quite simply, firms lack the organizational capacity to develop new competences quickly (Dierickx and Cool, 1989). Secondly, some assets are simply not readily tradeable, for example, tacit know-how (Teece, 1976, 1980) and reputation (Dierickx and Cool, 1989). Thus, resource endowments cannot equilibrate through factor input markets. Finally, even when an asset can be purchased, firms may stand to gain little by doing so. As Barney (1986) points out, unless a firm is lucky, possesses superior information, or both, the price it pays in a competitive factor market will fully capitalize the rents from the asset.

Given that in the resources perspective firms possess heterogeneous and sticky resource bundles, the entry decision process suggested by this approach is as follows: (1) identify your firm's unique resources; (2) decide in which markets those resources can earn the highest rents; and (3) decide whether the rents from those assets are most effectively utilized by (a) integrating into related market(s), (b) selling the relevant intermediate output to related firms, or (c) selling the assets themselves to a firm in related businesses (Teece, 1980, 1982).

The resource-based perspective puts both vertical integration and diversification into a new strategic light. Both can be viewed as ways of capturing rents on scarce, firm-specific assets whose services are difficult to sell in intermediate markets (Penrose, 1959; Williamson, 1975; Teece, 1980, 1982, 1986a, 1986b; Wernerfelt, 1984). Empirical work on the relationship between performance and diversification by Wernerfelt and Montgomery (1988) provides evidence for this proposition. It is evident that the resource-based perspective focuses on strategies for exploiting existing firm-specific assets.

However, the resource-based perspective also invites consideration of managerial strategies for developing new capabilities (Wernerfelt, 1984). Indeed, if control over scarce resources is the source of economic profits, then it follows that such issues as skill acquisition, the management of knowledge and know-how (Shuen, 1994), and learning become fundamental strategic issues. It is in this second dimension, encompassing skill acquisition, learning, and accumulation of organizational and intangible or 'invisible' assets (Itami

[15] Studies of the automobile and other industries displayed differences in organization which often underlay differences amongst firms. See, for example, Womack, Jones, and Roos, 1991; Hayes and Clark, 1985; Barney, Spender and Reve, 1994; Clark and Fujimoto, 1991; Henderson and Cockburn, 1994; Nelson, 1991; Levinthal and Myatt, 1994.

[16] Using FTC line of business data, Rumelt showed that stable industry effects account for only 8 percent of the variance in business unit returns. Furthermore, only about 40 percent of the dispersion in industry returns is due to stable industry effects.

[17] In this regard, this approach has much in common with recent work on organizational ecology (e.g., Freeman and Boeker, 1984) and also on commitment (Ghemawat, 1991: 17–25).

[18] Capability development, however, is not really analyzed.

and Roehl, 1987), that we believe lies the greatest potential for contributions to strategy.

The dynamic capabilities approach: Overview

The global competitive battles in high-technology industries such as semiconductors, information services, and software have demonstrated the need for an expanded paradigm to understand how competitive advantage is achieved. Well-known companies like IBM, Texas Instruments, Philips, and others appear to have followed a 'resource-based strategy' of accumulating valuable technology assets, often guarded by an aggressive intellectual property stance. However, this strategy is often not enough to support a significant competitive advantage. Winners in the global marketplace have been firms that can demonstrate timely responsiveness and rapid and flexible product innovation, coupled with the management capability to effectively coordinate and redeploy internal and external competences. Not surprisingly, industry observers have remarked that companies can accumulate a large stock of valuable technology assets and still not have many useful capabilities.

We refer to this ability to achieve new forms of competitive advantage as 'dynamic capabilities' to emphasize two key aspects that were not the main focus of attention in previous strategy perspectives. The term 'dynamic' refers to the capacity to renew competences so as to achieve congruence with the changing business environment; certain innovative responses are required when time-to-market and timing are critical, the rate of technological change is rapid, and the nature of future competition and markets difficult to determine. The term 'capabilities' emphasizes the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences to match the requirements of a changing environment.

One aspect of the strategic problem facing an innovating firm in a world of Schumpeterian competition is to identify difficult-to-imitate internal and external competences most likely to support valuable products and services. Thus, as argued by Dierickx and Cool (1989), choices about how much to spend (invest) on different possible areas are central to the firm's strategy. However, choices about domains of competence are influenced by past choices. At any given point in time, firms must follow a certain trajectory or path of competence development. This path not only defines what choices are open to the firm today, but it also puts bounds around what its internal repertoire is likely to be in the future. Thus, firms, at various points in time, make long-term, quasi-irreversible commitments to certain domains of competence.[19]

The notion that competitive advantage requires both the exploitation of existing internal and external firm-specific capabilities, and developing new ones is partially developed in Penrose (1959), Teece (1982), and Wernerfelt (1984). However, only recently have researchers begun to focus on the specifics of how some organizations first develop firm-specific capabilities and how they renew competences to respond to shifts in the business environment.[20] These issues are intimately tied to the firm's business processes, market positions, and expansion paths. Several writers have recently offered insights and evidence on how firms can develop their capability to adapt and even capitalize on rapidly changing environments.[21] The dynamic capabilities approach seeks to provide a coherent framework which can both integrate existing conceptual and empirical knowledge, and facilitate prescription. In doing so, it builds upon the theoretical foundations provided by Schumpeter (1934), Penrose (1959), Williamson (1975, 1985), Barney (1986), Nelson and Winter (1982), Teece (1988), and Teece *et al*. (1994).

TOWARD A DYNAMIC CAPABILITIES FRAMEWORK

Terminology

In order to facilitate theory development and intellectual dialogue, some acceptable definitions are desirable. We propose the following.

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[19] Deciding, under significant uncertainty about future states of the world, which long-term paths to commit to and when to change paths is the central strategic problem confronting the firm. In this regard, the work of Ghemawat (1991) is highly germane to the dynamic capabilities approach to strategy.

[20] See, for example, Iansiti and Clark (1994) and Henderson (1994).

[21] See Hayes *et al*. (1988), Prahalad and Hamel (1990), Dierickx and Cool (1989), Chandler (1990), and Teece (1993).

Factors of production

These are 'undifferentiated' inputs available in disaggregate form in factor markets. By undifferentiated we mean that they lack a firm-specific component. Land, unskilled labor, and capital are typical examples. Some factors may be available for the taking, such as public knowledge. In the language of Arrow, such resources must be 'non-fugitive.'[22] Property rights are usually well defined for factors of production.

Resources[23]

Resources are firm-specific assets that are difficult if not impossible to imitate. Trade secrets and certain specialized production facilities and engineering experience are examples. Such assets are difficult to transfer among firms because of transactions costs and transfer costs, and because the assets may contain tacit knowledge.

Organizational routines/competences

When firm-specific assets are assembled in integrated clusters spanning individuals and groups so that they enable distinctive activities to be performed, these activities constitute organizational routines and processes. Examples include quality, miniaturization, and systems integration. Such competences are typically viable across multiple product lines, and may extend outside the firm to embrace alliance partners.

Core competences

We define those competences that define a firm's fundamental business as core. Core competences must accordingly be derived by looking across the range of a firm's (and its competitors) products and services.[24] The value of core competences can be enhanced by combination with the appropriate complementary assets. The degree to which a core competence is distinctive depends on how well endowed the firm is relative to its competitors, and on how difficult it is for competitors to replicate its competences.

Dynamic capabilities

We define dynamic capabilities as the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Dynamic capabilities thus reflect an organization's ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions (Leonard-Barton, 1992).

Products

End products are the final goods and services produced by the firm based on utilizing the competences that it possesses. The performance (price, quality, etc.) of a firm's products relative to its competitors at any point in time will depend upon its competences (which over time depend on its capabilities).

Markets and strategic capabilities

Different approaches to strategy view sources of wealth creation and the essence of the strategic problem faced by firms differently. The competitive forces framework sees the strategic problem in terms of industry structure, entry deterrence, and positioning; game-theoretic models view the strategic problem as one of interaction between rivals with certain expectations about how each other will behave;[25] resource-based perspectives have focused on the exploitation of firm-specific assets. Each approach asks different, often complementary questions. A key step in building a conceptual framework related to dynamic capabilities is to identify the foundations upon which distinctive and difficult-to-replicate advantages can be built, maintained, and enhanced.

A useful way to vector in on the strategic elements of the business enterprise is first to identify what is not strategic. To be strategic, a

[22] Arrow (1996) defines fugitive resources as ones that can move cheaply amongst individuals and firms.

[23] We do not like the term 'resource' and believe it is misleading. We prefer to use the term firm-specific asset. We use it here to try and maintain links to the literature on the resource-based approach which we believe is important.

[24] Thus Eastman Kodak's core competence might be considered imaging, IBM's might be considered integrated data processing and service, and Motorola's untethered communications.

[25] In sequential move games, each player looks ahead and anticipates his rival's future responses in order to reason back and decide action, i.e., look forward, reason backward.

capability must be honed to a user need[26] (so there is a source of revenues), unique (so that the products/services produced can be priced without too much regard to competition) and difficult to replicate (so profits will not be competed away). Accordingly, any assets or entity which are homogeneous and can be bought and sold at an established price cannot be all that strategic (Barney, 1986). What is it, then, about firms which undergirds competitive advantage?

To answer this, one must first make some fundamental distinctions between markets and internal organization (firms). The essence of the firm, as Coase (1937) pointed out, is that it displaces market organization. It does so in the main because inside the firms one can organize certain types of economic activity in ways one cannot using markets. This is not only because of transaction costs, as Williamson (1975, 1985) emphasized, but also because there are many types of arrangements where injecting high-powered (market like) incentives might well be quite destructive of cooperative activity and learning.[27] Inside an organization, exchange cannot take place in the same manner that it can outside an organization, not just because it might be destructive to provide high-powered individual incentives, but because it is difficult if not impossible to tightly calibrate individual contribution to a joint effort. Hence, contrary to Arrow's (1969) view of firms as quasi markets, and the task of management to inject markets into firms, we recognize the inherent limits and possible counterproductive results of attempting to fashion firms into simply clusters of internal markets. In particular, learning and internal technology transfer may well be jeopardized.

Indeed, what is distinctive about firms is that they are domains for organizing activity in a nonmarket-like fashion. Accordingly, as we discuss what is distinctive about firms, we stress competences/capabilities which are ways of organizing and getting things done which cannot be accomplished merely by using the price system to coordinate activity.[28] The very essence of most capabilities/competences is that they cannot be readily assembled through markets (Teece, 1982, 1986a; Zander and Kogut, 1995). If the ability to assemble competences using markets is what is meant by the firm as a nexus of contracts (Fama, 1980), then we unequivocally state that the firm about which we theorize cannot be usefully modeled as a nexus of contracts. By 'contract' we are referring to a transaction undergirded by a legal agreement, or some other arrangement which clearly spells out rights, rewards, and responsibilities. Moreover, the firm as a nexus of contracts suggests a series of bilateral contracts orchestrated by a coordinator. Our view of the firm is that the organization takes place in a more multilateral fashion, with patterns of behavior and learning being orchestrated in a much more decentralized fashion, but with a viable headquarters operation.

The key point, however, is that the properties of internal organization cannot be replicated by a portfolio of business units amalgamated just through formal contracts as many distinctive elements of internal organization simply cannot be replicated in the market.[29] That is, entrepreneurial activity cannot lead to the immediate replication of unique organizational skills through simply entering a market and piecing the parts together overnight. Replication takes time, and the replication of best practice may be illusive. Indeed, firm capabilities need to be understood not in terms of balance sheet items, but mainly in terms of the organizational structures and managerial processes which support productive activity. By construction, the firm's balance sheet contains items that can be valued, at least at original market prices (cost). It is necessarily the case, therefore, that the balance sheet is a poor shadow of a firm's distinctive competences.[30]

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[26] Needless to say, users need not be the current customers of the enterprise. Thus a capability can be the basis for diversification into new product markets.

[27] Indeed, the essence of internal organization is that it is a domain of unleveraged or low-powered incentives. By unleveraged we mean that rewards are determined at the group or organization level, not primarily at the individual level, in an effort to encourage team behavior, not individual behavior.

[28] We see the problem of market contracting as a matter of coordination as much as we see it a problem of opportunism in the fact of contractual hazards. In this sense, we are consonant with both Richardson (1960) and Williamson (1975, 1985).

[29] As we note in Teece *et al.* (1994), the conglomerate offers few if any efficiencies because there is little provided by the conglomerate form that shareholders cannot obtain for themselves simply by holding a diversified portfolio of stocks.

[30] Owners' equity may reflect, in part, certain historic capabilities. Recently, some scholars have begun to attempt to measure organizational capability using financial statement data. See Baldwin and Clark (1991) and Lev and Sougiannis (1992).

That which is distinctive cannot be bought and sold short of buying the firm itself, or one or more of its subunits.

There are many dimensions of the business firm that must be understood if one is to grasp firm-level distinctive competences/capabilities. In this paper we merely identify several classes of factors that will help determine a firm's distinctive competence and dynamic capabilities. We organize these in three categories: processes, positions, and paths. The essence of competences and capabilities is embedded in organizational processes of one kind or another. But the content of these processes and the opportunities they afford for developing competitive advantage at any point in time are shaped significantly by the assets the firm possesses (internal and market) and by the evolutionary path it has adopted/inherited. Hence organizational processes, shaped by the firm's asset positions and molded by its evolutionary and co-evolutionary paths, explain the essence of the firm's dynamic capabilities and its competitive advantage.

Processes, positions, and paths

We thus advance the argument that the competitive advantage of firms lies with its managerial and organizational processes, shaped by its (specific) asset position, and the paths available to it.[31] By managerial and organizational processes, we refer to the way things are done in the firm, or what might be referred to as its routines, or patterns of current practice and learning. By position we refer to its current specific endowments of technology, intellectual property, complementary assets, customer base, and its external relations with suppliers and complementors. By paths we refer to the strategic alternatives available to the firm, and the presence or absence of increasing returns and attendant path dependencies.

Our focus throughout is on asset structures for which no ready market exists, as these are the only assets of strategic interest. A final section focuses on replication and imitation, as it is these phenomena which determine how readily a competence or capability can be cloned by competitors, and therefore distinctiveness of its competences and the durability of its advantage.

The firm's processes and positions collectively encompass its competences and capabilities. A hierarchy of competences/capabilities ought to be recognized, as some competences may be on the factory floor, some in the R&D labs, some in the executive suites, and some in the way everything is integrated. A difficult-to-replicate or difficult-to-imitate competence was defined earlier as a distinctive competence. As indicated, the key feature of distinctive competence is that there is not a market for it, except possibly through the market for business units. Hence competences and capabilities are intriguing assets as they typically must be built because they cannot be bought.

Organizational and managerial processes

Organizational processes have three roles: coordination/integration (a static concept); learning (a dynamic concept); and reconfiguration (a transformational concept). We discuss each in turn.

Coordination/integration. While the price system supposedly coordinates the economy,[32] managers coordinate or integrate activity inside the firm. How efficiently and effectively internal coordination or integration is achieved is very important (Aoki, 1990).[33] Likewise for external coordination.[34] Increasingly, strategic advantage requires the integration of external activities and technologies. The growing literature on strategic

[31] We are implicitly saying that fixed assets, like plant and equipment which can be purchased off-the-shelf by all industry participants, cannot be the source of a firm's competitive advantage. In asmuch as financial balance sheets typically reflect such assets, we point out that the assets that matter for competitive advantage are rarely reflected in the balance sheet, while those that do not are.

[32] The coordinative properties of markets depend on prices being "sufficient" upon which to base resource allocation decisions.

[33] Indeed, Ronald Coase, author of the pathbreaking 1937 article 'The nature of the firm,' which focused on the costs of organizational coordination inside the firm as compared to across the market, half a century later has identified as critical the understanding of 'why the costs of organizing particular activities differs among firms' (Coase, 1988: 47). We argue that a firm's distinctive ability needs to be understood as a reflection of distinctive organizational or coordinative capabilities. This form of integration (i.e., inside business units) is different from the integration between business units; they could be viable on a stand-alone basis (external integration). For a useful taxonomy, see Iansiti and Clark (1994).

[34] Shuen (1994) examines the gains and hazards of the technology make-vs.-buy decision and supplier codevelopment.

alliances, the virtual corporation, and buyer–supplier relations and technology collaboration evidences the importance of external integration and sourcing.

There is some field-based empirical research that provides support for the notion that the way production is organized by management inside the firm is the source of differences in firms' competence in various domains. For example, Garvin's (1988) study of 18 room air-conditioning plants reveals that quality performance was not related to either capital investment or the degree of automation of the facilities. Instead, quality performance was driven by special organizational routines. These included routines for gathering and processing information, for linking customer experiences with engineering design choices, and for coordinating factories and component suppliers.[35] The work of Clark and Fujimoto (1991) on project development in the automobile industry also illustrates the role played by coordinative routines. Their study reveals a significant degree of variation in how different firms coordinate the various activities required to bring a new model from concept to market. These differences in coordinative routines and capabilities seem to have a significant impact on such performance variables as development cost, development lead times, and quality. Furthermore, Clark and Fujimoto tended to find significant firm-level differences in coordination routines and these differences seemed to have persisted for a long time. This suggests that routines related to coordination are firm-specific in nature.

Also, the notion that competence/capability is embedded in distinct ways of coordinating and combining helps to explain how and why seemingly minor technological changes can have devastating impacts on incumbent firms' abilities to compete in a market. Henderson and Clark (1990), for example, have shown that incumbments in the photolithographic equipment industry were sequentially devasted by seemingly minor innovations that, nevertheless, had major impacts on how systems had to be configured. They attribute these difficulties to the fact that systems-level or 'architectural' innovations often require new routines to integrate and coordinate engineering tasks. These findings and others suggest that productive systems display high interdependency, and that it may not be possible to change one level without changing others. This appears to be true with respect to the 'lean production' model (Womack *et al.*, 1991) which has now transformed the Taylor or Ford model of manufacturing organization in the automobile industry.[36] Lean production requires distinctive shop floor practices and processes as well as distinctive higher-order managerial processes. Put differently, organizational processes often display high levels of coherence, and when they do, replication may be difficult because it requires systemic changes throughout the organization and also among interorganizational linkages, which might be very hard to effectuate. Put differently, partial imitation or replication of a successful model may yield zero benefits.[37]

[35] Garvin (1994) provides a typology of organizational processes.

[36] Fujimoto (1994: 18–20) describes key elements as they existed in the Japanese auto industry as follows: 'The typical volume production system of effective Japanese makers of the 1980s (e.g., Toyota) consists of various intertwined elements that might lead to competitive advantages. Just-in-Time (JIT), Jidoka (automatic defect detection and machine stop), Total Quality Control (TQC), and continuous improvement (Kaizen) are often pointed out as its core subsystems. The elements of such a system include inventory reduction mechanisms by Kanban system; levelization of production volume and product mix (heijunka); reduction of 'muda' (non-value adding activities), 'mura' (uneven pace of production) and muri (excessive workload); production plans based on dealers' order volume (genyo seisan); reduction of die set-up time and lot size in stamping operation; mixed model assembly; piece-by-piece transfer of parts between machines (ikko-nagashi); flexible task assignment for volume changes and productivity improvement (shojinka); multi-task job assignment along the process flow (takotei-mochi); U-shape machine layout that facilitates flexible and multiple task assignment, on-the-spot inspection by direct workers (tsukurikomi); fool-proof prevention of defects (poka-yoke); real-time feedback of production troubles (andon); assembly line stop cord; emphasis on cleanliness, order and discipline on the shop floor (5-S); frequent revision of standard operating procedures by supervisors; quality control circles; standardized tools for quality improvement (e.g., 7 tools for QC, QC story); worker involvement in preventive maintenance (Total Productive Maintenance); low cost automation or semi-automation with just-enough functions); reduction of process steps for saving of tools and dies, and so on. The human-resource management factors that back up the above elements include stable employment of core workers (with temporary workers in the periphery); long-term training of multi-skilled (multi-task) workers; wage system based in part on skill accumulation; internal promotion to shop floor supervisors; cooperative relationships with labor unions; inclusion of production supervisors in union members; generally egalitarian policies for corporate welfare, communication and worker motivation. Parts procurement policies are also pointed out often as a source of the competitive advantage.

[37] For a theoretical argument along these lines, see Milgrom and Roberts (1990).

The notion that there is a certain rationality or coherence to processes and systems is not quite the same concept as corporate culture, as we understand the latter. Corporate culture refers to the values and beliefs that employees hold; culture can be a *de facto* governance system as it mediates the behavior of individuals and economizes on more formal administrative methods. Rationality or coherence notions are more akin to the Nelson and Winter (1982) notion of organizational routines. However, the routines concept is a little too amorphous to properly capture the congruence amongst processes and between processes and incentives that we have in mind. Consider a professional service organization like an accounting firm. If it is to have relatively high-powered incentives that reward individual performance, then it must build organizational processes that channel individual behavior; if it has weak or low-powered incentives, it must find symbolic ways to recognize the high performers, and it must use alternative methods to build effort and enthusiasm. What one may think of as styles of organization in fact contain necessary, not discretionary, elements to achieve performance.

Recognizing the congruences and complementarities among processes, and between processes and incentives, is critical to the understanding of organizational capabilities. In particular, they can help us explain why architectural and radical innovations are so often introduced into an industry by new entrants. The incumbents develop distinctive organizational processes that cannot support the new technology, despite certain overt similarities between the old and the new. The frequent failure of incumbents to introduce new technologies can thus be seen as a consequence of the mismatch that so often exists between the set of organizational processes needed to support the conventional product/service and the requirements of the new. Radical organizational reengineering will usually be required to support the new product, which may well do better embedded in a separate subsidiary where a new set of coherent organizatonal processes can be fashioned.[38]

Learning. Perhaps even more important than integration is learning. Learning is a process by which repetition and experimentation enable tasks to be performed better and quicker. It also enables new production opportunities to be identified.[39] In the context of the firm, if not more generally, learning has several key characteristics. First, learning involves organizational as well as individual skills.[40] While individual skills are of relevance, their value depends upon their employment, in particular organizational settings. Learning processes are intrinsically social and collective and occur not only through the imitation and emulation of individuals, as with teacher–student or master–apprentice, but also because of joint contributions to the understanding of complex problems.[41] Learning requires common codes of communication and coordinated search procedures. Second, the organizational knowledge generated by such activity resides in new patterns of activity, in 'routines,' or a new logic of organization. As indicated earlier, routines are patterns of interactions that represent successful solutions to particular problems. These patterns of interaction are resident in group behavior, though certain subroutines may be resident in individual behavior. The concept of dynamic capabilities as a coordinative management process opens the door to the potential for interorganizational learning. Researchers (Doz and Shuen, 1990; Mody, 1993) have pointed out that collaborations and partnerships can be a vehicle for new organizational learning, helping firms to recognize dysfunctional routines, and preventing strategic blindspots.

Reconfiguration and transformation. In rapidly changing environments, there is obviously value in the ability to sense the need to reconfigure the firm's asset structure, and to accomplish the necessary internal and external transformation (Amit and Schoemaker, 1993; Langlois, 1994). This requires constant surveillance of markets and technologies and the willingness to adopt best practice. In this regard, benchmarking is of con-

[38] See Abernathy and Clark (1985).

[39] For a useful review and contribution, see Levitt and March (1988).

[40] Levinthal and March, 1993. Mahoney (1992) and Mahoney and Pandian (1995) suggest that both resources and mental models are intertwined in firm-level learning.

[41] There is a large literature on learning, although only a small fraction of it deals with organizational learning. Relevant contributors include Levitt and March (1988), Argyris and Schon (1978), Levinthal and March (1981), Nelson and Winter (1982), and Leonard-Barton (1995).

siderable value as an organized process for accomplishing such ends (Camp, 1989). In dynamic environments, narcissistic organizations are likely to be impaired. The capacity to reconfigure and transform is itself a learned organizational skill. The more frequently practiced, the easier accomplished.

Change is costly and so firms must develop processes to minimize low pay-off change. The ability to calibrate the requirements for change and to effectuate the necessary adjustments would appear to depend on the ability to scan the environment, to evaluate markets and competitors, and to quickly accomplish reconfiguration and transformation ahead of competition. Decentralization and local autonomy assist these processes. Firms that have honed these capabilities are sometimes referred to as 'high-flex'.

Positions

The strategic posture of a firm is determined not only by its learning processes and by the coherence of its internal and external processes and incentives, but also by its specific assets. By specific assets we mean for example its specialized plant and equipment. These include its difficult-to-trade knowledge assets and assets complementary to them, as well as its reputational and relational assets. Such assets determine its competitive advantage at any point in time. We identify several illustrative classes.

Technological assets. While there is an emerging market for know-how (Teece, 1981), much technology does not enter it. This is either because the firm is unwilling to sell it[42] or because of difficulties in transacting in the market for know-how (Teece, 1980). A firm's technological assets may or may not be protected by the standard instruments of intellectual property law. Either way, the ownership protection and utilization of technological assets are clearly key differentiators among firms. Likewise for complementary assets.

Complementary assets. Technological innovations require the use of certain related assets to produce and deliver new products and services. Prior commercialization activities require and enable firms to build such complementarities (Teece, 1986b). Such capabilities and assets, while necessary for the firm's established activities, may have other uses as well. These assets typically lie downstream. New products and processes either can enhance or destroy the value of such assets (Tushman, Newman, and Romanelli, 1986). Thus the development of computers enhanced the value of IBM's direct sales force in office products, while disk brakes rendered useless much of the auto industry's investment in drum brakes.

Financial assets. In the short run, a firm's cash position and degree of leverage may have strategic implications. While there is nothing more fungible than cash, it cannot always be raised from external markets without the dissemination of considerable information to potential investors. Accordingly, what a firm can do in short order is often a function of its balance sheet. In the longer run, that ought not be so, as cash flow ought be more determinative.

Reputational assets. Firms, like individuals, have reputations. Reputations often summarize a good deal of information about firms and shape the responses of customers, suppliers, and competitors. It is sometimes difficult to disentangle reputation from the firm's current asset and market position. However, in our view, reputational assets are best viewed as an intangible asset that enables firms to achieve various goals in the market. Its main value is external, since what is critical about reputation is that it is a kind of summary statistic about the firm's current assets and position, and its likely future behavior. Because there is generally a strong asymmetry between what is known inside the firm and what is known externally, reputations may sometimes be more salient than the true state of affairs, in the sense that external actors must respond to what they know rather than what is knowable.

Structural assets. The formal and informal structure of organizations and their external linkages have an important bearing on the rate and direction of innovation, and how competences and capabilities co-evolve (Argyres, 1995; Teece, 1996). The degree of hierarchy and the level of vertical and lateral integration are elements of

[42] Managers often evoke the 'crown jewels' metaphor. That is, if the technology is released, the kingdom will be lost.

firm-specific structure. Distinctive governance modes can be recognized (e.g., multiproduct, integrated firms; high 'flex' firms; virtual corporations; conglomerates), and these modes support different types of innovation to a greater or lesser degree. For instance, virtual structures work well when innovation is autonomous; integrated structures work better for systemic innovations.

Institutional assets. Environments cannot be defined in terms of markets alone. While public policies are usually recognized as important in constraining what firms can do, there is a tendency, particularly by economists, to see these as acting through markets or through incentives. However, institutions themselves are a critical element of the business environment. Regulatory systems, as well as intellectual property regimes, tort laws, and antitrust laws, are also part of the environment. So is the system of higher education and national culture. There are significant national differences here, which is just one of the reasons geographic location matters (Nelson, 1994). Such assets may not be entirely firm specific; firms of different national and regional origin may have quite different institutional assets to call upon because their institutional/policy settings are so different.

Market (structure) assets. Product market position matters, but it is often not at all determinative of the fundamental position of the enterprise in its external environment. Part of the problem lies in defining the market in which a firm competes in a way that gives economic meaning. More importantly, market position in regimes of rapid technological change is often extremely fragile. This is in part because time moves on a different clock in such environments.[43] Moreover, the link between market share and innovation has long been broken, if it ever existed (Teece, 1996). All of this is to suggest that product market position, while important, is too often overplayed. Strategy should be formulated with regard to the more fundamental aspects of firm performance, which we believe are rooted in competences and capabilities and shaped by positions and paths.

Organizational boundaries. An important dimension of 'position' is the location of a firm's boundaries. Put differently, the degree of integration (vertical, lateral, and horizontal) is of quite some significance. Boundaries are not only significant with respect to the technological and complementary assets contained within, but also with respect to the nature of the coordination that can be achieved internally as compared to through markets. When specific assets or poorly protected intellectual capital are at issue, pure market arrangements expose the parties to recontracting hazards or appropriability hazards. In such circumstances, hierarchical control structures may work better than pure arms-length contracts.[44]

Paths

Path dependencies. Where a firm can go is a function of its current position and the paths ahead. Its current position is often shaped by the path it has traveled. In standard economics textbooks, firms have an infinite range of technologies from which they can choose and markets they can occupy. Changes in product or factor prices will be responded to instantaneously, with technologies moving in and out according to value maximization criteria. Only in the short run are irreversibilities recognized. Fixed costs—such as equipment and overheads—cause firms to price below fully amortized costs but never constrain future investment choices. 'Bygones are bygones.' Path dependencies are simply not recognized. This is a major limitation of microeconomic theory.

The notion of path dependencies recognizes that 'history matters.' Bygones are rarely bygones, despite the predictions of rational actor theory. Thus a firm's previous investments and

[43] For instance, an Internet year might well be thought of as equivalent to 10 years on many industry clocks, because as much change occurs in the Internet business in a year that occurs in say the auto industry in a decade.

[44] Williamson (1996: 102–103) has observed, failures of coordination may arise because 'parties that bear a long term bilateral dependency relationship to one another must recognize that incomplete contracts require gap filling and sometimes get out of alignment. Although it is always in the collective interest of autonomous parties to fill gaps, correct errors, and affect efficient realignments, it is also the case that the distribution of the resulting gains is indeterminate. Self-interested bargaining predictably obtains. Such bargaining is itself costly. The main costs, however, are that transactions are maladapted to the environment during the bargaining interval. Also, the prospect of ex post bargaining invites ex ante prepositioning of an inefficient kind.'

its repertoire of routines (its 'history') constrain its future behavior.[45] This follows because learning tends to be local. That is, opportunities for learning will be 'close in' to previous activities and thus will be transaction and production specific (Teece, 1988). This is because learning is often a process of trial, feedback, and evaluation. If too many parameters are changed simultaneously, the ability of firms to conduct meaningful natural quasi experiments is attenuated. If many aspects of a firm's learning environment change simultaneously, the ability to ascertain cause–effect relationships is confounded because cognitive structures will not be formed and rates of learning diminish as a result. One implication is that many investments are much longer term than is commonly thought.

The importance of path dependencies is amplified where conditions of increasing returns to adoption exist. This is a demand-side phenomenon, and it tends to make technologies and products embodying those technologies more attractive the more they are adopted. Attractiveness flows from the greater adoption of the product amongst users, which in turn enables them to become more developed and hence more useful. Increasing returns to adoption has many sources including network externalities (Katz and Shapiro, 1985), the presence of complementary assets (Teece, 1986b) and supporting infrastructure (Nelson, 1996), learning by using (Rosenberg, 1982), and scale economies in production and distribution. Competition between and amongst technologies is shaped by increasing returns. Early leads won by good luck or special circumstances (Arthur, 1983) can become amplified by increasing returns. This is not to suggest that first movers necessarily win. Because increasing returns have multiple sources, the prior positioning of firms can affect their capacity to exploit increasing returns. Thus, in Mitchell's (1989) study of medical diagnostic imaging, firms already controlling the relevant complementary assets could in theory start last and finish first.

In the presence of increasing returns, firms can compete passively, or they may compete strategically through technology-sponsoring activities.[46] The first type of competition is not unlike biological competition amongst species, although it can be sharpened by managerial activities that enhance the performance of products and processes. The reality is that companies with the best products will not always win, as chance events may cause 'lock-in' on inferior technologies (Arthur, 1983) and may even in special cases generate switching costs for consumers. However, while switching costs may favor the incumbent, in regimes of rapid technological change switching costs can become quickly swamped by switching benefits. Put differently, new products employing different standards often appear with alacrity in market environments experiencing rapid technological change, and incumbents can be readily challenged by superior products and services that yield switching benefits. Thus the degree to which switching costs cause 'lock-in' is a function of factors such as user learning, rapidity of technological change, and the amount of ferment in the competitive environment.

Technological opportunities. The concept of path dependencies is given forward meaning through the consideration of an industry's technological opportunities. It is well recognized that how far and how fast a particular area of industrial activity can proceed is in part due to the technological opportunities that lie before it. Such opportunities are usually a lagged function of foment and diversity in basic science, and the rapidity with which new scientific breakthroughs are being made.

However, technological opportunities may not be completely exogenous to industry, not only because some firms have the capacity to engage in or at least support basic research, but also because technological opportunities are often fed by innovative activity itself. Moreover, the recognition of such opportunities is affected by the

[45] For further development, see Bercovitz, de Figueiredo, and Teece, 1996.

[46] Because of huge uncertainties, it may be extremely difficult to determine viable strategies early on. Since the rules of the game and the identity of the players will be revealed only after the market has begun to evolve, the pay-off is likely to lie with building and maintaining organizational capabilities that support flexibility. For example, Microsoft's recent about-face and vigorous pursuit of Internet business once the Net-Scape phenomenon became apparent is impressive, not so much because it perceived the need to change strategy, but because of its organizational capacity to effectuate a strategic shift.

organizational structures that link the institutions engaging in basic research (primarily the university) to the business enterprise. Hence, the existence of technological opportunities can be quite firm specific.

Important for our purposes is the rate and direction in which relevant scientific frontiers are being rolled back. Firms engaging in R&D may find the path dead ahead closed off, though breakthroughs in related areas may be sufficiently close to be attractive. Likewise, if the path dead ahead is extremely attractive, there may be no incentive for firms to shift the allocation of resources away from traditional pursuits. The depth and width of technological opportunities in the neighborhood of a firm's prior research activities thus are likely to impact a firm's options with respect to both the amount and level of R&D activity that it can justify. In addition, a firm's past experience conditions the alternatives management is able to perceive. Thus, not only do firms in the same industry face 'menus' with different costs associated with particular technological choices, they also are looking at menus containing different choices.[47]

Assessment

The essence of a firm's competence and dynamic capabilities is presented here as being resident in the firm's organizational processes, that are in turn shaped by the firm's assets (positions) and its evolutionary path. Its evolutionary path, despite managerial hubris that might suggest otherwise, is often rather narrow.[48] What the firm can do and where it can go are thus rather constrained by its positions and paths. Its competitors are likewise constrained. Rents (profits) thus tend to flow not just from the asset structure of the firm and, as we shall see, the degree of its imitability, but also by the firm's ability to reconfigure and transform.

The parameters we have identified for determining performance are quite different from those in the standard textbook theory of the firm, and in the competitive forces and strategic conflict approaches to the firm and to strategy.[49] Moreover, the agency theoretic view of the firm as a nexus of contracts would put no weight on processes, positions, and paths. While agency approaches to the firm may recognize that opportunism and shirking may limit what a firm can do, they do not recognize the opportunities and constraints imposed by processes, positions, and paths.

Moreover, the firm in our conceptualization is much more than the sum of its parts—or a team tied together by contracts.[50] Indeed, to some extent individuals can be moved in and out of organizations and, so long as the internal processes and structures remain in place, performance will not necessarily be impaired. A shift in the environment is a far more serious threat to the firm than is the loss of key individuals, as individuals can be replaced more readily than organizations can be transformed. Furthermore, the dynamic capabilities view of the firm would suggest that the behavior and performance of particular firms may be quite hard to replicate, even if its coherence and rationality are observable. This matter and related issues involving replication and imitation are taken up in the section that follows.

Replicability and imitatability of organizational processes and positions

Thus far, we have argued that the competences and capabilities (and hence competitive advantage) of a firm rest fundamentally on processes, shaped by positions and paths. However, competences can provide competitive advantage and generate rents only if they are based on a collection of routines, skills, and complementary assets that are difficult to imitate.[51] A particular set of routines can lose their value if they support a competence which no longer matters in the marketplace, or if they can be readily replicated or emulated by competitors. Imitation occurs when firms discover and simply copy a firm's organizational routines and procedures. Emulation occurs when firms

[47] This is a critical element in Nelson and Winter's (1982) view of firms and technical change.

[48] We also recognize that the processes, positions, and paths of customers also matter. See our discussion above on increasing returns, including customer learning and network externalities.

[49] In both the firm is still largely a black box. Certainly, little or no attention is given to processes, positions, and paths.

[50] See Alchian and Demsetz (1972).

[51] We call such competences distinctive. See also Dierickx and Cool (1989) for a discussion of the characteristics of assets which make them a source of rents.

discover alternative ways of achieving the same functionality.[52]

Replication

To understand imitation, one must first understand replication. Replication involves transferring or redeploying competences from one concrete economic setting to another. Since productive knowledge is embodied, this cannot be accomplished by simply transmitting information. Only in those instances where all relevant knowledge is fully codified and understood can replication be collapsed into a simple problem of information transfer. Too often, the contextual dependence of original performance is poorly appreciated, so unless firms have replicated their systems of productive knowledge on many prior occasions, the act of replication is likely to be difficult (Teece, 1976). Indeed, replication and transfer are often impossible absent the transfer of people, though this can be minimized if investments are made to convert tacit knowledge to codified knowledge. Often, however, this is simply not possible.

In short, competences and capabilities, and the routines upon which they rest, are normally rather difficult to replicate.[53] Even understanding what all the relevant routines are that support a particular competence may not be transparent. Indeed, Lippman and Rumelt (1992) have argued that some sources of competitive advantage are so complex that the firm itself, let alone its competitors, does not understand them.[54] As Nelson and Winter (1982) and Teece (1982) have explained, many organizational routines are quite tacit in nature. Imitation can also be hindered by the fact few routines are 'stand-alone;' coherence may require that a change in one set of routines in one part of the firm (e.g., production) requires changes in some other part (e.g., R&D).

Some routines and competences seem to be attributable to local or regional forces that shape firms' capabilities at early stages in their lives. Porter (1990), for example, shows that differences in local product markets, local factor markets, and institutions play an important role in shaping competitive capabilities. Differences also exist within populations of firms from the same country. Various studies of the automobile industry, for example, show that not all Japanese automobile companies are top performers in terms of quality, productivity, or product development (see, for example, Clark and Fujimoto, 1991). The role of firm-specific history has been highlighted as a critical factor explaining such firm-level (as opposed to regional or national-level) differences (Nelson and Winter, 1982). Replication in a different context may thus be rather difficult.

At least two types of strategic value flow from replication. One is the ability to support geographic and product line expansion. To the extent that the capabilities in question are relevant to customer needs elsewhere, replication can confer value.[55] Another is that the ability to replicate also indicates that the firm has the foundations in place for learning and improvement. Considerable empirical evidence supports the notion that the understanding of processes, both in production and in management, is the key to process improvement. In short, an organization cannot improve that which it does not understand. Deep process understanding is often required to accomplish codification. Indeed, if knowledge is highly tacit, it indicates that underlying structures are not well understood, which limits learning because scientific and engineering principles cannot be as systematically applied.[56] Instead, learning is confined to proceeding through trial and error, and the

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[52] There is ample evidence that a given type of competence (e.g., quality) can be supported by different routines and combinations of skills. For example, the Garvin (1988) and Clark and Fujimoto (1991) studies both indicate that there was no one 'formula' for achieving either high quality or high product development performance.

[53] See Szulanski's (1995) discussion of the intrafirm transfer of best practice. He quotes a senior vice president of Xerox as saying 'you can see a high performance factory or office, but it just doesn't spread. I don't know why.' Szulanski also discusses the role of benchmarking in facilitating the transfer of best practice.

[54] If so, it is our belief that the firm's advantage is likely to fade, as luck does run out.

[55] Needless to say, there are many examples of firms replicating their capabilities inappropriately by applying extant routines to circumstances where they may not be applicable, e.g., Nestle's transfer of developed-country marketing methods for infant formula to the Third World (Hartley, 1989). A key strategic need is for firms to screen capabilities for their applicability to new environments.

[56] Different approaches to learning are required depending on the depth of knowledge. Where knowledge is less articulated and structured, trial and error and learning-by-doing are necessary, whereas in mature environments where the underlying engineering science is better understood, organizations can undertake more deductive approaches or what Pisano (1994) refers to as 'learning-before-doing.'

leverage that might otherwise come from the application of scientific theory is denied.

Imitation

Imitation is simply replication performed by a competitor. If self-replication is difficult, imitation is likely to be harder. In competitive markets, it is the ease of imitation that determines the sustainability of competitive advantage. Easy imitation implies the rapid dissipation of rents.

Factors that make replication difficult also make imitation difficult. Thus, the more tacit the firm's productive knowledge, the harder it is to replicate by the firm itself or its competitors. When the tacit component is high, imitation may well be impossible, absent the hiring away of key individuals and the transfers of key organization processes.

However, another set of barriers impedes imitation of certain capabilities in advanced industrial countries. This is the system of intellectual property rights, such as patents, trade secrets, and trademarks, and even trade dress.[57] Intellectual property protection is of increasing importance in the United States, as since 1982 the legal system has adopted a more pro-patent posture. Similar trends are evident outside the United States. Besides the patent system, several other factors cause there to be a difference between replication costs and imitation costs. The observability of the technology or the organization is one such important factor. Whereas vistas into product technology can be obtained through strategies such as reverse engineering, this is not the case for process technology, as a firm need not expose its process technology to the outside in order to benefit from it.[58] Firms with product technology, on the other hand, confront the unfortunate circumstances that they must expose what they have got in order to profit from the technology. Secrets are thus more protectable if there is no need to expose them in contexts where competitors can learn about them.

One should not, however, overestimate the overall importance of intellectual property protection; yet it presents a formidable imitation barrier in certain particular contexts. Intellectual property protection is not uniform across products, processes, and technologies, and is best thought of as islands in a sea of open competition. If one is not able to place the fruits of one's investment, ingenuity, or creativity on one or more of the islands, then one indeed is at sea.

We use the term appropriability regimes to describe the ease of imitation. Appropriability is a function both of the ease of replication and the efficacy of intellectual property rights as a barrier to imitation. Appropriability is strong when a technology is both inherently difficult to replicate and the intellectual property system provides legal barriers to imitation. When it is inherently easy to replicate and intellectual property protection is either unavailable or ineffectual, then appropriability is weak. Intermediate conditions also exist.

CONCLUSION

The four paradigms discussed above are quite different, though the first two have much in common with each other (strategizing) as do the last two (economizing). But are these paradigms complementary or competitive? According to some authors, 'the resource perspective complements the industry analysis framework' (Amit and Schoemaker, 1993: 35). While this is undoubtedly true, we think that in several important respects the perspectives are also competitive. While this should be recognized, it is not to suggest that there is only one framework that has value. Indeed, complex problems are likely to benefit from insights obtained from all of the paradigms we have identified plus more. The trick is to work out which frameworks are appropriate for the problem at hand. Slavish adherence to one class to the neglect of all others is likely to generate strategic blindspots. The tools themselves then generate strategic vulnerability. We now explore these issues further. Table 1 summarizes some similarities and differences.

[57] Trade dress refers to the 'look and feel' of a retail establishment, e.g., the distinctive marketing and presentation style of The Nature Company.

[58] An interesting but important exception to this can be found in second sourcing. In the microprocessor business, until the introduction of the 386 chip, Intel and most other merchant semi producers were encouraged by large customers like IBM to provide second sources, i.e., to license and share their proprietary process technology with competitors like AMD and NEC. The microprocessor developers did so to assure customers that they had sufficient manufacturing capability to meet demand at all times.

Table 1. Paradigms of strategy: Salient characteristics

Paradigm	Intellectual roots	Representative authors addressing strategic management questions	Nature of rents	Rationality assumptions of managers	Fundamental units of analysis	Short-run capacity for strategic reorientation	Role of industrial structure	Focal concern
(1) Attenuating competitive forces	Mason, Bain	Porter (1980)	Chamberlinean	Rational	Industries, firms, products	High	Exogenous	Structural conditions and competitor positioning
(2) Strategic conflict	Machiavelli, Schelling, Cournot, Nash, Harsanyi, Shapiro	Ghemawat (1986) Shapiro (1989) Brandenburger and Nalebuff (1995)	Chamberlinean	Hyper-rational	Firms, products	Often infinite	Endogenous	Strategic interactions
(3) Resource-based perspectives	Penrose, Selznick, Christensen, Andrews	Rumelt (1984) Chandler (1966) Wernerfelt (1984) Teece (1980, 1982)	Ricardian	Rational	Resources	Low	Endogenous	Asset fungibility
(4) Dynamic capabilities perspective	Schumpeter, Nelson, Winter, Teece	Dosi, Teece, and Winter (1989) Prahalad and Hamel (1990) Hayes and Wheelwright (1984) Dierickx and Cool (1989) Porter (1990)	Schumpeterian	Rational	Processes, positions, paths	Low	Endogenous	Asset accumulation, replicability and inimitability

Efficiency vs. market power

The competitive forces and strategic conflict approaches generally see profits as stemming from strategizing—that is, from limitations on competition which firms achieve through raising rivals' costs and exclusionary behavior (Teece, 1984). The competitive forces approach in particular leads one to see concentrated industries as being attractive—market positions can be shielded behind entry barriers, and rivals costs can be raised. It also suggests that the sources of competitive advantage lie at the level of the industry, or possibly groups within an industry. In text book presentations, there is almost no attention at all devoted to discovering, creating, and commercializing new sources of value.

The dynamic capabilities and resources approaches clearly have a different orientation. They see competitive advantage stemming from high-performance routines operating 'inside the firm,' shaped by processes and positions. Path dependencies (including increasing returns) and technological opportunities mark the road ahead. Because of imperfect factor markets, or more precisely the nontradability of 'soft' assets like values, culture, and organizational experience, distinctive competences and capabilities generally cannot be acquired; they must be built. This sometimes takes years—possibly decades. In some cases, as when the competence is protected by patents, replication by a competitor is ineffectual as a means to access the technology. The capabilities approach accordingly sees definite limits on strategic options, at least in the short run. Competitive success occurs in part because of policies pursued and experience and efficiency obtained in earlier periods.

Competitive success can undoubtedly flow from both strategizing and economizing,[59] but along with Williamson (1991) we believe that 'economizing is more fundamental than strategizing . . . . or put differently, that economy is the best strategy.'[60] Indeed, we suggest that, except in special circumstances, too much 'strategizing' can lead firms to underinvest in core competences and neglect dynamic capabilities, and thus harm long-term competitiveness.

Normative implications

The field of strategic management is avowedly normative. It seeks to guide those aspects of general management that have material effects on the survival and success of the business enterprise. Unless these various approaches differ in terms of the framework and heuristics they offer management, then the discourse we have gone through is of limited immediate value. In this paper, we have already alluded to the fact that the capabilities approach tends to steer managers toward creating distinctive and difficult-to-imitate advantages and avoiding games with customers and competitors. We now survey possible differences, recognizing that the paradigms are still in their infancy and cannot confidently support strong normative conclusions.

Unit of analysis and analytic focus

Because in the capabilities and the resources framework business opportunities flow from a firm's unique processes, strategy analysis must be situational.[61] This is also true with the strategic conflict approach. There is no algorithm for creating wealth for the entire industry. Prescriptions they apply to industries or groups of firms at best suggest overall direction, and may indicate errors to be avoided. In contrast, the competitive forces approach is not particularly firm specific; it is industry and group specific.

Strategic change

The competitive forces and the strategic conflict approach, since they pay little attention to skills, know-how, and path dependency, tend to see

[59] Phillips (1971) and Demsetz (1974) also made the case that market concentration resulted from the competitive success of more efficient firms, and not from entry barriers and restrictive practices.

[60] We concur with Williamson that economizing and strategizing are not mutually exclusive. Strategic ploys can be used to disguise inefficiencies and to promote economizing outcomes, as with pricing with reference to learning curve costs. Our view of economizing is perhaps more expansive than Williamson's as it embraces more than efficient contract design and the minimization of transactions costs. We also address production and organizational economies, and the distinctive ways that things are accomplished inside the business enterprise.

[61] On this point, the strategic conflict and the resources and capabilities are congruent. However, the aspects of 'situation' that matter are dramatically different, as described earlier in this paper.

strategic choice occurring with relative facility. The capabiliies approach sees value augmenting strategic change as being difficult and costly. Moreover, it can generally only occur incrementally. Capabilities cannot easily be bought; they must be built. From the capabilities perspective, strategy involves choosing among and committing to long-term paths or trajectories of competence development.

In this regard, we speculate that the dominance of competitive forces and the strategic conflict approaches in the United States may have something to do with observed differences in strategic approaches adopted by some U.S. and some foreign firms. Hayes (1985) has noted that American companies tend to favor 'strategic leaps' while, in contrast, Japanese and German companies tend to favor incremental, but rapid, improvements.

Entry strategies

Here the resources and the capabilities approaches suggest that entry decisions must be made with reference to the competences and capabilities which new entrants have, relative to the competition. Whereas the other approaches tell you little about where to look to find likely entrants, the capabilities approach identifies likely entrants. Relatedly, whereas the entry deterrence approach suggests an unconstrained search for new business opportunities, the capabilities approach suggests that such opportunities lie close in to one's existing business. As Richard Rumelt has explained it in conversation, 'the capabilities approach suggests that if a firm looks inside itself, and at its market environment, sooner or later it will find a business opportunity.'

Entry timing

Whereas the strategic conflict approach tells little abut where to look to find likely entrants, the resources and the capabilities approach identifies likely entrants and their timing of entry. Brittain and Freeman (1980) using population ecology methodologies argued that an organization is quick to expand when there is a significant overlap between its core capabilities and those needed to survive in a new market. Recent research (Mitchell, 1989) showed that the more industry-specialized assets or capabilities a firm possesses, the more likely it is to enter an emerging technical subfield in its industry, following a technological discontinuity. Additionally, the interaction between specialized assets such as firm-specific capabilities and rivalry had the greatest influence on entry timing.

Diversification

Related diversification—that is, diversification that builds upon or extends existing capabilities—is about the only form of diversification that a resources/capabilities framework is likely to view as meritorious (Rumelt, 1974; Teece, 1980, 1982; Teece *et al*., 1994). Such diversification will be justifiable when the firms' traditional markets decline.[62] The strategic conflict approach is likely to be a little more permissive; acquisitions that raise rivals' costs or enable firms to effectuate exclusive arrangements are likely to be seen as efficacious in certain circumstances.

Focus and specialization

Focus needs to be defined in terms of distinctive competences or capability, not products. Products are the manifestation of competences, as competences can be molded into a variety of products. Product market specialization and decentalization configured around product markets may cause firms to neglect the development of core competences and dynamic capabilities, to the extent to which competences require accessing assets across divisions.

The capabilities approach places emphasis on the internal processes that a firm utilizes, as well as how they are deployed and how they will evolve. The approach has the benefit of indicating that competitive advantage is not just a function of how one plays the game; it is also a function of the 'assets' one has to play with, and how these assets can be deployed and redeployed in a changing market.

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[62] Cantwell shows that the technological competence of firms persists over time, gradually evolving through firm-specific learning. He shows that technological diversification has been greater for chemicals and pharmaceuticals than for electrical and electronic-related fields., and he offers as an explanation the greater straight-ahead opportunities in electrical and electronic fields than in chemicals and pharmaceuticals. See Cantwell (1993).

Future directions

We have merely sketched an outline for a dynamic capabilities approach. Further theoretical work is needed to tighten the framework, and empirical research is critical to helping us understand how firms get to be good, how they sometimes stay that way, why and how they improve, and why they sometimes decline.[63] Researchers in the field of strategy need to join forces with researchers in the fields of innovation, manufacturing, and organizational behavior and business history if they are to unlock the riddles that lie behind corporate as well as national competitive advantage. There could hardly be a more ambitious research agenda in the social sciences today.

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