The Behavioral, Evolutionary, and Dynamic Capabilities

Theories of the Firm:

Retrospective and Prospective

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Abstract

Work on dynamic capabilities is proving to be a fruitful direction in understanding the nature of the firm. An evaluation of this literature makes the foundational contributions of Cyert and March (1963) and Nelson and Winter (1982) abundantly clear. Cyert and March redefined firms as heterogeneous organizations possessing standard operating procedures that are difficult to codify, arguing that they are therefore not easily imitated by others or even replicated by the firm itself. Nelson and Winter redefined standard operating procedures as routines, and showed how these routines, the genetic material of the firm, influenced the firm’s adaptation in its environment. These developments allowed subsequent scholars to couch firm strategy in a dynamic setting. In this paper we trace the lineage of dynamic capabilities from the revolutionary, but generally non-strategic behavioral model of Cyert and March, through the dynamic evolutionary theory of the firm found in Nelson and Winter, then through to the more recent efforts of Teece et al (1990, 1997), Zollo and Winter (2002), and Teece (2006). The paper traces the lineage from Cyert and March’s view of firms as heterogeneous organizations comprised of standard operating procedures to the development of a dynamic theory of firm capabilities through the contribution of Nelson and Winter’s model of routine-based firms evolving in a changing environment.
I. Introduction

A principal tenet of the field of strategy is that a firm’s performance over time is strongly tied to its ability to align capabilities to the ever-changing challenges of its environment, and ever-changing technological opportunities. Over the years, a handful of scholars have made major strides toward developing this basic insight. Particularly influential in this regard are the works of Schumpeter (1934), Penrose (1959), Cyert and March (1963), Barney (1986), Teece (1982, 1984), Nelson and Winter (1982), Teece and Pisano (1994), Teece, Pisano, and Shuen (1990, 1997) and Teece (2006). What sets these scholars apart is that, unlike many of their contemporaries (particularly in economics), they recognized that firms should not be conceptualized as production functions or production sets. Rather, understanding the resources, behavior and boundaries of firms entails conceptualizing firms as unique modes of organization, possessing distinct resources and capabilities.

Work on dynamic capabilities is proving to be a fruitful direction in understanding the nature of the firm. An evaluation of this literature makes the foundational contributions of Cyert and March (1963) and Nelson and Winter (1982) abundantly clear. Organizational routines, as refined by Nelson and Winter, become the repositories of the firm’s knowledge. Inherently tacit routines that are difficult to replicate can lend the firm a competitive advantage. The firm’s evolutionary path is critical to its range of possible alterations to its existing routines, and ultimately to its long-term success. The idea that
‘history matters’ is crucial to the dynamic capabilities literature. A firm’s history helps shape its heterogeneity. The key to dynamic capabilities, however, are high-level routines that determine the firm’s ability to perceive new opportunities, and allow the firm to alter lower-level routines to address these opportunities.

One of the most significant early contributions to our understanding of firm behavior and dynamic capabilities is Cyert and March’s (1963) *The Behavioral Theory of the Firm*. In *The Behavioral Theory*, Cyert and March redefined firms as heterogeneous organizations possessing standard operating procedures. Because these procedures are frequently difficult to codify, Cyert and March argued that they are not easily imitated by others or even replicated by the firm itself. This explanation of firm heterogeneity and immutability provided an important foundation for understanding firm level capabilities. It established that the ability of the firm to adapt to its environment cannot be taken for granted, and that a firm skilled at innovation and change might possess an advantage over its competitors.

However, while Cyert and March recognized the difficulty of such change, they did not provide a mechanism for understanding firm evolution. The critical next step toward a dynamic, strategic theory of the firm came from Nelson and Winter’s *An Evolutionary Theory of Economic Change*, which redefined standard operating procedures as routines, and showed how these routines, the genetic material of the firm, influenced the firm’s adaptation in its environment. These developments allowed subsequent scholars to couch firm strategy in a dynamic setting.
In the remainder of this paper we trace the lineage of dynamic capabilities from the revolutionary, but non-strategic behavioral model of Cyert and March, through the dynamic evolutionary theory of the firm found in Nelson and Winter, then through to the more recent efforts of Teece et al (1990, 1997), Zollo and Winter (2002), and Teece (2005). The paper shows how Cyert and March’s view of firms as heterogeneous organizations comprised of standard operating procedures led to the development of a dynamic theory of firm capabilities through the contribution of Nelson and Winter’s model of routine-based firms evolving in a changing environment.

II. The Behavioral Theory of the Firm

When Cyert and March’s work appeared in 1963, the drawbacks of conceptualizing the firm as a production function had already been underscored by scholars such as Coase, Simon, and Penrose. The assumptions of the neoclassical view were that the firm enjoyed perfect information and certainty about environmental outcomes, it suffered no control or adaptability problems, it maximized profit, and it suffered no dysfunctional internal resource allocation problems. Its strategies and performance were predictable, it manufactured and assembled tangible components, and it sold its output in final product markets. These assumptions provided for a very simple and manageable treatment of the firm which could be integrated into neoclassical price theory; but it was not a good

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1 A notable exception is Knight (1921), who acknowledged that economic decisions by individuals often involve great uncertainty, with probability calculation potentially impossible.
abstraction of a firm’s internal organization. Indeed, the neoclassical model failed to recognize firm heterogeneity, strategic behavior, and performance.

Meanwhile, early organizational theorists had focused on the internal characteristics that accounted for this diversity of organization. Sociological and social psychological approaches examined the decision-making processes, efficiency of individuals and small groups, and the coordination of effort (Gouldner 1954; Blau 1955; Argyris 1960; Likert 1961). While the work of organizational theorists had yielded insights into the decision processes employed by humans and in organizations, they had failed to specifically relate this understanding to the context of the firm. Their theories did not address the unique environmental and decision variables facing this particular form of organization.

Thus while the work of organizational theorists formed a basis for analyzing the structure and actions of organizations, a behavioral theory of the firm had not yet emerged. Cyert and March set out to create a theory that ‘takes (1) the firm as its basic unit, (2) the prediction of firm behavior with respect to such decisions as price, output, and resource allocation as its objective, and (3) an explicit emphasis on the actual process of organizational decision making as its basic research commitment’ (Cyert and March, p. 19). Against these goals, the shortfalls of earlier theories are clear. Although the neoclassical view addresses (1) and (2), it fails to approach the actual processes of condition (3). Likewise, early organizational theory satisfies (1) and (3), yet fails to predict the components of firm behavior in (2). Cyert and March sought to create a

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2 Economists such as Friedman (1953) argued that whether or not the model accurately represented the firm was irrelevant so long as its predictive value was high.
theory that met all these challenges and, in doing so, develop the language necessary for a robust theoretical discussion of the firm.

Cyert and March argue that a behavioral theory of the firm requires attention to organizational goals, expectations, choice, and control. Only through these characteristics can one truly understand how firms function. Their treatment of organizational goals focuses on how coalitions of individuals bargain to determine the goals of the greater organization. While the goals of individuals within a coalition may be disparate, so long as the resources available are greater than the demands of the members, the coalition, and thus the organization, will be feasible. At any given time, organizations will have numerous goals pertaining to each of the diverse decision variables facing them. These goals must address a variety of subjects including sales, market share, profit, inventory, and production levels.

Organizational expectations focus on how a firm gathers and interprets information from its environment.\(^3\) The bounded-rationality view of organizational expectations found in behavioral, evolutionary, and dynamic capabilities theory owes its development to the insights of Simon (1955, 1957). Simon was the first to argue that the limited cognitive ability of individuals prevented them from succeeding at complex optimization. Noting the complexity of most real-world problems, Simon suggested that the concept of \textit{maximizing} be replaced with the goal of \textit{satisficing}, where individuals aim for satisfactory outcomes rather than global maxima. Managers within the firm, for example,

\[^3\] For an extensive discussion of the evolution of theories on learning and organizational expectations, see Boerner et al. (2001)
are not able to perceive all possible courses of action, as they are ‘intendedly rational, but limitedly so.’ (Simon 1957; xxiv; Simon’s emphasis) Consequently, firms, composed of individuals, settle for sufficient outcomes, as they are unable to achieve or even identify ideal outcomes.

Cyert and March present the firm as adaptively rational, where its learning and behavior are conditioned by its experience. The adaptive nature of the firm is focused in the firm’s learning and memory, which are operationalized in the form of standard operating procedures and decision rules. These standard operating procedures include general choice procedures and specific operating procedures. General choice procedures address three principles: avoid uncertainty, maintain the rules, and use simple rules. These general choice procedures have been learned through the firm’s past environmental conditions and internal constraints. Consequently, general choice procedures tend to be extremely stable in the long-run and change only with considerable pressure.

Specific standard operating procedures also change slowly, but can be adjusted with concentrated effort. These procedures are the unique characteristics of the firm, which define and determine how the firm reacts to stimuli and situations. Some of these procedures may be codified to achieve consistency in organizational protocol, but other procedures may be tacit in nature. Standard operating procedures can therefore entail everything from the temperature at which coffee is served in a restaurant to the tacit search of applications for basic research. These specific standard operating procedures highly differentiate even those firms producing similar products by creating embedded
differences in every common task they perform. Procedures are highly fixed and difficult to change, and therefore represent dissimilarities relatively invulnerable to market transactions.

The four major types of specific standard operating procedures are task performance rules, continuing records and reports, information handling rules, and plans. Task performance rules deal with the specification of methods for accomplishing a variety of tasks, including pricing, production procedure, and accounting procedures. These rules need to be consistent within the organization in order to facilitate coordination between units performing indelibly linked tasks. If units are unable to understand and predict how complementary tasks will be performed, they may hinder one another with conflicting decisions. Task performance rules strictly define the parameters within which one can accomplish a task. This may include production line tasks as well as more complicated engineering and design solutions. These rules are persistent, though they may change as new ideas and rules are brought in with labor movement.

Continuing records and reports concern the documentation and codification of all elements of business operations important to the firm. Records and reports are the way in which a firm controls its procedures and predicts future outcomes and environments. They also control how information is stored and disseminated throughout the firm, an element critical to the firm’s ability to monitor adherence to standard procedures. Recording procedures also determine the level of codification of standard operating procedures, a concept extremely important in the replicability and imitability of all
procedures. In a related fashion, information handling rules define how the firm absorbs, transmits, and exports information. These procedures dictate what information the firm will perceive in its outside environment, which is critical to its ability to recognize opportunity and potential threats. The transmission of information influences how different components of the firm assimilate outside information, and whether or not this information is analyzed and applied within the firm. These procedures have wide-ranging effects for technology adoption and process improvements. Technological spillovers from outside the firm and among intrafirm organizations are dependent on the codified and tacit procedures for information transmission and dissemination. Firms unable to effectively gain outside knowledge and share process improvements will innovate with limited success and will be slow to adapt to a changing environment. These procedures also relate to information leaving the firm, or potentially its protection of intellectual property. Clearly the firm does not want its innovations distributed among its competitors, therefore it will establish strict protocols regarding confidentiality and information releases.

Plan procedures define how resources will be allocated, including both short-run and long-run budgets and expenditures. These procedures have significant influences on the firm’s long-run success in that they determine which aspects of the organization will receive priority support. Research and development funding is an integral part of a firm’s ability to evolve and grow, and plan procedures dictate the relative support these activities will receive. A firm whose plan procedures do not support innovation is unlikely to survive over long periods of time. More specifically, what types and areas of
research and development are supported will tend to determine the firm’s potential evolution. Plan procedures can define the firm’s intent and ability to innovate and evolve, its dynamic capabilities in particular directions.

III. The Behavioral Theory of the Firm and Strategy

Perhaps the most basic contribution of Cyert and March to this literature is their recognition of the fundamental importance of firm heterogeneity. While their work was not the first to challenge neoclassical views, they present the business enterprise as a complex organization defined by its unique goals, expectations, and standard operating procedures. Because each business enterprise is uniquely defined by these aspects, they are heterogeneous and thus not easily modeled. This heterogeneity creates differences in both short and long-term performance, as each firm’s unique characteristics may impact success in a given environment. Cyert and March’s analysis of the internal organization of the firm challenges the very idea of a perfectly competitive market. A market will never reach equilibrium with identical firms earning the same minimal level of profits. Diversity in standard operating procedures amongst firms within an industry will inevitably produce differential performance amongst competitors. Performance heterogeneity has been subsequently examined and verified by several empirical studies (Jacobson 1988; Hansen and Wernerfelt 1989). Cool and Schendel (1988) have shown that there are systematic and significant differences in performance among firms belonging to the same strategic group within the U.S. pharmaceutical industry. Additionally, Rumelt (1991) found intra-industry profit heterogeneity to be greater than inter-industry differences in profits, suggesting the relative importance of firm-related
sources of performance. Cyert and March’s assertions about the importance of firm characteristics have been strongly supported in empirical work within the field of strategy.

The idea that firms are fundamentally heterogeneous, in terms of their internal knowledge, skills, and resources, is at the heart of the field of strategic management. Homogeneous firms can possess no sustainable advantages over one another, and are thus of little strategic interest. Cyert and March's work in *The Behavioral Theory* was an important step toward understanding firm heterogeneity. Their move to develop a complete theory of the firm that explicitly recognized firm differences undercut the prevailing neoclassical assumptions that had so hindered the creation of a useful theory of the firm. Subsequent economic theories of firm evolution and strategy are consequently intellectual descendents of Cyert and March's early efforts.

While *The Behavioral Theory* brought added complexity to the internal characteristics of the firm, strategic and managerial considerations were not its focus. The goal was to understand decisions and actions inside the firm rather than provide prescriptive insight. Cyert and March believed organizations were incapable of following specific, unified objectives. Such specific objectives are critical to the establishment of corporate strategy, and without this ability, managers could only marginally influence the direction of the firm. Any objectives agreed upon by a management coalition would inevitably be weak, enfeebling the ability of a top manager or entrepreneur to truly control the direction of the
firm. Cyert and March argued that while ‘individuals have goals; collectivities of people do not’ (1992, p.30), and thus the firm could not have well-defined objectives.

Premised on weak leadership, The Behavioral Theory posits that the firm’s strategies and learning processes are short-term in focus, with adaptations induced by crises. Management is unable to reconfigure internal resources because of the immutability of standard operating procedures and the ambiguity of coalition goals. In his discussion of firm strategy, Oliver Williamson notes that in Cyert and March ‘the firm resembles a fire department more than a strategic actor’ (1999, p. 14). The firm is focused on finding solutions to immediate problems, not on longer-term strategic options. Although The Behavioral Theory ‘can not articulate a serious policy proposal for changing the behavior pattern’ (Cyert and March, 1963. p. 297), it nevertheless provides a greater understanding of the limitations to strategic action. The understanding of how routines and path dependency limit and enable the firm to solve problems was an important step in the development of the strategy literature.

While the behavioral theory introduced the implications of static firms in a dynamic environment, it failed to expand on how and why firms evolve as they do. Their major contribution to this dynamic view was the path dependency of relatively immutable standard operating procedures, a concept that would prove valuable and insightful for future studies of the firm. But their theory does not provide a clear picture of how firms change over time, and lends a sense of hopelessness toward the intention of guiding firm evolution. For, after all, the firm in the The Behavioral Theory does not focus on long-
term strategies of evolution. It is buoyed along by its obstinate procedures and relentless obsession with short-term solutions. To the credit of Cyert and March, their intention was not to develop a dynamic theory of firm strategy and long-term firm evolution. They sought to integrate economic theory and organizational theory into a tractable model of firm organization. In that goal they were undoubtedly successful, as is attested by the expansive literature that they spawned.

The Behavioral Theory, in its first effective modeling of firm organization, opened many opportunities for future work. One of these opportunities was clearly in the dynamic capabilities of the firm; how the firm, and consequentially industry, evolved with regard to exogenous stochastic stimulus. Cyert and March opened the door to this discussion. Nelson and Winter sought to move beyond Cyert and March’s static behavioral theory to a more dynamic, evolutionary approach. Evolutionary models of economic change were not new at this time, as they had earlier been championed by the likes of Schumpeter (1934), Penrose (1952, 1959), and Alchian (1950). Indeed, Sidney Winter (1971) had in earlier work noted the implications of the behavioralists’ decision rules for an evolutionary theory’s genetic process. Together, Nelson and Winter molded these earlier contributions into a new theory with direct implications for firm evolution and strategy.

IV. The Evolutionary Theory and Deliberate Action

Nelson and Winter’s evolutionary theory is loosely based on a biological evolutionary model, where organisms, with genetic material, evolve in response to their changing
environment. They are careful to note, however, that they feel no need to remain consistent with such biological models, as their goal is to use models of evolutionary theory to improve economic theory. In this spirit, they ‘emphatically disavow any intention to pursue biological analogies for their own sake, or even for the sake of progress toward an abstract, higher-level evolutionary theory that would incorporate a range of existing theories (1982, p.11). They are solely interested in the understanding of economic problems, with the core concern of their evolutionary theory being ‘the dynamic process by which firm behavior patterns and market outcomes are jointly determined over time’ (1982, p. 18).

In the spirit of this goal, they are quick to note that their theory does not observe a sharp distinction between blind evolution and deliberate goal-seeking. This approach, where firms are both carried along by their changing environment and deliberately evolve to improve their position therein, is the critical contribution of Nelson and Winter toward firm strategy and ultimately the dynamic capabilities theory of the firm.

While Nelson and Winter acknowledge the difficulty of deliberate direction in firm evolution, they do not espouse the impossibility of it. Unlike Cyert and March, Nelson and Winter suggest a role for long-term strategic planning in the dynamic performance of the firm. Firms are no longer purely myopic and inevitably tied to their existing standard operating procedures. They have the ability to affect their chances of long-term survival, that is, to partially guide their evolution. They do not possess the absolute control of neoclassical managers, nor do they suffer from the evolutionary impotence of the behavioral
theory. They have differential characteristics and abilities and thus have unique potential evolutionary paths. This limited but nonetheless existent adaptive control implies that firm strategy is not only possible, but also profitable. Those few firms capable of successfully evolving with their environment will enjoy supernormal rents as maladapted competitors become increasingly inefficient and irrelevant.

V. Routines: Evolutionary Theory’s Standard Operating Procedures

One of the great contributions of Cyert and March was their definition of the firm as a set of standard operating procedures. Nelson and Winter recognized the legitimacy of this characterization, and sought to redefine it in terms of firm routines. They define routines similarly as the decision rules which firms employ, both in terms of highly defined production techniques and extremely tacit strategic directions. These routines encompass most of what is regular and predictable about business behavior, and represent the “genetic” material of the firm in the evolutionary model. They are persistent and define not only how the firm operates now, but also how it will tend to operate in the future. The stochastic forces of the environment, in combination with the “genetic” material of the firm, guide how the firm changes and how it will perform.

Routines are patterns of interactions representing solutions to particular problems resident in group behavior, and can only be partially codified, due to their inherently tacit dimension. Routines can be both static and dynamic. Static routines allow the firm to replicate certain previously performed tasks, and although they are generally stable,
improvements and mutations will always occur with repetition. Dynamic routines are those that seek new product, process, and business model innovations. They are heavily embedded in the research and development a firm pursues. As both Nelson and Winter (1982) and Teece (1984) argue, routines can be highly tacit in nature. This makes replication or imitation of them difficult, and renders them difficult to buy and sell in some intermediate markets.

Nelson and Winter’s work also emphasized routines as organizational memory. They assert that organizations learn by doing, and this knowledge is stored in the routines of the firm. In their view of the firm, information flows into the organization from the external environment. Members interpret this information and react by invoking routines that were successful in the past. Their performance generates information recognized by others, who interpret it and invoke the associated routine. Members of the organization are thus continually reacting to both external and internal information. The routines of the organization are self-sustaining, in that their repetition strengthens their existence in the firm. It is the conformity to these routines that can pose a problem for the organization. As the firm’s environment changes, routines will continue to persist even though they may no longer be effective at solving the relevant problems. This persistence is dangerous if it makes the firms unable to adapt to a new environment. Firms will tend to select inputs that are compatible with internal routines rather than alter the routine to fit new alternative inputs.
The routines in Nelson and Winter have many similarities to the standard operating procedures of the behavioral theory. Imbedded in the everyday operations of the firm, routines as defined by Nelson and Winter are inherently difficult to change. They are reinforced daily through their repetition, and are therefore self-enforcing, self-sustaining entities. Their relatively immutable nature tends to make the firm’s actions path-dependent, that is, the strengthening of routines through their repetition makes their alteration difficult. Routines, like standard operating procedures, contain significant levels of tacit knowledge. Routines are therefore not easily defined, codified, or taught. Rather, they are learned and sustained through practice. Their tacit nature makes their replication extremely difficult, as they are not easily understood and defined procedures that can be applied identically in a new environment. Their tacitness is also typically embodied at an organizational level, such that individuals are rarely capable of replicating them through a new job assignment. While replication is difficult, imitation may be nearly impossible. For while the firm can at least observe the characteristics, outputs, and processes of the routine, those outside the firm can only glimpse it at a distance.

Identifying and replicating successful routines can be a challenging proposition for the firm. Attributing causal relationships between a routine and subsequent performance may be highly inaccurate due to complicated interactions between the firm’s many routines. Furthermore, performance feedbacks can be vague due to a constantly changing environment, time lags, and the limited cognitive ability of management. Even if firms can accurately observe which routines are most effective at obtaining their objective, they
will be limited in their ability to apply these routines to other, less-efficient parts of the organization. The difficulty of replication of routines creates heterogeneity in the internal structure of firms as competitors are even less likely to successfully imitate routines. Less-efficient firms, while always striving to adopt the routines of their more successful competitors, are rarely able to do so, even through the hiring of key personnel. The tacit nature of routines therefore makes sustainable competitive advantage possible, and gives importance to firm-level characteristics. Unlike the orthodox economic treatment of the firm, routines are not observable, replicable production functions ripe for imitation.

Nelson and Winter divide routines into three classes. The first of these classes includes the short-run procedures that determine how the firm uses its current capital stock. They define these routines as operating characteristics, and note that they govern a firm’s behavior in a given time period. The second group of routines determines how the firm alters its capital stock across periods in response to environmental stimulus. How the firm chooses to expand or retract its capital investment is unique, and is closely determined by profitability. The third and final set of routines are those which over time alter certain aspects of operating characteristics. As Nelson and Winter define them, these routines include market analysis departments, operations research shops, and research and development laboratories. They define how the firm critically analyzes the existing operating routines and decides whether or not to alter them. Nelson and Winter argue that even the way in which a firm scrutinizes and changes existing routines is rule-guided. Routines are therefore hierarchical, with higher-level strategic procedures acting to alter lower-level operating procedures. They argue that top-level routines, which serve
to alter other routines, define the probability distribution of what routine modifications or new routines will be found through search. Firms evaluate potential routine alterations by the criterion of anticipated profit.

Nelson and Winter’s characterization of these higher-level routines is an important advance of the behavioral theory of the firm. Whereas the behavioral theory of Cyert and March defined the possibility of intendedly altering procedures as negligible, the evolutionary theory argues that particular routines accomplish exactly this feat. The firm is to some degree capable, through analysis and research, of intendedly mutating its “genetic” routines, strategically positioning itself in the dynamic environment it perceives. The range of possible mutations and the way in which it accomplishes these changes are determined by its idiosyncratic search routines and the stochastic environment. The firm is therefore constrained in its ability to evolve, but is nevertheless deliberate in its ability to do so. Nelson and Winter introduce self-determination to the behavioral theory’s concept of procedures. The firm is no longer governed by the uncontrollable components of its organization. It has at least some ability to strategically alter them over time, in response to stimulus from its environment. This theoretical advance is critical to the application of the behavioral theory’s idiosyncratic firm characteristics to the field of firm strategy. Without some ability to dictate change over time, the firm has no strategic recourse for an inherently dynamic environment. Firms defined as mere puppets of their own characteristics have no hope of sustainable competitive advantage. In such a case, the changing exogenous environment will be the sole determinant of their fate. The firm’s ability to identify new opportunities and change
its lower-level routines to pursue them will therefore be defined by the high-level search routines of Nelson and Winter. Since each firm has unique routines, firms will have differential abilities to profitably adapt to a dynamic environment. Firms will thus have different dynamic capabilities, a concept to be more explicitly defined later by strategy scholars.

Another aspect of Nelson and Winter’s routines is that the firm selects among alternative investments by evaluating their expected profit potential. While bounded rationality limits the firm in formulating complex expectations about future profits, it does not prevent the evolutionary theory’s firm from having an objective. This objective, although not explicitly defined or evident for the firm, nevertheless exists. In its actions and decisions, the ‘evolutionary firm’ is a singular entity capable of unified action. This is a sharp contrast from the behavioral theory, where the firm possesses no coherent objective but rather is portrayed as a coalition of decision-makers with distinctly different objectives. Nelson and Winter, more concerned with long-term evolution than behavioralists, recognize that while bounded rationality inherently limits cleanly defined objective functions, such objectives nevertheless exist. Recognizing these objectives, firms use their search routines to achieve them. At an even higher level of routine, firms choose strategies that over time allow them to adapt in the way that most consistently achieves these objectives. In the evolutionary model of Nelson and Winter, ‘firms have different strategies, and a central analytical concern is the viability or profitability of firms with different strategies’ (p. 37). While they do not explicitly model firms’ abilities
to change strategies, ‘such changes are quite admissible within the logic of our theory’ (p. 37).

A third important advance of the evolutionary theory is its recognition of the critical nature of learning in long-term firm performance. The search routines of Nelson and Winter guide the firm toward innovation similar to the firm’s current stock of technological knowledge. The firm is unlikely to scan the entire stock of knowledge before making their technological choices, but will rather focus on those technologies perceptible through their search routines. These search routines will tend to focus the firm in areas in which it already has experience, thus creating a form of technological path dependence. The strength of this path dependence and the counter-acting ability of the firm to change directions will be determined by its high-level strategic routines. Thus while firms will tend toward path dependent innovation, they are not hopelessly locked into their current course.

VI. The Resources and Dynamic Capabilities Literature

Nelson and Winter’s conception of firms as embodying organizational routines plays a central role in what has become one of the dominant perspectives of firms strategy: the Resource-Based View of the Firm. The resource-based approach to firm strategy portrays firms as a collection of tangible and intangible assets, resources or competences, which are tied to the firm and are difficult for others to imitate. Drawing on Nelson and Winter, Teece (1988) describes a firm's competences as a set of differentiated
technological skills, complementary assets and organizational routines that provide the basis for a firm’s competitive capacities in one or more businesses. Externally, these competences may be perceived as a firm’s skill in a particular product area. However, a competence is the ability of a firm to solve organizational and technical problems, and thus is not limited to a specific set of products. Indeed, firms frequently possess competences that extend into multi-product space. Examples of firm-specific competences include employment of skilled personnel, in-house knowledge of technology, operating routines and trade contacts (Wernerfelt, 1984). Consistent with Nelson and Winter (1982), Teece (1984) notes that these resources arise primarily through organizational learning. As a result, they are closely tied to the products and markets in which the firm has historically been active. These resources enable firms to have markedly lower costs or to offer higher quality products and performance than competitors. To the extent that resource endowments are ‘sticky,’ firms with superior competences will tend to be more profitable than competitors.

To be considered a source of competitive advantage, an organizational competence must meet three conditions: it must be heterogeneously distributed within an industry; it must be difficult to purchase on the market; and it must be difficult or impossible to imitate (Peteraf, 1993). Considerable discussion in the literature suggests that high-technology competences are particularly likely to meet these conditions since such capabilities are frequently based on tacit knowledge, involve knowledge which isn’t widely distributed, and are subject to considerable uncertainty regarding quality and performance (Dosi, 1988).

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4 A firm's competences, as defined by Teece, are typically implicitly or explicitly assumed in economic theory. As such, competences are viewed as widely and freely distributed among firms, thus giving limited
As a result, high technology competences are likely to be difficult to acquire through straightforward market transactions (Teece, 1982; Mowery, 1983). The same features that make the market transfer of technology competences difficult also limit the ability of other firms to imitate these competences. The non-replicable nature of many technology competences is the cornerstone of their strategic importance.

Teece and Pisano (1994) divide a firm's organizational competence into three components: (1) allocative competence – the decisions involving what to produce and how to price it; (2) transactional competence – decisions on whether to make or to buy, and whether to do so alone or in a partnership; and (3) administrative competence – how to design organizational structures and policies to improve performance, whether through lower costs, higher quality or product performance. Additionally, they define technical competence as the ability to design and develop products and processes, and as the ability to operate facilities effectively. Technical competences, which also include learning, typically have significant tacit components, making them relatively safe from replication. These competences reside largely in the organizational routines that contain a firm's collective knowledge.

The resource-based view of firm strategy builds on and extends many core concepts addressed by Nelson and Winter. As with Nelson and Winter’s discussion of organizational routines, the resource-based view portrays firm competences as self-sustaining and static, despite a dynamic environment. A number of forces conspire to insight into heterogeneity, organizational structure or firm performance.
endow a firm with long-lived and immutable competences, regardless of the firm’s intent to adapt. Firms may lack the ability to create new competences (Dierickx and Cool, 1989) and may be unable to acquire them in the market due to their tacit nature (Teece, 1976, 1980). Even if a firm were able to purchase a competence, it likely would pay prices high enough to limit any profits the asset might yield (Barney, 1986).

In some sense, however, much of the resource-based view fails to exploit what is truly novel and insightful in Nelson and Winter’s work: its dynamic focus. Indeed, it is conceivable that a relatively static form of the resource-based theory of the firm could have been achieved even without reference to the work of Nelson and Winter. Such a theory would have incorporated many of the Cyert and March’s behavioral theory’s firm-specific aspects and even possibly the tacit nature of procedures and the consequential difficulties of replication and imitation. Certainly, the tacitness of routines helps create heterogeneity among firms, and can explain much of the cross-sectional performance differences important in the resource-based theory (Dosi and Marengo, 1994; Coriat and Weinstein, 1995; Dosi, 1998). But while such a static theory would have been important in defining the importance of firm-level characteristics, it would have missed the critical dynamic characteristics introduced in The Evolutionary Theory. Without such a dynamic view of firm evolution, the importance concept of sustainable advantage would be intractable. Building directly on Nelson and Winter’s work, the dynamic capabilities literature (Teece, Pisano, and Shuen, 1990; Teece and Pisano, 1994; Teece, Pisano, and Shuen, 1997) has sought to study firms’ abilities to adapt to and exploit a changing environment i.e. dynamic capabilities seeks to explain how firms achieve and sustain
competitive advantage despite an ever-changing environment, and it argues that a firm gains competitive advantage through innovation processes and through the orchestration abilities of the top management team. While dynamic capabilities draws from the resource-based view and transaction cost economics, it also draws upon Nelson and Winter’s work in evolutionary economics.

Dynamic capabilities emphasize the key role of strategic management in appropriately adapting, integrating, and re-configuring internal and external organizational skills, resources, and functional competences in a changing environment (Teece and Pisano, 1994, p. 57). The firm’s flexibility is likely to be constrained by available paths, its current position, and its organizational processes or routines.

The available **paths** represent the firm’s opportunities and strategic alternatives. As in the evolutionary theory, firms typically are only capable of successful learning in areas or ways close to those it currently employs (Teece, 1988). The marginal cost of gaining further knowledge in known areas is usually much less than innovating in unrelated fields (Cohen and Levinthal, 1990). Thus firms will tend to innovate close in to areas they know well. A firm is not an infinitely malleable entity, but rather is an organization capable of limited change at significant cost. The past and current activities of the firm will powerfully influence the technological paths available to it, in that breakthroughs in related areas will be more readily identifiable and exploitable to the firm (Dosi, 1982).
The firm’s current position is defined by its intellectual property, supplier relations, strategic alliances, and endowment of technology. As in the resource-based view, tradable and readily transferable assets represent no concrete competitive advantage. These assets therefore are often tacit knowledge assets, ones deeply embedded in the routines and processes of the firm (Teece, 1981). Other assets, such as the firm’s location and financial position, can also determine its available strategic options. Those assets that are difficult to replicate or imitate, however, form the key competences of the firms, and dynamic capabilities are those competences that allow the firm to respond to and exploit changing market environments.

The organizational processes or routines of the firm can be partly viewed in how efficient the firm is in the integration of its internal activities and its external ties. These routines govern how information is gathered and processed, aspects critical to innovation and problem solving. Routines exist in how the firm relates to its suppliers, and how information is gathered from external sources. The coordination of separate groups within the firm is routinized in the practices of management, as are research and development processes, fields, and goals. The incentives and controls within the firm are critical routines defining its position and future paths.

Some of the most important routines within the firm involve learning. In the dynamic capabilities view, learning in the firm is an inherently organizational process. While individual skills and knowledge can contribute critically to the organization, learning processes are intrinsically social and collective. The coordination of search procedures
and communication are necessary for effective learning, and the current routines determine how and what a firm can process. Additionally, the organizational knowledge gained from learning is stored in the new routines and logic of the organization. The existing processes for locating, identifying, and integrating important information into the firm will guide the trajectory of the firm’s learning. As discussed in Nelson and Winter, learning by the firm is largely determined by these routines and is thus highly path-dependent in nature.

Although existing routines are largely determinant of the firm’s learning trajectory, the firm may still have difficulty harnessing competences based in these routines for specific strategic adaptations. The firm may wish to apply its highly successful routines toward other aspects of its organization for geographic and product line expansion, and may believe that this replication can help it better understand the routines in order to modify and improve them. But as Teece (1976) and Winter and Szulanski (2002) outline, replication or utilization of existing routines is rarely costless or perfect. The capabilities created by routines may be difficult to understand because they involve tacit knowledge and production and research processes not readily observable or codified. The tacit nature of these processes may be impossible to replicate, even by the firm itself, and the firm’s ability to replicate its routines may be inevitably hampered by its inability to identify them (Szulanski, 1996). Lippman and Rumelt (1982) have argued that some sources of competitive advantage are so opaque that the firm itself cannot identify them. Even if the firm can identify its routines, the firm may not wholly understand them, or
may find them inseparably linked to other specific routines (Teece, 1976). Thus attempting to apply these routines in strategic initiative may be improbable.

When the firm is unable to replicate its successful routines, its competitors are even more unlikely to successfully imitate them. When routines are highly tacit, imitation will likely be impossible, as competitors have no ability to observe internal procedures. When competitors are able to observe and imitate competence-forming routines, however, the firm may be able to protect itself with intellectual property rights. Although intellectual property rights, such as patents, are highly observable, they are mostly limited to product technologies. Process technologies, or the routines endemic in the firm’s production, are not readily observable, and thus can not be easily imitated. Such routines may be difficult to replicate as well, but allow no window of observation for the potential imitator.

The critical aspects of dynamic capabilities are the ability of the firm to identify the changing market environment, to sense the opportunity, then to seize it. The ability of the firm to sense the need and the opportunity and then accomplish the necessary transformation and alignment of complementary and cospecialized assets is the essence of dynamic capability, and creates significant value. (Amit and Schoemaker, 1993; Langlois, 1994) Part of this ability is dependent on the firm’s ability to locate and assimilate information from its environment. The location and integration of this information is grounded in part on the firm’s search and information processing routines, and market and competition intelligence routines. Not only must the firm discover new
paths through its own and others’ intelligence, it must also recognize the importance of these paths, and be able to address them. Past experience and managerial insight conditions the feasible alternatives management is likely to perceive (Teece, Pisano, and Shuen, 1997).

The firm must also be able to reconfigure its organization and assets before its competitors upon recognition of a new opportunity or environmental shift. The firm’s evolutionary path may be narrow, and the alternative directions available to the firm are limited by its positions and its history. The ability to locate and address new opportunities while working within constraints is an inherently entrepreneurial function, not an administrative one. While there is path dependence in the dynamic capabilities framework, it is also recognized that management not only guides the organization in adaptation; it also proactively endeavors to shape the firms evolutionary path. The top management team searches for new information, tries to make sense of it, and then endeavors to orchestrate the firm’s resources, reaching out to acquire missing (cospecialized) assets. Because markets for specialized assets are thin, astute bargaining and acquisition of complementary and cospecialized assets and technologies can yield considerable value.

VII. Dynamic Capabilities: New Elements and Testable Hypotheses
The dynamic capabilities literature now has momentum of its own. In this section we discuss recent extensions, testable hypotheses, and implications for the theory of the firm and for strategic management.

Recent work (Teece, 2005) has highlighted certain dimensions and attributes of dynamic capabilities. First, not all routines constitute dynamic capabilities. Basic operating routines clearly do not. The manner in which a firm makes investment choices and achieves alignment of cospecialized assets is, however, critical. As noted above, while Nelson and Winter recognized the importance of routines that alter the capital stock, they do not spell out in any detail the key issues and mechanisms of resource allocation. In Teece (2005) particular emphasis is given to several factors not discussed directly by Nelson and Winter. They are (1) selection of business models, (2) investment decision criteria and choices, (3) the development and acquisition of complementary and cospecialized assets and, (4) asset orchestration activities of management. These are important sources of competitive advantage. They aren’t necessarily defined by routines; but nor are they ad hoc. They depend in part on the entrepreneurial capacities of management, and the governance/leadership structure of the firm. We briefly elaborate on these items below.

Figuring out the right business model is a key success factor for firms operating in fast changing business environments. R&D will not create competitive advantage unless the commercialization strategy is set astutely. Teece (1986), Chesbrough and Rosenbloom (2002) and Teece (2005) stress the critical role of business models/strategy. Key
elements of the business model include whether one outsources manufacturing, whether one simply licenses the technology, whether one sells or leases the product to customers, the selection of the target markets, the primary strategy, whether one bundles the sale with other offerings etc etc. There are a plethora of choices. Getting the model right matters. Sony lost with its arguably superior Betamax technology standard over Matsushita’s VHS standard because Matsushita adopted a more collaborative strategy, recognizing early on the 2-sided market (Evans, 2003) issue that it was confronting. Also, Dell’s success in the PC business and Wal-Mart’s in retailing are based on their ability to design and implement superior organizational arrangements for going to market.

One of the challenges of our ongoing work is explaining the sources of dynamic capabilities. For instance, we doubt that developing a business model can be routinized. On the other hand, it cannot be ad hoc. The business model sets the architecture of a business; developing a new model involves creative acts --- in the case of Dell and Wal-Mart, it involved the use of new information technology to revolutionize the supply chain. The necessary skills and insights often come from entrepreneurs, actors largely missing from Cyert and March. Even Nelson and Winter, who view change routines as adaptive mechanisms; do not capture the entrepreneurial acts that transcend adaptive capacities, and are ultimately proactive. As Schumpeter noted, these activities involve “new combinations” which are not simply adaptive. A brilliant entrepreneur can string together a series of insights and see clearly possibilities that always existed but simply hadn’t been recognized by others. While the focus in studying entrepreneurial activity has
been in high technology industries, these combinations, in our view, can, but need not be, new technologies.

The astuteness with which investment choices are made inside the enterprise is also of critical importance. While small (incremental) investments made as part of the firms annual capital budgetary cycle can be routinized, we believe there is an important class of large irreversible investments which cannot be routinized and involve judgment calls by management and the board of directors. Included in this category are large mergers and acquisitions. While elements of these decisions (e.g. legal due diligence, valuation) may be routinized, issues around strategic fit involve critical elements of managerial judgment. Good governance from tough-minded boards of directors can undoubtedly help steer management away from egregious errors. Quality judgments about the likely evolution of technologies and markets are critical to success. While models exist for valuing assets under uncertainty\(^5\), there remain important visions to be articulated, and judgment calls to be made. The genius (or lack thereof) and judgment of the top management team has to be important to this process.

Another missing element from the Cyert and March and the Nelson and Winter perspectives is recognition of the distinctive asset orchestration roles that management can play. An important source of competitive advantage that firms possess is the unique value creation opportunities that can flow from employing specific assets/resources inside the firm. These assets can sometimes be secured externally (possibly through M&A activity) or built internally. Because there isn’t a well-developed market for idiosyncratic
assets, they can sometimes be secured on advantageous terms. Once under managerial control, they can be orchestrated to yield products and services that are differentiated. Such differentiation based on difficult to imitate resources/assets combinations can be a source of rents, if demand conditions are satisfactory. The ability of (entrepreneurial) management to coalign idiosyncratic assets in a semicontinuous fashion is an important dynamic capability.

While the dynamic capabilities approach is still in its infancy, a body of studies on firm and industry evolution suggests the promise for empirically identifying dynamic capabilities. Extensive industry studies by Klepper and Graddy (1990), Klepper (1997), Klepper and Simons (2000) have shown how industry life cycles may follow general patterns, but have further raised questions about idiosyncratic firm success. Other industry studies have demonstrated the importance of innovation in industry and firm evolution (Mowery and Nelson, 1999; Bottazzi et al., 2001). More recent historical case studies have demonstrated the value in the detailed description of dynamic capabilities. These papers have shown the importance of prior experience and managerial beliefs on both the success and failure of firms in adapting to changing environments, examining firms in typesetting (Tripsas, 1997), internet services (Rindova and Kotha, 2001), imaging (Tripsas and Gavetti, 2000), and semiconductors (Holbrook, Cohen, Hounshell, and Klepper; 2000).

King and Tucci (2002) demonstrate the promise of using panel data to study the sources of dynamic capabilities in experience with sales and production, and with the

\[5\] Monte Carlo simulation models can assist in this process.
transformational activities of new market entry. In their work on the disk-drive industry, they use panel data to identify the effect of both experience in existing markets and experience with new market niche entry on new entry and performance. They find evidence that while many incumbent firms missed market opportunities, static experience from past production and sales actually led to entry and increased sales. Furthermore, they find no evidence that transformational experience, or experience from previous market entry, increased entry or success of entry. Their results suggest that dynamic capabilities may come from multiple types of experience, and that the routines developed in existing markets may yield success in new endeavors as much as they may yield unhealthy inertia.

King and Tucci acknowledge, however, that their results suggesting market entry experience does not encourage future entry may be the result of limited resources for market entry. Their results indicate that further studies using panel data are important in linking transformational experience with dynamic capabilities. It may be fruitful for researchers to explore how experience in integrating and divesting diverse (or related) assets may lead to superior performance in diversified corporations. Can the number of past acquisitions and divestments predict higher returns in new markets or acquisitions? Acknowledging the importance of industry and firm-level controls, this empirical approach may yield a better understanding of whether dynamic capabilities stem from past transformational or dynamic activities.
Another idea, briefly pursued by Rindova and Taylor (2002), involves measuring the heterogeneous effects of exogenous shocks on firm profitability and survival. Their project examines how firms in defense-related IT and biotechnology reacted to the terrorist attacks of September 11, 2001, and while the use of exogenous shocks to identify performance is hardly new, this approach is promising for dynamic capabilities. While Rindova and Taylor’s approach also involves small sample studies, the promise for a broader empirical study is evident. The terrorist attacks provide a severe, exogenous shock with effects in numerous industries. This shock may allow empirical researchers to better identify those firm characteristics that predict successful adaptation across multiple industries, each effected uniquely by the natural experiment.

Another area of promise for empirical work in dynamic capabilities involves work on entrepreneurial spinoffs. Recent work has explored why some innovations remain within corporations while others are developed through outside entrepreneurial ventures (Burton et al., 2001; Klepper and Sleeper, 2002). As Klepper (2001) has argued, spinoffs may result from the competence-destroying innovations first explicated by Tushman and Anderson (1986), often resulting in lost profits for the source firm. The key for incumbent firms may be in acquiring the complementary assets necessary for commercializing radical innovations (Teece, 1986; Zingales, 2000). The dynamic capability of a firm may be measured in the success of intrapreneurship vs. entrepreneurial spinoffs. Furthermore, this work on spinoffs holds promise in identifying how capabilities may reside in management or management practices. If the source firms are important to the success of spinoffs as Burton et al. (2001) suggest, this success may
stem from managerial routines learned in the source organization (Klepper and Sleeper, 2002).

VIII. Conclusion

As is shown in this paper, both The Behavioral Theory of the Firm and The Evolutionary Theory of Economic Change have richly contributed to a tradition of literature culminating in theories on firm competence and dynamic capabilities. The focus of Cyert and March on the heterogeneity and path dependence of firm characteristics was critical to the development of these theories. The work of Nelson and Winter provided additional insight as well as theory necessary for the development of a dynamic, strategic theory of firm behavior. Their work introduced a self-deterministic quality in the behavioralist firm by allowing it to pursue objectives even within the constraints of bounded rationality. While the idiosyncratic characteristics of firms fundamental to the resourced-based and dynamic capabilities literature can be attributed to Cyert and March, the dynamic and deterministic aspects of the firm introduced by Nelson and Winter were an important step to developing truly strategic models of firm behavior. The understanding of the process by which firms identify opportunities and adapt to exploit them is a direct result of the evolutionary insight of Nelson and Winter. They provided the critical link between a behavioral theory of the firm and the dynamic capabilities literature.
Cyert and March provided a critical step in the development of a dynamic, strategic theory of firm performance. Nelson and Winter in turn transformed parts of their work into a dynamic, more strategic view of the firm. These foundational works have spurred more recent work focused on identifying the foundations of dynamic capabilities, competitive advantages that allow some firms to profit in an evolving market economy. While recent work by Eisenhart and Martin (2000), Zollo and Winter (2002), Winter (2003), Teece (2006) and others has moved further toward explicating sources of dynamic capabilities, further work is needed in this important tradition, particularly in the empirical identification of capabilities. It is our hope that current work on dynamic capabilities will inform future research to the same degree that Cyert and March and Nelson and Winter have informed us, moving us closer to the sources of competitive advantage.
IX. References


