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D. J. Teece

Dynamic Capabilities and Strategic Management

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To the University of California, Berkeley, which is my intellectual home, and

To my friends and colleagues in academia, business, and government who have over the years shared insights, experiences, and bonhomie.

Preface

It is over two hundred years since Adam Smith began his "Inquiry into the Nature and Causes of the Wealth of Nations". The field of strategic management[1] is barely fifty years old and it struggles to answer for the business organization the analogous question that smith posed (and for which he provided primitive but remarkably insightful answers) with respect to the nation state. The question (namely, what explains the ability of the business enterprise to generate wealth for the stockholders and other stakeholders) animates managers, policy makers, investors, and the public. Over the last couple of decades a significant body of empirical research has emerged which provides at least partial answers.

Research indicates that characteristics of individual businesses explain variations in enterprise performance more successfully than characteristics of industry. Moveover, over time risk adjusted returns are remarkably similar across industries (but not firms) as one would expect if capital markets are reasonably efficient. These results call into question (or at minimum put into perspective) well entrenched market positioning approaches which posit the objective of strategy is to locate the enterprise's products in a market niche that can be insulated from strong competition so as to generate above-average profits. The standard approach is built on frameworks from the field of industrial organization, which unfortunately tends to ignore intangible assets, innovation, firm capabilities, and disequilibrium phenomena.

What is ignored by the standard market positioning or industry analysis approach is central to the thesis advanced here. In advanced post-industrial societies, the creation, ownership, and

deployment of intangible assets (especially knowledge and relationships) is at the core of any strategy likely to yield shareholder value. Intangibles do indeed help explain differences in performance by enterprises in the same industry. Intangibles typically do not reside with just a few individuals, but are deeply embedded in processes and procedures and sometimes even in simple (strategic) rules for operating in complex environments. There is also likely to be a unique configuration of complementry assets necessary to support many new product and service offerings. However, intangible assets and the activites (i.e. innovation) that create them are largely ignored in market positioning approaches.

Of course, uniqueness in product offerings is not enough to guarantee superior financial returns. Uniqueness must be married to a good marketing strategy which ensures that the enterprise is making distinctive products (or services) that customers want and can afford.

This book draws on multiple fields in an endeavor to identify characteristics of the business enterprise and of management actions, designs, and processes which undergird superior enterprise performance. It is grounded in the analysis of markets, competition, innovation, and the organization of the business enterprise itself. The conceptual structure developed is designed to help managers and academics make sense of the vast number of real world situations and the large amount of empirical data that are available. It also yields testable propositions.

The approach highlights the nature and microfoundations of enterprise level capabilities. It pulls together and integrates concepts that can help one understand not just how firms stay alive but how they develbp uniqueness and competitive advantage in environments where competition is robust in both input and component markets as well as in final product markets. In such environments entry is easy but achieving profitability is challenging. Sustainable advantage is more likely to flow from situations where firms can create and protect intangible assets that can undergird competitive advantage. Success in building or buying intangible assets which are then orchestrated to meet customer needs is core. To achieve this, management must be entrepreneurial, sensing if

not creating new opportunities before others do, and executing swiftly and expertly and collaboratively where the situation allows and requires. This is the essence of dynamic capabilities.

The dynamic capabilities framework draws in part from economic theory—such as basic understandings about imitability and competition—but also from the study of innovation and organizations. However, much economic analysis focuses on analytically easy situations where technology is unchanging, and markets are in equilibrium. In contrast, the focus of dynamic capabilities is on innovation (both technological and organizational) and market disequilibrium. Because the framework is not wedded to some of the traditional assumptions in economics—like profit-maximizing behavior, hyperrational decisions, and costless technology/knowledge transfer—it is hopefully more useful to managers, investors, and to business intellectuals trying to understand why some companies do well while others struggle.

At minimum, dynamic capabilities is a tool for integrating over fifty years of scholarship and empirical analysis in economics, sociology, behavioral decision theory, business history, and strategic management itself. More pretentiously, it outlines a new theory of management which can be the cornerstone to a much deeper understanding of the business enterprise, competitive processes, competitive outcomes, and wealth creation in advanced post-industrial knowledgebased societies. The essence of the framework is contained in Chapter 1, which outlines the book's basic conceptual structure (Figure 14 shows linkages and suggests a causal structure, articulated in Chapter 1, section 7; intellectual lineage and assumptions are addressed and discussed in Chapter 3).

Some readers will recognize that many of the chapters began their life as scholarly papers that were published in academic journals. Indeed, practically all the material in this book has survived the peer review process. The core idea of this book was contained in a University of California working paper (co-authored with former students Gary Pisano and Amy Shuen), and circulated in the early 1990s (Teece *et al.*, 1990a); indeed, this working paper is where the term "dynamic capabilities" was first introduced into the literature. The core idea was first published in 1994 (Teece and

Pisano, 1994), and in expanded form in "Dynamic Capabilities and Strategic Management", *Strategic Management Journal*, 18: 7 (August 1997) with Gary Pisano and Amy Shuen. The published article, like the working paper, received considerable scholarly attention. Gary Pisano, Amy Shuen, and myself were grateful that it received the best paper of the year award from the Strategic Management Society in 2003. Moreover, according to *Science Watch* it was the most cited paper the top hundred academic journals in business and economics worldwide for the period 1995–2005. This was extremely surprising to us, and deeply gratifying. Other chapters are based on collaboration with Mie Augier at Stanford University. Mie has a deep understanding of organization theory and practice and has a unique understanding of the history of ideas in management and organizations.

It is hoped that this book will provide new insights to readers not familiar with the literature on dynamic capabilities. To those already familiar with the literature, it is hoped that this book will help mold disparate ideas and observations together in such a way that it stimulates deeper insights into business and economic phenomena that impact society. It is my sincerest wish that managers who read on will become more astute and reflective managers, and scholars who read on will grow more insightful and will join the endeavor to create a knowledge based theory of the firm.

David J. Teece
Berkeley, California
September 2008

[1] Strategic management is about the major decisions and investments needed to achieve the goals of the enterprise: taking actions and making investments to reflect opportunities and changing circumstances. These decisions are the most complex and the most important facing the enterprise. Complexity enters not just because of interdependencies, but also because of uncertainty about customer reaction, competitor response, and market and technological change.

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Part I

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Chapter 1

The Nature and Microfoundations of (Sustainable) Enterprise Performance

This chapter draws on the social and behavioral sciences in an endeavor to specify the nature and microfoundations of the capabilities necessary to sustain superior enterprise performance in an open economy with rapid innovation and globally dispersed sources of invention, innovation, and manufacturing capability. Dynamic capabilities enable business enterprises to create, deploy, and protect the intangible assets that support superior long-run business performance. The microfoundations of dynamic capabilities—the distinct skills, processes, procedures, organizational structures, decision rules, and disciplines—which undergird enterprise-level sensing, seizing, and reconfiguring capacities are difficult to develop and deploy. Enterprises with strong dynamic capabilities are

intensely entrepreneurial. They not only adapt to business ecosystems, but also shape them through innovation and through collaboration with other enterprises, entities, and institutions. The framework advanced can help scholars understand the foundations of long-run enterprise success while helping managers delineate relevant strategic considerations and the priorities they must adopt to enhance enterprise performance and escape the zero-profit tendency associated with operating in markets open to global competition.

1. Introduction

Recent scholarship stresses that business enterprises consist of portfolios of idiosyncratic and difficult-to-trade assets and competencies ("resources").[1] Within this framework, competitive advantage can flow *at a point in time* from the ownership of scarce but relevant and difficult-to-imitate assets, especially know-how. However, in fast-moving business environments open to global competition, and characterized by dispersion in the geographical and organizational sources of innovation and manufacturing, *sustainable* advantage requires more than the ownership of difficult-to-replicate (knowledge) assets. It also requires unique and difficult-to-replicate dynamic capabilities. These capabilities can be harnessed to continuously create, extend, upgrade, protect, and keep relevant the enterprise's unique asset base. For analytical purposes, dynamic capabilities can be disaggregated into the capacity (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting, and when necessary, reconfiguring the business enterprise's intangible and tangible assets. Dynamic capabilities include difficult-to-replicate enterprise capabilities required to adapt to changing customer and technological opportunities. They also embrace the enterprise's capacity to shape the ecosystem it occupies, develop new products and processes, and design and implement viable business models. It is hypothesized that excellence in these "orchestration"[2] capacities undergirds an

enterprise's capacity to successfully innovate and capture sufficient value to deliver superior long-term financial performance. The thesis advanced is that while the long-run performance of the enterprise is determined in some measure by how the (external) business environment rewards its heritage, the development and exercise of (internal) dynamic capabilities lie at the core of enterprise success (and failure). This chapter first describes the nature of dynamic capabilities, and then explicates their microfoundations.

The ambition of the dynamic capabilities framework is nothing less than to explain the sources of enterprise-level competitive advantage over time, and provide guidance to managers for avoiding the zero-profit condition that results when homogeneous firms compete in perfectly competitive markets. A framework, like a model, abstracts from reality. It endeavors to identify classes of relevant variables and their interrelationships. A framework is less rigorous than a model as it is sometimes agnostic about the particular form of the theoretical relationships that may exist. Early statements of the dynamic capabilities framework can be found in Teece, Pisano, and Shuen (1990a, 1990b, 1997) and Teece and Pisano (1994). An extensive literature on dynamic capabilities now exists (e.g. Helfat *et al.*, 2007) that can be organized and integrated into the general framework offered here.

As indicated, the possession of dynamic capabilities is especially relevant to multinational enterprise performance in business environments that display certain characteristics. The first is that the environment is open to international commerce and fully exposed to the opportunities and threats associated with rapid technological change. The second is that technical change itself is systemic in that multiple inventions must be combined to create products and/or services that address customer needs. The third is that there are well-developed global markets for the exchange of (component) goods and services; and the fourth is that the business environment is characterized by poorly developed markets in which to exchange technological and managerial know-how. These characteristics can be found in large sectors of the global economy and especially in high-technology sectors. In such

sectors, the foundations of enterprise success today depend very little on the enterprise's ability to engage in (textbook) optimization against known constraints, or capturing scale economies in production. Rather, enterprise success depends upon the discovery and development of opportunities; the effective combination of internally generated and externally generated inventions; efficient and effective technology transfer inside the enterprise and between and amongst enterprises; the protection of intellectual property; the upgrading of "best practice" business processes; the invention of new business models; making unbiased decisions; and achieving protection against imitation and other forms of replication by rivals. It also involves shaping new "rules of the game" in the global marketplace. The traditional elements of business success—maintaining incentive alignment, owning tangible assets, controlling costs, maintaining quality, "optimizing" inventories—are necessary but they are unlikely to be sufficient for sustained superior enterprise performance.

Executives seem to recognize new challenges in today's globally competitive environments and understand how technological innovation is necessary but not sufficient for success. A. J. Lafley, CEO of Proctor & Gamble, notes that "the name of the game is innovation. We work really hard to try to turn innovation into a strategy and a process . . . ".[3] Sam Pamisano, CEO of IBM, remarks that "innovation is about much more than new products. It is about reinventing business processes and building entirely new markets that meet untapped customer demand."[4] Put differently, there is an emerging recognition by managers themselves that the foundations of enterprise success transcend simply being productive at R&D, achieving new product introductions, adopting best practice, and delivering quality products and services. Not only must the innovating enterprise spend heavily on R&D and assiduously develop and protect its intellectual property; it must also generate and implement the complementary organizational and managerial innovations needed to achieve and sustain competitiveness.

As indicated, not all enterprise-level responses to opportunities and threats are manifestations of dynamic capabilities. As Sidney

Winter (2003: 991) notes, "*ad hoc* problem solving" isn't necessarily a capability. Nor is the adoption of a well-understood and replicable "best" practice likely to constitute a dynamic capability. Implementing best practice may help an enterprise become or remain viable, but best practices that are already widely adopted cannot by themselves in a competitive market situation enable an enterprise to earn more than its cost of capital, or outperform its competitors. Likewise, invention and innovation by themselves are insufficient to generate success (Teece, 1986a).

Two yardsticks can be proposed for calibrating capabilities: "technical" fitness and "evolutionary" fitness (Helfat *et al.*, 2007). Technical fitness is defined by how effectively a capability performs its function, regardless of how well the capability enables a firm to make a living. Evolutionary or external fitness refers to how well the capability enables a firm to make a living. Evolutionary fitness references the selection environment. Helfat *et al.* (2007) further note that both technical and evolutionary fitness range from zero to some positive value. These yardsticks are consistent with the discussion here. Dynamic capabilities assist in achieving evolutionary fitness, in part by helping to shape the environment. The element of dynamic capabilities that involves shaping (and not just adapting to) the environment is entrepreneurial in nature. Arguably, entrepreneurial fitness ought to have equal standing with evolutionary fitness.

Dynamic capabilities have no doubt been relevant to achieving competitive advantage for some time. However, their importance is now amplified because the global economy has become more open and the sources of invention, innovation, and manufacturing are more diverse geographically and organizationally (Teece, 2000), and multiple inventions must be combined to achieve marketplace success (Somaya and Teece, 2007). Achieving evolutionary fitness is harder today that it was before the millennium. Moreover, regulatory and institutional structures must often be reshaped for new markets to emerge; and as discussed later, the ubiquity of "platforms" must now be recognized (Evans *et al.*, 2006).

While the development and astute management of intangible assets/intellectual capital is increasingly recognized as central to

sustained enterprise competitiveness, the understanding of why and how intangibles are now so critical still remains opaque and is not addressed by orthodox frameworks. What is needed is a new framework for business and economic analysis. As former US Federal Reserve Chairman Alan Greenspan remarked, "we must begin the important work of developing a framework capable of analyzing the growth of an economy increasingly dominated by conceptual products".[5] The dynamic capabilities approach developed here endeavors to be responsive to this challenge at the enterprise level.

In an earlier treatment (Teece *et al.*, 1997: 530), it was noted that "we have merely sketched an outline for a dynamic capabilities approach". In what follows, the nature of various classes of dynamic capabilities is identified, and an effort is made to separate the microfoundations of dynamic capabilities from the capability itself. Put differently, important distinctions are made between the organizational and managerial processes, procedures, systems, and structures that undergird each class of capability, and the capability itself. One should note that the identification of the microfoundations of dynamic capabilities must be necessarily incomplete, inchoate, and somewhat opaque and/or their implementation must be rather difficult. Otherwise sustainable competitive advantage would erode with the effective communication and application of dynamic capability concepts.

Of course, the existence of processes, procedures, systems, and structures already ubiquitously adopted by competitors does not imply that these have not in the past been the source of competitive advantage, or might not still be a source of competitive advantage in certain contexts. For example, studies of the diffusion of organizational innovations (e.g. Armour and Teece, 1978; Teece, 1980b) indicate that diffusion is by no means instantaneous, and that profits can persist for many years before being competed away. Decade-long adoption cycles for new business structures and procedures (e.g. performance measurement systems) are not uncommon. Uncertain imitability (Lippman and Rumelt, 1982) may also serve to slow the diffusion process and support persistent differential performance.

Fortunately, the existing literature on strategy, innovation, and organization, and the new literature on dynamic capabilities have identified a panoply of processes and routines that can be recognized as providing certain microfoundations for dynamic capabilities. For instance, Eisenhardt and Martin (2000) identify cross-functional R&D teams, new product development routines, quality control routines, and technology transfer and/or knowledge transfer routines, and certain performance measurement systems as important elements (microfoundations) of dynamic capabilities. The effort here is not designed to be comprehensive, but to integrate the strategy and innovation literature and provide an umbrella framework that highlights the most critical capabilities management needs to sustain the evolutionary and entrepreneurial fitness of the business enterprise.

2. Sensing (and Shaping) Opportunities and Threats

Nature of the Capability

In fast-paced, globally competitive environments, consumer needs, technological opportunities, and competitor activity are constantly in a state of flux. Opportunities open up for both newcomers and incumbents, putting the profit streams of incumbent enterprises at risk. As discussed in Teece *et al.* (1997), some emerging marketplace trajectories are easily recognized. In microelectronics this might include miniaturization, greater chip density, and compression and digitization in information and communication technology. However, most emerging trajectories are hard to discern. Sensing (and shaping) new opportunities is very much a scanning, creation, learning, and interpretive activity. Investment in research and related activities is usually a necessary complement to this activity.

Opportunities get detected by the enterprise because of two classes of factors. First, as stressed by Kirzner (1973), entrepreneurs can have differential access to existing information. Second, new information and new knowledge (exogenous or endogenous) can create opportunities, as emphasized by Schumpeter (1934).

Kirzner stressed how the entrepreneurial function recognizes any disequilibrium and takes advantage of it. The Kirznerian view is that entrepreneurship is the mechanism by which the economy moves back toward equilibrium. Schumpeter, on the other hand, stressed upsetting the equilibrium. As Baumol (2006: 4) notes, "the job of Schumpeter's entrepreneur is to destroy all equilibria, while Kirzner's works to restore them. This is the mechanism underlying continuous industrial evolution and revolution." Equilibrium is rarely if ever achieved (Shane, 2003). Both forces are relevant in today's economy.

To identify and shape opportunities, enterprises must constantly scan, search, and explore across technologies and markets, both "local" and "distant" (March and Simon, 1958; Nelson and Winter, 1982). This activity not only involves investment in research activity and the probing and reprobing of customer needs and technological possibilities; it also involves understanding latent demand, the structural evolution of industries and markets, and likely supplier and competitor responses. To the extent that business enterprises can open up technological opportunities (through engaging in R&D and through tapping into the research output of others) while simultaneously learning about customer needs, they have a broad menu of commercialization opportunities. Overcoming a narrow search horizon is extremely difficult and costly for management teams tied to established problem-solving competences. Henderson (1994) notes that General Motors (GM), IBM, and Digital Equipment Corporation (DEC) encountered difficulties because they became prisoners of the deeply ingrained assumptions, information filters, and problem-solving strategies that made up their world views, turning the solutions that once made them great into strategic straitjackets.

When opportunities are first glimpsed, entrepreneurs and managers must figure out how to interpret new events and developments, which technologies to pursue, and which market segments to target. They must assess how technologies will evolve and how and when competitors, suppliers, and customers will respond. Competitors may or may not see the opportunity, and even if they do they may calibrate it differently. Their actions, along

with those of customers, suppliers, standard-setting bodies, and governments, can also change the nature of the opportunity and the manner in which competition will unfold.

There are also constraints on the rules by which competitive forces will play out. These constraints are imposed by regulators, standard-setting bodies, laws, social mores, and business ethics. The shape of the "rules of the game" is thus the result of coevolution and complex interaction between what might be thought of as (business) ecosystem participants. Because of uncertainty, entrepreneurs/managers must make informed conjectures about the path ahead. These conjectures become working hypotheses that can be updated as evidence emerges. Once a new evolutionary path becomes apparent, quick action is needed.

Microfoundations

The literature on entrepreneurship emphasizes that opportunity discovery and creation can originate from the cognitive and creative ("right brain") capacities of individual(s). However, discovery can also be grounded in organizational processes, such as research and development activity. The ability to create and/or sense opportunities is clearly not uniformly distributed amongst individuals or enterprises. Opportunity creation and/or discovery by individuals require both access to information and the ability to recognize, sense, and shape developments. The ability to recognize opportunities depends in part on the individual's capabilities and extant knowledge (or the knowledge and learning capacities of the organization to which the individual belongs) particularly about user needs in relationship to existing as well as novel solutions. This requires specific knowledge, creative activity, and the ability to understand user/customer decision making, and practical wisdom (Nonaka and Toyama, 2007). It involves interpreting available information in whatever form it appears—a chart, a picture, a conversation at a trade show, news of scientific and technological breakthroughs, or the angst expressed by a frustrated customer. One must accumulate and then filter information from professional

and social contacts to create a conjecture or a hypothesis about the likely evolution of technologies, customer needs, and marketplace responses. This task involves scanning and monitoring internal and external technological developments and assessing customer needs, expressed and latent. It involves learning, interpretation, and creative activity.

While certain individuals in the enterprise may have the necessary cognitive and creative skills, the more desirable approach is to embed scanning, interpretative, and creative processes inside the enterprise itself. The enterprise will be vulnerable if the sensing, creative, and learning functions are left to the cognitive traits of a few individuals.[6] Organizational processes can be put in place inside the enterprise to garner new technical information, tap developments in exogenous science, monitor customer needs and competitor activity, and shape new products and processes opportunities. Information must be filtered, and must flow to those capable of making sense of it. Internal argument and discussion about changing market and technological reality can be both inductive and deductive. Hypothesis development, hypothesis "testing", and synthesis about the meaning of information obtained via search are critical functions, and must be performed by the top management team. The rigorous assembly of data, facts, and anecdotes can help test beliefs. Once a synthesis of the evidence is achieved, recurrent synthesis and updating can be embedded in business processes designed by middle management and/or the planning unit in the business organization (Casson, 1997). If enterprises fail to engage in such activities, they won't be able to assess market and technological developments and spot opportunities. As a consequence, they will likely miss opportunities visible to others.

As noted in Teece *et al.* (1997), more decentralized organizations with greater local autonomy are less likely to be blindsided by market and technological developments. Because of the problem of information decay as information moves up (and down) a hierarchy, businesses must devise mechanisms and procedures to keep management informed. Bill Hewlett and David Packard developed "management by walking about" (Packard, 1995) as a mechanism

to prevent top management at Hewlett-Packard from becoming isolated from what was going on at lower levels in the enterprise, and outside the enterprise as well. In other organizations (e.g. professional services) the management ranks can be filled by leading professionals who remain involved with professional work. This protects them from the hazards of managerial isolation.

The search activities that are relevant to "sensing" include information about what's going on in the business ecosystem. With respect to technologies, R&D activity can itself be thought of as a form of "search" for new products and processes. However, R&D is too often usually a manifestation of "local" search. "Local" search is only one component of relevant search. In fast-paced environments, with a large percentage of new product introductions coming from external sources, search/exploration activity should not just be local. Enterprises must search the core as well as to the periphery of their business ecosystem. Search must embrace potential collaborators—customers, suppliers, complementors—that are active in innovative activity.

Customers are sometimes amongst the first to perceive the potential for applying new technology. Visionary members of customer organizations are often able to anticipate the potential for new technology and possibly even begin rudimentary development activities. Moreover, if the suppliers of new technology do not succeed in properly understanding user/customer needs, it is unlikely that new products they might develop will be successful. Indeed, one of the most consistent findings from empirical research is that the probability that an innovation will be successful commercially is highly correlated with the developers' understanding of user/customer needs (Freeman, 1974). Electronic computing and the Internet itself can rightly be viewed as having a significant component of user-led innovations. Business enterprises that are alert and sense the opportunity are often able to leverage customer-led efforts into new products and services, as the users themselves are frequently ill prepared to carry initial prototypes further forward.

Suppliers can also be drivers of innovation important in the final product. Innovation in microprocessor and DRAMs is a classic case.

This upstream or "component" innovation has impacted competition and competitive outcomes in personal computers, cellular telephony, and consumer electronics more generally. Failure to "design in" new technology/components in a timely fashion will lead to failure; conversely, success can sometimes be achieved by continuous rapid "design in". Indeed, continuous and rapid design around new technology/components developed elsewhere can itself be a source of durable competitive advantage. Put differently, with rapid innovation by component suppliers, downstream competitive success can flow from the ability of enterprises to continuously tap into such (external) innovation ahead of the competition. External search and acquisition of technology have been going on for decades, but as Chesbrough (2003) explains, "Open Innovation" is now a mandate for enterprise success.

The concept and practice of open innovation underscore the importance of broad-based external search and subsequent integration involving customers, suppliers, and complementors. Establishing linkages between corporations and universities assists broad-based search, as university programs are usually unshackled from the near at hand. Indeed, a recent study of patenting in the optical disk industry (Rosenkopf and Nerkar, 2001) seems to suggest that exploration that is more confined generates lower impacts, and that the impact of exploration is highest when exploration spans organizational (but not technological) boundaries. However, it is not just a matter of searching for external inventions/innovations that represent new possibilities. Frequently it is a matter of combining complementary innovations so as to create a solution to a customer problem. The systemic nature (Teece, 2000) of many innovations compounds the need for external search.

Sensing opportunities and threats can also be facilitated if the enterprise and/or the entrepreneur explicitly or implicitly employs some kind of analytical framework, as this can help highlight what is important. The field of strategic management has been stranded for some time with a framework that implicitly assumes that industry structure (and product market share), mediated by enterprise behavior, determines enterprise performance. In Porter's

(1980) Five Forces framework, a good strategy involves somehow picking an attractive industry and positioning oneself to be shielded from competition. Porter's approach mandates "industry" analysis[7] and the calibration of five distinct industry-level forces: the role of potential entrants, suppliers, buyers, substitutes, and rivalry amongst competitors. Because of its rather static nature and the fact that it ignores many aspects of the competitive environment including the role of complementarities, path dependencies, and supporting institutions, its application in the contexts outlined in the Introduction to this chapter will limit the ability of the entrepreneur and/or the enterprise to properly sense opportunities and threats and properly calibrate strengths, weaknesses, and technological and market trajectories. If network effects, path dependencies, and the co-evolution of technologies and institutions are significant, the Five Forces framework is of limited utility.

The Five Forces framework has inherent weaknesses in dynamic environments. Fundamental is that it implicitly views market structure as exogenous, when in fact market structure is the (endogenous) result of innovation and learning.[8] Changes in science and technology create opportunities for innovation. Enterprises can search amongst new possibilities and engage in development activities. If successful, such development impacts the relative fate of firms. This in turn determines market structure. Outcomes for individual enterprises are shaped in part by the selection processes at work in the business ecosystem. Relevant factors ignored or underplayed by Five Forces include technological opportunities, path dependencies, appropriability conditions, supporting institutions, installed base effects, learning, certain switching costs, and regulation. In short, in regimes of rapid technological change with well-developed markets for goods and services (and poorly developed markets for know-how), the Five Forces framework is compromised because it has insufficient appreciation (a) for the importance of and nature of innovation and other factors that change the "rules of the game", (b) for factors inside the business enterprise that constrain choices, (c) for factors that impact imitation and appropriability issues, (d) for the role of supporting

institutions, complementary assets, cospecialization, and network externalities, or (e) for the blurred nature of industry boundaries. Also, as discussed later, in many "platform" industries or where there is significant outsourcing, scale is an industry asset.

The dynamic capabilities framework represents a strong break with Five Forces. Within the dynamic capabilities framework, the "environmental" context recognized for analytical purposes is not that of the industry, but that of the business "ecosystem"—the community of organizations, institutions, and individuals that impact the enterprise and the enterprise's customers and supplies. The relevant community therefore includes complementors, suppliers, regulatory authorities, standard-setting bodies, the judiciary, and educational and research institutions. It is a framework that recognizes that innovation and its supporting infrastructure have major impacts on competition. The dynamic capabilities framework is grounded in Kirznerian, Schumpeterian, and evolutionary theories of economic change, whereas Five Forces is grounded in the Mason-Bain paradigm of industrial economics.[9] Also, whereas according to Porter the essence of strategy formulation is "coping with competition" (Porter, 1991: 11), in the dynamic capabilities tradition the essence of strategy involves selecting and developing technologies and business models that build competitive advantage through assembling and orchestrating difficult-to-replicate assets, thereby shaping competition itself.

Even when utilizing the ecosystem as the organizing paradigm for assessing developments in the business environment, the full import of particular facts, statistics, and developments is rarely obvious. Accordingly, the evaluative and inferential skill possessed by an organization and its management is important. Indeed, much of the information gathered and communicated inside the enterprise has minimal decision relevance. Even if relevant, it often arrives too late. Management must find methods and procedures to peer through the fog of uncertainty and gain insight. This involves gathering and filtering technological, market, and competitive information from both inside and outside the enterprise, making sense of it, and figuring out implications for action. However, because attention is a scarce resource inside the enterprise (Cyert

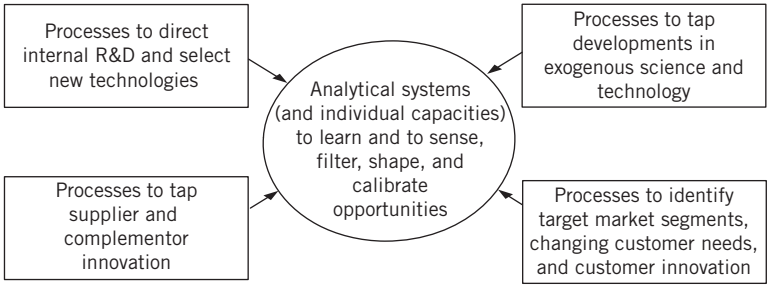

Fig. 1.1. Elements of ecosystem framework for "sensing" market and technological opportunities

and March, 1963), management must carefully allocate resources to search and discovery. The enterprise's articulated strategy can become a filter so that attention is not diverted to every opportunity and threat that "successful" search reveals. Likewise, scenario planning can collapse likely situations into a small number of scenarios that can facilitate cognition, and then action, once uncertainty is resolved. Figure 1.1 summarizes individual and enterprise traits that undergird sensing capabilities.

3. Seizing Opportunities

Nature of the Capability

Once a new (technological or market) opportunity is sensed, it must be addressed through new products, processes, or services. This almost always requires investments in development and commercialization activity. Multiple (competing) investment paths are possible, at least early on. The quintessential example is the automobile industry, where in the early days different engine technologies—steam, electric, and gasoline—each had their champions. Once a dominant design begins to emerge, strategic choices become much more limited. This paradigm, which was first offered by Abernathy and Utterback (1978) and then built upon by the author (Teece, 1986a), now has considerable evidence supporting

it over a wide range of technologies (Klepper and Graddy, 1990; Utterback and Suarez, 1993; Malerba and Orsenigo, 1996). It implicitly recognizes inflexion points in technological and market evolution. These inflexion points impact investment requirements and strategic choices. Implications for investment decisions have been noted elsewhere (Teece, 1986a) and include staying flexible until the dominant design emerges and then investing heavily once a design looks like it can become the winner. Any strategy is, of course, likely to be fraught with hazards because of uncertainties. Moreover, the manner and time at which an enterprise needs to place its bets depend on competition in the "input" markets and on the identity of the enterprise itself. Mitchell (1991) suggests that the timing of resource commitments can differ according to the enterprise's existing positions with respect to the relevant complementary assets. Enterprises that are well positioned can wait, while those that are not must scramble.

Addressing opportunities involves maintaining and improving technological competences and complementary assets and then, when the opportunity is ripe, investing heavily in the particular technologies and designs most likely to achieve marketplace acceptance. When network externalities are present, early entry and commitment are necessary. The presence of increasing returns means that if one network gets ahead, it tends to stay ahead. Getting ahead may require significant up-front investments. Customers will not want an enterprise's products if there are strong network effects and the installed base of users is relatively small. Accordingly, one needs to strategize around investments decisions, getting the timing right, building on increasing return advantages, and leveraging products and services from one application to another. The capacity to make high-quality, unbiased but interrelated investment decisions in the context of network externalities, innovation, and change is as rare as decision-making errors and biases are ubiquitous.

However, the issue that the enterprise faces is not just when, where, and how much to invest. The enterprise must also select or create a particular business model that defines its commercialization strategy and investment priorities. Indeed, there is

considerable evidence that business success depends as much on organizational innovation, for example, design of business models, as it does on the selection of physical technology. This is true at the enterprise level as well as at the economy-wide level (Nelson, 2005). Indeed, the invention and implementation of business models and associated enterprise boundary choices involve issues as fundamental to business success as the development and adoption of the physical technologies themselves. Business models implicate processes and incentives; their alignment with the physical technology is a much overlooked component of strategic management. The understanding of the institutional/organizational design issues is typically more limited than the understanding of the technologies themselves. This ignorance affords considerable scope for mistakes around the proper design of business models and the institutional structures needed to support innovation in both the private and public sectors.

In theory, one could imagine transactions between entities that scout out and/or develop opportunities, and those that endeavor to execute upon them. In reality, the two functions cannot be cleanly separated, and the activities must be integrated inside a single enterprise, where new insights about markets—particularly those that challenge the conventional wisdom—will likely encounter negative responses. The promoters/visionaries must somehow defeat the naysayers, transform internal views, and facilitate necessary investment. Some level of managerial consensus will be necessary to allow investment decisions to be made. Investment will likely involve committing financial resources behind an informed conjecture about the technological and marketplace future. However, managers of established product lines in large organizations can sometimes have sufficient decision-making authority to starve the new business of financial capital. This posture can be buttressed by capital budgeting techniques that more comfortably support investments for which future cash flow can be confidently projected. In short, the new can lose out to the established unless management is sensitive to the presence of certain biases in accepted investment decision processes. An important class of dynamic capabilities emerges around a manager's ability to override certain

"dysfunctional" features of established decision rules and resource allocation processes.

It helps to begin by recognizing that decision-making processes in hierarchically organized enterprises involve bureaucratic features that are useful for many purposes, but they nevertheless may muzzle innovation proclivities. In particular, a formal expenditure process involving submissions and approvals is characteristic of "well-managed" companies. Decision making is likely to have a committee structure, with top management requiring reports and written justifications for significant decisions. Moreover, approvals may need to be sought from outside the organizational unit in which the expenditure is to take place. While this may ensure a matching up of expenditures to opportunities across a wider range of economic activity, it unquestionably slows decision making and tends to reinforce the status quo. Committee decision-making structures almost always tend toward balancing and compromise. But innovation is often ill served by such structures, as the new and the radical will almost always appear threatening to some constituents. Strong leaders can frequently overcome such tendencies, but such leaders are not always present. One consequence is a "program persistence bias". Its corollary is various forms of "anti-innovation bias", including the "anti-cannibalization" basis discussed in a later section. Program persistence refers to the funding of programs beyond what can be sustained on the merits, and follows from the presence or influence of program advocates in the resource allocation process. This proclivity almost automatically has the countervailing effect of reducing funds available to new initiatives.

One should not be surprised, therefore, if an enterprise senses a business opportunity but fails to invest. In particular, incumbent enterprises tend to eschew radical competency-destroying innovation in favor of more incremental competency-enhancing improvements. The existence of layer upon layer of standard procedures, established capabilities, complementary assets, and/or administrative routines can exacerbate decision-making biases against innovation. Incumbent enterprises, relying on (path-dependent) routines, assets, and strategies developed to cope with existing

technologies, are handicapped in making and/or adopting radical, competency-destroying, noncumulative innovation (Nelson and Winter, 1982; Tushman and Anderson, 1986; Henderson and Clark, 1990). This is true whether the competence is external to the firm or internal to the firm.

Evidence also shows that decision-makers discount outcomes that are merely probable in comparison with outcomes that are certain. This has been called the certainty effect (Kahneman and Lovallo, 1993). It contributes to excessive risk aversion when choices involve possible losses. Further, to simplify choices between alternatives, individuals generally evaluate options in isolation. Viewing each alternative as unique leads decision-makers to undervalue possibilities for risk pooling. This approach to decision making may produce inconsistent preferences and decision biases (timid choices) that lead to outcomes that block innovation (Kahneman and Tversky, 1979; Kahneman and Lovallo, 1993). An opposing bias to loss/risk aversion is excessive optimism. This leads to investment in low or negative return projects. As a result, entry decisions often fail. Audretsch (1995) found that over the period of 1976–86 the average 10-year failure rate in two-digit SIC manufacturing sectors ranged from 75.8 percent to 54.8 percent. Similar failure rates have been reported in other studies (Dunne *et al.*, 1988; Klepper and Miller, 1995). However, these failure rates disguise wide variation amongst particular enterprises and between new entrants and incumbents.

The existence of established assets and routines exacerbates problems of excessive risk aversion. Specifically, both the isolation effect and the certainty effect can be intensified by the existence of established assets, causing incumbent enterprises to become comparably more risk averse than new entrants. In terms of innovative activity, this excessive risk aversion leads to biased decision making and limits the probability that incumbent enterprises will explore risky radical innovations. In short, success in one period leads to the establishment of "valid" processes, procedures, and incentives to manage the existing business. This can have the unintended effect of handicapping the new business. The proficiency

with which such biases are overcome and a new opportunity is embraced is likely to depend importantly on the quality of the enterprise's routines, decision rules, strategies, and leadership around evaluating new investment opportunities. Business historians (e.g. Chandler, 1990a; Lazonick, 2005) and others have reminded us that over the long run the ability of enterprises to commit financing and invest astutely around new technologies is critical to enterprise performance.[10]

In regimes of rapid technological innovation, it is clear that making investment choices requires special skills not ubiquitously distributed amongst management teams. Nor are they ubiquitously distributed amongst investors.[11] Resource/asset alignment and coalignment issues are important in the context of innovation, but they are quite different from portfolio balance issues faced by financial investors. The presence of increasing returns means that one also needs to strategize around investment decisions, getting the timing right, building on increasing return advantages, and leveraging products and services from one application to another. Value-enhancing investments inside the knowledge-based enterprise are often cospecialized[12] to each other. Also, the nature of the portfolio "balance" needed inside the enterprise is different from the portfolio balance sought by pure financial investors. The economics of cospecialization are not the economics of covariance with which investors are familiar. In short, the task of making astute project-and-enterprise-level investment decisions is quite challenging because of cospecialization and irreversibilities.

The project finance and related literatures provide tools and clear decision rules for project selection once cash flows are specified, uncertainty and/or risk are calibrated, and interdependencies between and amongst cash flows are ignored. However, the essence of the investment decision for the (strategic) manager is that it involves estimating interdependent future revenue streams and cost trajectories, and understanding a panoply of continuous and interrelated cospecialized investment issues.[13] The returns to particular cospecialized assets cannot generally be neatly apportioned or partitioned. As a result, the utility of traditional

investment criteria is impaired. Thus while project-financing criteria (e.g. discounted cash flow, payback periods, and the like) and techniques for decision making under uncertainty are well known, there is little recognition of how to value intangibles and take into account features such as cospecialization, irreversibility, and opportunity costs.[14] Nor is the concept of a "strategic investment" recognized in the finance literature. Finance theory provides almost no guidance with respect to how to estimate future cash flows, although making such estimates is as much, if not more, the essence of good decision making as are the methodologies and procedures for analyzing cash flow.

In short, managers need to make unbiased judgments under uncertainty around not just future demand and competitive responses associated with multiple growth trajectories, but also around the pay-offs from making interrelated investments in intangible assets. In the world of tangible assets, this can sometimes be precisely modeled; not so for the world of cospecialized intangibles. In essence, the organizational challenge appears to be that in environments experiencing rapid change, activities are not fully decomposable. Cross-functional activities and associated investments must take place concurrently, rather than sequentially, if enterprises are to cut time-to-market for new products and processes. Managerial judgments (decision-making skills) take on great significance in such contexts. This was also true during prior centuries, as Alfred Chandler's (1990a, 1990b) analysis of successful enterprises from the 1870s through the 1960s makes apparent. No matter how much analytical work is done, tacit investment skills are of great importance. Chandler further argues that success in the late-nineteenth century and much of the twentieth century came to those enterprises that pursued his "three-pronged" strategy: (1) early and large-scale investments behind new technologies; (2) investment in product-specific marketing, distribution, and purchasing networks; and (3) recruiting and organizing the managers needed to supervise and coordinate functional activities. The first and second elements require commitment to investments where irreversibilities and cospecialization are identified. While the nature of required investments may have changed in recent

decades (less decomposable/more interrelated), investment decision skills remain important.

4. Microfoundations

Selecting Product Architectures and Business Models

The design and performance specification of products, and the business model employed, all help define the manner by which the enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit. They reflect management's hypothesis about what customers want and how an enterprise can best meet those needs, and get paid for doing so. They embrace: (1) which technologies and features are to be embedded in the product and service; (2) how the revenue and cost structure of a business is to be "designed" and if necessary "redesigned" to meet customer needs; (3) the way in which technologies are to be assembled; (4) the identity of market segments to be targeted; and (5) the mechanisms and manner by which value is to be captured. The function of a business model is to "articulate" the value proposition, select the appropriate technologies and features, identify targeted market segments, define the structure of the value chain, and estimate the cost structure and profit potential (Chesbrough and Rosenbloom, 2002: 533–4). In short, a business model is a plan for the organizational and financial "architecture" of a business. This model makes assumptions about the behavior of revenues and costs, and likely customer and competitor behavior. It outlines the contours of the solution required to earn a profit, if a profit is available to be earned. Once adopted it defines the way the enterprise "goes to market". Success requires that business models be astutely crafted. Otherwise, technological innovation will not result in commercial success for the innovating enterprise. Generally there is a plethora of business models that can be designed and employed, but some will be better adapted to the ecosystem than others. Selecting, adjusting, and/or improving the business model is a complex art.

Nevertheless, the importance of "business models" has been given short shrift in the academic literature, at least until quite recently. Important (business model) choices include technological choices, market segments to be targeted, financial terms (e.g. sale versus leasing), choices with respect to bundled versus unbundled sales strategies, joint ventures versus licensing versus go-it-alone approaches, etc. For example, in the early days of the copier industry, Xerox focused on leasing rather than selling copiers. This stemmed from a belief that customer trial would lead to further use. Another example from the USA is Southwest Airlines, which believes that most customers want low frills, reliability, and low cost. It eschews the hub-and-spoke model, does not belong to any alliances, and does not allow interlining of passengers and baggage. Nor does it sell tickets through travel agencies—all sales are direct. All aircraft are Boeing 737s. Its business model is quite distinct from the major carriers, although many have tried (without much success) to copy elements of the Southwest model.[15]

The capacity an enterprise has to create, adjust, hone, and, if necessary, replace business models is foundational to dynamic capabilities. Choices around how to capture value all help determine the architecture or design of a business. Having a differentiated (and hard-to-imitate) yet effective and efficient "strategic architecture" to an enterprise's business model is important. Both Dell Inc. and Wal-Mart have demonstrated the value associated with their business models (Webvan and many other dot-coms demonstrated just the opposite). Both Dell Inc.'s and Wal-Mart's business models were different, superior, and hard for competitors to replicate. They have also constantly adjusted and improved their processes over time.[16]

One might be tempted to argue that designing, implementing, and validating business models is straightforward, but this simply is not so. Aspects of designing (and redesigning) a business model are undoubtedly readily routinized and codified. Note the plethora of business books providing instruction on how to write a business plan. Such manuals can provide some discipline to the business model questions that one should ask. However, designing a new business requires creativity, insight, and a good deal of

customer, competitor, and supplier information and intelligence. There is a significant tacit component. Entrepreneurs and executives are forced to make many informed guesses about customer and competitor behavior, as well as the behavior of costs. Indeed, validating a business model and a business plan requires both effort and judgment. It takes detailed fact-specific inquiry including: a keen understanding of customer needs and customer willingness to pay; an understanding of procurement cycles and the sales cycle; knowledge of supply and distribution costs; and an understanding of competitor positioning and likely competitive responses. Put differently, selecting the right "architecture" for a business requires not just understanding the choices available; it also requires assembling the evidence needed to validate conjectures and hunches about costs, customers, competitors, complementors, distributors, and suppliers.

Designing good business models is in part "art". However, the chances of success are greater if enterprises (1) analyze multiple alternatives, (2) have a deep understanding of user needs, (3) analyze the value chain thoroughly so as to understand just how to deliver what the customer wants in a cost-effective and timely fashion, and (4) adopt a neutrality or relative efficiency perspective to outsourcing decisions. Useful tools include market research and transaction cost economics. Chesbrough and Rosenbloom (2002) suggest that established enterprises often have blinders with respect to alternative business models—and that this prevails even if the technology is spun off into a separate organization, where other (path-dependent constraints) are less likely to exist.

In short, designing the business correctly, and figuring out what John Seeley Brown refers to as the "architecture of the revenues"[17] (and costs), involve processes critical to the formation and success of new and existing businesses. No amount of good governance and leadership is likely to lead to success if the wrong business model is in place. Good business models achieve advantageous cost structures and generate value propositions acceptable to customers. They will enable innovators to capture a large enough portion of the (social) value generated by

innovation[18] to permit the enterprise at least to earn its cost of capital.

Selecting Enterprise Boundaries

In regimes of rapid technological progress, setting the enterprise boundaries correctly is important, and can be viewed as an element of getting the business model right. In Teece (1986a), Chesbrough and Teece (1996), and Teece (2000), normative rules were advanced indicating how enterprise boundaries ought to be set to ensure that innovation is more likely to benefit the sponsor of the innovation rather than imitators and emulators. Key elements of this framework were: (1) the appropriability regime (i.e. the amount of natural and legal protection afforded the innovation by the circumstances prevailing in the market); (2) the nature of the complementary assets (cospecialized or otherwise) that an innovating enterprise possessed; (3) the relative positioning of innovator and potential imitators with respect to complementary assets; and (4) the phase of industry development (pre or post the emergence of a dominate design). The framework is prescriptive not only as to strategy but also as to outcomes.

Enterprise boundary decisions need to reflect other criteria too. A company's integration upstream, downstream, as well as externally, is partly driven by the need to build capabilities, particularly when such capabilities are not widely distributed in the industry. Of course, vertical specialization is not itself independent of enterprise strategy, and vice versa (Macher and Mowery, 2004). Studies of the early vertical evolution of the petroleum industry stressed the need to align upstream and downstream capacities in an environment where qualified business partners were limited (Teece, 1976). Pisano, Shan, and Teece (1988: 202) developed a framework for understanding R&D outsourcing that recognized that the locus of world-class research/productive capability might lie external to the enterprise, requiring outsourcing as a way to compete.[19] Jacobides and Winter (2005: 398) have also clearly stated that "it is necessary to look at the distribution of productive capabilities—to

understand when enterprises are integrated and when they are not. It becomes clear that vertical specialization must be in part a function of heterogeneity in productive capabilities along the value chain." They also note that the capability development process itself changes as a consequence of changing scope. Recognition that systemic innovation favors integration, for both transaction costs and capability reasons, is also embedded in the saga of the development of the diesel electric locomotive (Teece, 1988). The ability of enterprises to procure technology externally as well as develop it internally are critical skills, as discussed above. Firms must dispel prejudices against technology from the outside, and hone their absorptive capacity through learning activities and skill accumulation. Enterprises may require alliance arrangements to actively learn and upgrade relevant skills (Branzei and Vertinsky, 2006).

The critical strategic element associated with capturing value from innovation is the ability of the innovating enterprise to identify and control the "bottleneck assets" or "choke points" in the value chain from invention through to market (Teece, 1986a, 2000). Outsourcing those assets/services that are in competitive supply is, of course, consistent with such a strategy. In short, the boundaries of the enterprise need to be artfully contoured for each major innovation, using decision criteria referenced above. Failure to do so is likely to be associated with the failure to stimulate market development (especially of complementary technologies) and incomplete capture of the profits available from innovation.

Managing Complements and "Platforms"

Investment choices in many high-technology industries today are driven by imperatives quite different from the (industrial) contexts that have animated strategy research over the past half-century. Scale and scope economy "mandates", which to some strategists dictate the scale and scope of the enterprise, have given way to

a different set of mandates around developing (or encouraging) complementary investments and capturing cospecialization benefits. The reason for this is that in many industries outsourcing has made scale an industry asset, in the sense that economies of scale can be captured by outsourcing to contract manufacturers who, in the face of competition, pass on the benefits of scale. Witness the contract semiconductor fabricators. They enable fabless semiconductor "designers" to capture most of the benefits of scale without engaging in manufacturing. Likewise, in the clothing industry, small-scale designers of footwear and outerwear can source at competitive rates from large suppliers, thereby capturing the benefit of scale economics previously enjoyed only by large integrated manufacturers. With competition, scale advantages are not proprietary, and are unlikely to be a source of sustainable differentiation.

When intermediate (product) markets are well developed, neither economies of scale nor economies of scope need define the scale and scope of the enterprise. Contractual access (on competitive terms) to scale-based "facilities" vitiates the need for enterprise scale and scope. This was the major theme in Teece (1980a) but the importance of the argument was often not appreciated. Today its importance is more evident.

While the importance of scale and scope economies to enterprise boundary decisions may have been softened, the significance to enterprise strategy of cospecialization has been elevated. As viewed by customers, high-technology "products" are often systems. These systems consist of interdependent components resting on "platforms". There is strong functional interdependence amongst components of the system. End-user demand is for the system, not the platform. There is often a multisided "market" phenomenon at work as well. For instance, electronic game consoles are not much use without games; computer operating systems are not much use without a suite of application programs; credit cards are not much use to cardholders without merchants that will accept them, and vice versa; and hydrogen cars are not much use without hydrogen filling stations, and vice versa. This important class of situations

has highlighted the importance of cospecialization, and strategic decision making must now take this into account.

The phenomenon is not new—the automobile industry depended first on the general store and then specialized retail outlets to make gasoline ubiquitously available to motorists. The role of complementary assets and cospecialization has already been recognized in the innovation process, and a decision framework outlined to chart the innovator on a course more likely to lead to a higher share of the available profit (Teece, 1986a, 2000). What is new today is that complements often sit on top of what might be thought of as "platforms", which are managed by an incumbent enterprise (Evans *et al*., 2006). In these circumstances, entry decision and "boundary" conundrums exist. The platform owner needs complementary products to be provided by others, particularly when it has little or no relevant skills to develop them itself. Fostering innovation and entry by the providers of complementary products may, in fact, require the platform manager to commit (by word or deed) not to provide certain complements. When the interface between the complementors and the platform is itself evolving, decision rules become ever more complex. The platform owner and the complementors might also need to consider whether the platform needs to be open or proprietary, and whether tools and other incentives should be provided to stimulate investment by the complementors. Decision frameworks that recognize the importance of network effects, dispersion in the sources of innovation of complementary products, interoperability issues, and installed base trajectories must all be factored into decisions. Quality decisions will require uncommon foresight and the ability to shape outcomes. In this regard, the existing asset base of the platform manager, including its financial resources, is of considerable significance. The distribution of (development) capabilities between the platform manager and the complementors will also be important. Also, as discussed below, the boundaries of the enterprise (i.e. whether the platform manager is also providing complements) is likely to be of significance, possibly deterring (or encouraging) entry and innovation by complementors.

Avoiding Bias, Delusion, Deception, and Hubris[20]

As noted, proclivities toward decision errors are not uncommon in managerial decision making, particularly in large organizations. Investment decision errors already identified include excessive optimism, loss aversion, isolation errors, strategic deception, and program persistence. As Nelson and Winter (2002: 29) note, organizational decision processes often display features that seem to defy basic principles of rationality and sometimes border on the bizarre. These errors can be especially damaging in fast-paced environments with path dependencies and network effects, as there is less opportunity to recover from mistakes. When investments are small and made frequently, there are many opportunities to learn from mistakes. Since large investments are usually occasional, major investment decisions are likely to be (potentially) more vulnerable to error.

Fortunately, biases can be recognized ahead of time. Enterprises can bring discipline to bear to purge bias, delusion, deception, and hubris. However, the development of disciplines to do so is still in its infancy. The implementation of procedures to overcome decision-making biases in enterprise settings is, accordingly, not yet a well-distributed skill, and may not be for decades to come. Accordingly, competitive advantage can be gained by early adopters of techniques to overcome decision biases and errors.

Overcoming biases almost always requires a cognitively sophisticated and disciplined approach to decision making. Being alert to the incentives of the decision-makers and to possible information asymmetries is a case in point. Obtaining an "outside view" through the review of external data can help eliminate bias. Testing for errors in logic is also essential. Management also needs to create an environment where the individuals involved in making the decision, at both the management and board level, feel free to offer their honest opinions, and look at objective (historical) data in order to escape from closed thinking. Incentives must also be designed to create neutrality when assessing investments in the old and the new.

Considerable progress in combating biases has been made. Advisors call upon managers to adopt radical, nonformulaic strategies in order to overcome the inertias that inhibit breakthrough innovation (Davidow and Malone, 1992; Handy, 1990). Specifically, corrective strategies encourage change through two basic mechanisms: (1) designing organizational structures, incentives, and routines to catalyze and reward creative action; and (2) developing routines to enable the continual shedding of established assets and routines that no longer yield value. Strategies that provide structures, incentives, and processes to catalyze and reward creative action serve to attenuate problems of excessive risk aversion. For example, strategies that call on the enterprise to "cut overhead" and "increase divisional authority" can be interpreted as efforts to reduce the number of management layers of the enterprise and to push decision making down to lower levels to minimize the inherent isolation errors associated with multilevel, hierarchical decision-making processes. These recommendations can be viewed as organizational processes and strategic mechanisms to mitigate decision-making biases.

Perhaps most importantly, executives must acknowledge the interaction effect between owning established assets and decision-making biases. Many recommended strategies (such as cannibalizing profitable product lines and licensing your most advanced technology) call for the shedding of established capabilities, complementary assets, and/or administrative routines to reduce the intensity of decision-making biases. By jettisoning "dead" or dying assets, the enterprise is no longer shackled with an asset base that can be a crutch and provide a false sense of security, and sustain groups inside the enterprise that persist in torpedoing new initiatives. In abandoning dead or dying assets, the enterprise frees itself of certain routines, constraints, and opportunities for undesirable protective action inside the enterprise.

Sources of the "anti-cannibalization" bias mentioned earlier can also be attacked. Self-serving behavior inside the enterprise to "protect" incumbent constituencies undergirds this bias. Flawed investment frameworks may also contribute. Entry into a market by an enterprise with a new and superior technology will

cause rapid depreciation of the economic value of an incumbent's plant and equipment. However, the incumbent may well make business decisions based on examining accounting profits that reflect depreciation rates specified by accepted accounting standards. If decision-makers confuse depreciation calculated according to general accepted accounting principles (GAAP) with real economic depreciation, and conclude that the existing business is still profitable when, in fact, it is not, then the business enterprise may eschew profit-enhancing cannibalization of its own products. To guard against this bias, investment decision-makers and incumbents must use accounting data cautiously. In particular, they must also consider the opportunity cost associated with not cannibalizing their own products. Capital-budgeting procedures implicitly biased against projects with long-term horizons must be jettisoned or used cautiously. That is not to say that incumbents need to invest on the same schedule as new entrants. As Teece (1986a) and Mitchell (1991) demonstrate, incumbents need not be the first movers. Superior positioning in complementary assets may enable incumbents to let the new entrants do the prospecting, investing later once market and technological risk has diminished.

There is an obvious role for leadership in making quality decisions, communicating goals, values, and expectations, while also motivating employees and other constituencies. Organizational identification (and commitment, which is the corollary) can dramatically augment enterprise performance, although it is doubtful it can override completely misaligned incentives. Nevertheless, group loyalty is a "powerful altruistic force" that conditions employee goals and the cognitive models they form of their situation (Simon, 1993a: 160). Top management through its action and its communication has a critical role to play in garnering loyalty and commitment and achieving adherence to innovation and efficiency as important goals. Since there is already an extensive literature on culture, commitment, and leadership, these issues are not discussed further. However, it would be a significant oversight in a summary statement of the dynamic capabilities framework to ignore them completely. Their full integration into the framework

is left to others. However, it is recognized that to the extent such properties are not ubiquitously distributed amongst business enterprises, they can be a very important source of superior performance. Figure 1.2 summarizes the microfoundations identified in this section of the chapter.

5. Managing Threats and Reconfiguration

Nature

The successful identification and calibration of technological and market opportunities, the judicious selection of technologies and product attributes, the design of business models, and the commitment of (financial) resources to investment opportunities can lead to enterprise growth and profitability. Profitable growth will lead to the augmentation of enterprise-level resources and assets. Success will cause the enterprise to evolve in a path-dependent way. A key to sustained profitable growth is the ability to recombine and to reconfigure assets and organizational structures as the enterprise grows, and as markets and technologies change, as they surely will. Reconfiguration is needed to maintain evolutionary fitness and, if necessary, to try and escape from unfavorable path dependencies. In short, success will breed some level of routine, as this is necessary for operational efficiency. Routines help sustain continuity until there is a shift in the environment. Changing routines is costly, so change will not be (and should not be) embraced instantaneously. Departure from routines will lead to heightened anxiety within the organization, unless the culture is shaped to accept high levels of internal change. If innovation is incremental, routines and structures can probably be adapted gradually or in (semi-continuous) steps. When it is radical, possibly because it is science based, then there will be a mandate to completely revamp the organization and create an entirely new "break out" structure (Teece, 2000) within which an entirely different set of structures and procedures is established.

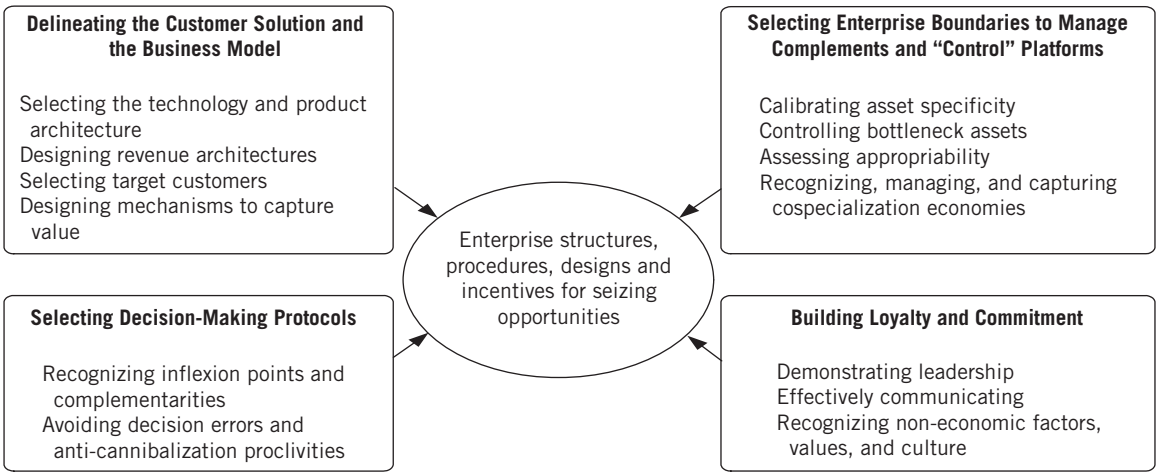

Fig. 1.2. Strategic decision skills/execution

As discussed earlier, the "anti-cannibalization" bias is a particular manifestation of incentive and structural problems that can thwart innovation in established enterprises. Incumbent enterprises possessing fixed assets may further tend to limit their new investments to innovations that are "close-in" to the existing asset base. They tend to narrowly focus search activities to exploit established technological and organizational assets. This effect makes it difficult for these enterprises to see potential radical innovations. In addition, incumbent enterprises tend to frame new problems in a manner consistent with the enterprise's current knowledge base, assets, and/or established problem-solving heuristics and established business model. This second effect means that managers may not successfully address opportunities or potential innovations even when they do recognize them. Managers face and must overcome at least two constraints—cognitive limitations and framing biases—arising from established assets (Teece, 2000).

As the enterprise grows, it has more assets to manage and to protect against malfeasance and mismanagement. Shirking, free riding, the strategic manipulation of information, and internal complacency are all issues that established enterprises will confront continuously. As discussed earlier, over time successful enterprises will develop hierarchies and rules and procedures (routines) that begin to constrain certain interactions and behaviors unnecessarily. Except in very stable environments, such rules and procedures are likely to require constant revamping if superior performance is to be sustained. It is not uncommon to find that a once functional routine becomes dysfunctional, providing inertia and other rigidities that stand in the way of improved performance (Leonard-Barton, 1995; Rumelt, 1995). As a result, less well-resourced enterprises (sometimes established enterprises that have divested certain assets, sometimes new entrants) end up winning in the marketplace.

Traditional management approaches endorse strong hierarchies with at least three levels of management: top, middle, and lower. Control is exerted at the top and cascades down through multiple levels. Employees tend to end up beholden to the

management and CEO, and not the customer. The existence of independent profit centers can lead to internal boundaries that stand in the way of providing integrated solutions that benefit customers. With centralized structures, strategic decisions made at the top tend to become isolated from marketplace realities. Customer care is relegated to employees who are lower down in the organization. In short, the systems and rules needed to manage many layers of organization tend to create structural rigidities and perversities that in turn handicap customer and technological responsiveness. To sustain dynamic capabilities, decentralization must be favored because it brings top management closer to new technologies, the customer, and the market.

Top management leadership skills are required to sustain dynamic capabilities. An important managerial function is achieving semi-continuous asset orchestration and corporate renewal, including the redesign of routines. This is because the sustained achievement of superior profitability requires semi-continuous and/or continuous efforts to build, maintain, and adjust the complementarity of product offerings, systems, routines, and structures. Inside the enterprise, the old and the new must complement each other. If they do not, business units must be disposed of or placed in some type of separate structure. Otherwise, work will not proceed efficiently, and conflicts of one kind or another will arise. Put differently, periodic if not continuous asset orchestration—involving achieving asset alignment, coalignment, realignment, and redeployment—is necessary to minimize internal conflict and to maximize complementarities and productive exchange inside the enterprise.

Redeployment and reconfiguration (Capron *et al.*, 1998) may also involve business model redesign as well as asset-realignment activities, and the revamping of routines. Redeployment can involve transfer of nontradable assets to another organizational or geographic location. It may or may not involve mergers, acquisitions, and divestments.[21] Helfat and Peteraf (2003: 1006) suggest that capability redeployment takes one of two forms: the sharing of capability between the old and the new, and the geographic

transfer of capability from one market to another. Both are possible, but neither is easy.

6. Microfoundations

Achieving Decentralization and Near Decomposability

Every system comprises subsystems (elements) that are to some extent interdependent and independent. However, as discussed earlier, enterprises are unlikely to be continuously responsive to customers and new technologies absent a high degree of decentralization. With decentralized decision making, different managers observe different information and control different decisions, but there is not the need for communication to a single central decision-maker, and hence no comprehensive "roll-up" of information is required. Decentralization must be pursued as enterprises expand, otherwise flexibility and responsiveness will erode.

One well-documented restructuring that is widely adopted as enterprises grow is the adoption of the multidivisional form. This involves decomposition and the devolution of decision rights to quasi-independent profit centers. The abandonment of functional structures in favor of the multidivisional form has been analyzed by Chandler (1962), Williamson (1975), and many others. The basic rationale of this reconfiguration was to achieve greater accountability of managerial decisions so that the recognition of opportunities and threats could proceed more thoroughly and expeditiously. With functional internal structures, day-to-day problems tend to distract management from long-run strategic issues. Studies showed that decentralization along product or market lines with independent profit centers led to performance improvements in many industries, at least during the period in which these organizational innovations were diffusing (Armour and Teece, 1978; Teece, 1980b). More recent scholarship has suggested that even further decentralization and decomposition in large organizations may be beneficial (Bartlett and Ghoshal, 1993).

There is also some evidence that "modern" human resource management techniques—involving delayering, decentralization of decision rights, teamwork, flexible task responsibilities and performance-based rewards—also improve performance (Jantunen, 2005).

Of course, achieving decentralization can compromise the organization's ability to achieve integration. There is little harm and much benefit from decentralization when the customer does not benefit from an integrated product offering, or when sourcing and other inputs do not benefit from integration and/or aggregation. If customer and supply considerations allow decomposability (because the required integration between units is less than within units), then management's ability to identify and implement decomposable subunits should enhance performance. However, if firm-specific economies of scale and scope are available, they must be captured—otherwise the enterprise is tantamount to a conglomerate. This tension can be managed through a collaborative nonhierarchical management style assisted by establishing councils and other integration forums. Middle management can also play a critical role when such forums are established. They can also design and implement tight financial controls and performance-based reward systems. Since intangibles are key drivers of performance, their enhancement and protection must become a managerial priority.

The open innovation model of Chesbrough (2003) also recognizes the benefits of relying on a distributed model of innovation where the enterprise reaches out beyond its own boundaries to access and integrate technology developed by others. By way of example, Henderson and Cockburn (1994) found that an enterprise's ability to integrate knowledge from external sources—their "architectural competence"—was positively associated with research productivity, as measured by patent counts. Likewise, Iansiti and Clark (1994) found that "integration capability" in the automobile industry and in the computer industry was associated with positive enterprise performance, again demonstrating the importance of knowledge integration skills. In the end, it appears that in fast-paced environments organizational units must have considerable autonomy (to make decisions rapidly) but remain

connected to activities that must be coordinated. Achieving this delicate balance is what Simon (2002) called "near decomposability" and implementing it is an important microfoundation of dynamic capabilities.

Managing Cospecialization

The field of strategic management and the dynamic capabilities framework recognizes that "strategic fit" needs to be continuously achieved. However, unless the concept is operationalized it has limited utility. The key dimension of "fit" emphasized in the dynamic capabilities framework is that of "cospecialization". The concept of cospecialization, introduced in Teece (1986a) and discussed in the "Managing Complements and 'Platforms' " section above, operationalizes at least one dimension of the otherwise rather vague concept of organizational adaptation and "fit". Cospecialization can be of one asset to another, or of strategy to structure, or of strategy to process. It is important to both seizing and reconfiguration. In environments of rapid change, there is a need for continuous or at least semi-continuous realignment.

In many ways, much of the traditional literature on organizational adaptation and "fit" (e.g. Miles and Snow, 1994) is consistent with dynamic capabilities. In particular, both the strategy and organizational behavior literature emphasize fit between and amongst strategy, structure, and processes. While it is not central to his framework, Michael Porter does note that:

> [S]trategic fit among many activities is fundamental not only to competitive advantage but also to sustainability of that advantage. It is harder for a rival to match an array of interlocked activities than it is merely to imitate a particular sales force approach, match a process technology, or replicate a set of product features. (Porter, 1996: 73)

Despite Porter's clear recognition of the concept of "fit", neither complementarities nor cospecialization are recognized in the Five Forces framework. However, complementarities and cospecialization are recognized in various ways in the literature (Teece,

1986a), Brandenburger and Nalebuff (1996), and Santoro and McGill (2005). Economic historians (Rosenberg, 1982; Hughes, 1983) have also noted the phenomenon at a general level; but in most analyses of competition and competitive advantage, it is common to stress that various innovations are substitutes, rather than complements that may be cospecialized to each other. Indeed, Schumpeter (1934) stressed that successful innovations/enterprises are threatened by swarms of imitators, all striving to produce "me-too" substitutes.[22] He completely neglected complementarities.

However, complementary innovation and complementary assets are of great significance, particularly in industries in which innovation might be characterized as cumulative, and/or where industry "platforms" exist or are needed. Examples of complementary innovation are ubiquitous. In the enterprise software industry, business applications can be especially valuable to users if they can somehow be integrated into a single program, or into a tightly integrated suite. The development of gyroscopic stabilizers made imaging devices such as video cameras and binoculars easier to use by minimizing the impact of camera shake, and enhanced the product, especially when the new feature was able to be introduced at low cost. Likewise, better high-energy rechargeable batteries enable laptop computers and cell phones to operate for longer times. Situations of complementarities where there is also cospecialization between technologies, and between technologies and other parts of the value chain, are common, yet until recently poorly analyzed in economic analysis and in strategy formulation.

Cospecialized assets are a particular class of complementary assets where the value of an asset is a function of its use in conjunction with other particular assets.[23] With cospecialization, joint use is value enhancing.[24] Cospecialization results in "thin" markets; that is, the assets in question are idiosyncratic and cannot be readily bought and sold in a market. Capturing cospecialization benefits may require integrated operations (Teece, 2000). Cospecialization allows differentiated product offerings or unique cost savings. The inherent "thin" market environment surrounding

specific assets means that competitors are not able to rapidly assemble the same assets by acquisition, and hence cannot offer the same products/services at competing price points.

Management's ability to identify, develop, and utilize in combination specialized and cospecialized assets built or bought is an important dynamic capability, but it is not always present in enterprise settings. Special value can be created (and potentially appropriated by another party) through asset combinations, particularly when an asset owner is not cognizant of the value of its assets to another party that owns assets whose value will be enhanced through combination.[25] This arises because the markets for cospecialized assets are necessarily thin or nonexistent. Langlois (1992) highlights the case of the diesel-electric locomotive where, in the 1920s, Charles Kettering had developed advanced lightweight diesel technology at the GM labs. The earliest use was in submarines. Alfred P. Sloan, GM's chairman, saw the possibility of applying the technology to make diesel-electric locomotives—steam power was, at the time, completely dominant. To accomplish this, GM needed capabilities resident in the locomotive manufacturers and at Westinghouse Electric. As Langlois (1992: 115) notes, the three sets of capabilities might have been combined by some kind of contract or joint venture, but the steam manufacturers—Alco, Baldwin, and Lima—failed to cooperate.[26] In short, both innovation and reconfiguration may necessitate cospecialized assets being combined by management in order for (systemic) innovation[27] to proceed. Managers do not always succeed in doing so, sometimes because they do not sense the need or the opportunity, and sometimes because they do but they are unable to effectuate the integration. If the assets cannot be procured externally, they will need to be built internally.

The ability of management to identify needs and opportunities to "invest" in cospecialized assets (through its own development or astute purchase) is fundamental to dynamic capabilities. Mere "horse-trading" skills (which market agents possess) will not suffice to build sustainable competitive advantage, and decisions on when and how to invest—whether and when to build or buy

cospecialized assets—will depend upon many factors, including transaction costs. In particular, they will depend on management's entrepreneurial capacities with respect to matching up and integrating relevant cospecialized assets.

It is apparent that cospecialization involves "lock-in" and is a particular form of complementarity that exists when technologies and other assets need to be part of a tightly integrated system to achieve the performance that customers want. Business success in such circumstances requires the coordination of R&D investment and alliance activity. The manner and timing with which such coordination needs to be accomplished is important to success (Teece, 1986a; Mitchell, 1991). Common ownership of the parts facilitates system-wide innovation and economic performance (Teece, 2000) and protects against opportunism (Williamson, 1975).

To summarize, entrepreneurs and managers can create special value by combining cospecialized assets inside the enterprise (Teece, 2007). This may require investments to create the necessary cospecialized technologies—as illustrated by Thomas Edison and the creation of electric power as a system. It is not uncommon in technology-based industries to find that certain technologies are worth more to some market participants than to others, based on the technology they already have, and their technology and product strategy.

Learning, Knowledge Management, and Corporate Governance

With intangible assets being critical to enterprise success, the governance and incentive structures designed to enable learning and the generation of new knowledge become salient. There are many types of learning—including experiential, vicarious, individual, and organizational—and a large literature that explores each type. Also "sensing" requires learning about the environment and about new technological capabilities. R&D was seen as one way that the enterprise could promote such learning. However, in the context of the dynamic capability discussed in this section, the ability to integrate and combine assets, including knowledge, is a core

skill (Kogut and Zander, 1992; Grant, 1996). The combination of know-how within the enterprise, and between the enterprise and organizations external to it (e.g. other enterprises, universities), is important.

Integrating know-how from outside as well as within the enterprise is especially important to success when "systems" and "networks" are present. Good incentive design and the creation of learning, knowledge-sharing, and knowledge-integrating procedures are likely to be critical to business performance, and a key (micro)foundation of dynamic capabilities (Nonaka and Takeuchi, 1995; Chesbrough, 2003). Of equal importance are monitoring and managing the "leakage", misappropriation, and misuse of know-how, trade secrets, and other intellectual property. Of course, tacit know-how is difficult to imitate and has a certain amount of "natural" protection. However, much know-how does leak out. Innovating business enterprises with limited experience have been known to inadvertently compromise or lose their intellectual property rights. Failure to proactively monitor and protect know-how and intellectual property is common.

The outsourcing of production and the proliferation of joint development activities likewise create requirements that enterprises develop governance procedures to monitor the transfer of technology and intellectual property. Technology transfer activities, which hitherto took place inside the enterprise, increasingly take place across enterprise boundaries. The development of governance mechanisms to assist the flow of technology while protecting intellectual property rights from misappropriation and misuse are foundational to dynamic capabilities in many sectors today. Figure 1.3 summarizes the microfoundations of this third class of dynamic capability.

There are also several other "governance" issues relevant to dynamic capabilities. At one level there are governance and business model issues associated with an enterprise's ability to achieve asset "combinations" and reconfiguration. As noted earlier, there is a continuous need to modify product offerings, business models, enterprise boundaries, and organizational structures. Decentralized

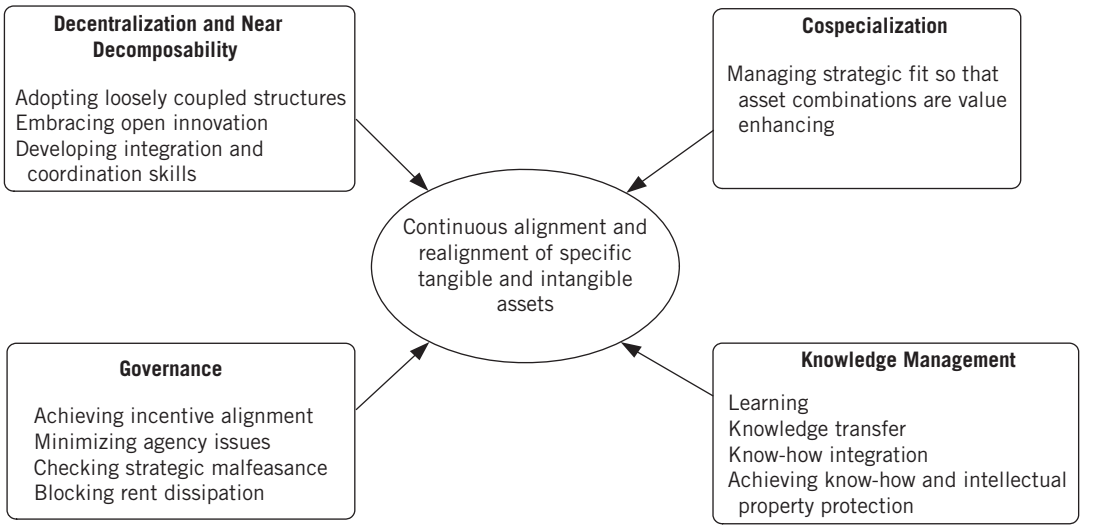

Fig. 1.3. Combination, reconfiguration, and asset protection skills

structures that facilitate near decomposability are likely to assist in achieving reconfiguration.

One class of governance issues relate to incentive alignment. The microfoundations of incentive issues are embedded in an understanding of agency and incentive design issues, also discussed earlier. Agency theory has long emphasized that the separation of ownership from control creates interest alignment problems, particularly around management compensation and the allocation of corporate perquisites. The abuse of discretion and the use of corporate assets for private purposes can occur absent appropriate accountability/oversight. These issues become more severe as an enterprise grows and the separation between ownership and management widens. Recent corporate governance scandals in the USA, Europe, and Japan indicate the need for continued vigilance. However, increasing the mix of independent and "inside" directors will not necessarily ameliorate problems associated with strategic "malfeasance".

There are likely to be benefits associated with participation at the board level by individuals who can calibrate whether the top management team is sufficiently "dynamic". The replacement of the CEO and other members of the top management team, if they demonstrate weak sensing, seizing, and reconfiguration capabilities (strategic "malfeasance"), is important to effectuate. That is not to say that guarding against financial malfeasance is unimportant. It will always remain as an important corporate governance function; but its significance is likely to pale next to strategic "malfeasance", which is harder to detect and evaluate. The current wave of governance reforms in the USA—with its strong emphasis on accounting controls and systems integrity—may inadvertently lead to much bigger "strategic" performance failures by management. Boards stacked with inexperienced "independent" board members may not have the requisite talents to properly diagnose strategic "malfeasance" and respond accordingly.

A related literature in economics has stressed how poorly designed incentives can produce tensions between the actions of employees and the actions needed to achieve profitable performance. Dysfunctional behavior, such as activity that generates

influence costs, has received considerable attention (Teece, 2003). Also, through use of collective bargaining, employees in industries insulated from global competition have been able to appropriate economic surplus. Above-market wages—which characterized, and to some extent still characterize, certain enterprises in the auto, steel, and airline industries in the USA—are a case in point. These conditions can extend to managerial ranks as well. Restructuring may then require the judicious use of bankruptcy laws to rewrite uncompetitive supply contracts that are the product of unrealistic collective bargaining actions in an earlier period. The ability of some enterprises to craft work specifications, attract and retain more committed talent, design reward systems, develop corporate cultures, and blunt the formation of coalitions that extract quasi-rents through threatening to withhold participation, is an important managerial capacity.

The design and creation of mechanisms inside the enterprise to prevent the dissipation of rents by interest groups (both management and employees) would also appear to be very relevant to dynamic capabilities, but has not been high on the agenda of strategy researchers. One exception is Gottschalg and Zollo (2007), who point out that the capacity to continuously achieve incentive alignment is an important performance-enhancing (and rent-protecting) dynamic capability.

Many of the issues discussed here have, in the past, fallen under the rubric of human resource management; a closer connection of these issues to strategic management issues would appear to be warranted. The reason is that strategic management is focused not only on how to generate rent streams, but also on how to prevent them from being dissipated or captured by various entities or groups inside and outside the enterprise. For instance, the concepts of the "appropriability regime" and "isolating mechanisms" were developed by strategic management scholars to help explain how rents from innovation and other sources of superior performance can be protected and guarded from dissipation by competitors and others. However, the earlier focus on markets or "external" competition did not address internal appropriation by interest groups.

7. *Dynamic Capabilities, "Orchestration" Skills, and Competitive Advantage*

The general framework advanced here sees dynamic capabilities as the foundation of enterprise-level competitive advantage in regimes of rapid (technological) change. The framework indicates that the extent to which an enterprise develops and employs superior (nonimitable) dynamic capabilities will determine the nature and amount of intangible assets it will create and/or assemble and the level of economic profits it can earn (see Figure 1.4). Furthermore, the framework emphasizes that the past will impact current and future performance. However, there is much that management can do to simultaneously design processes and structures to support innovation while unshackling the enterprise from dysfunctional processes and structures designed for an earlier period.

In Teece and Pisano (1994) and Teece, Pisano, and Shuen (1997), we proposed three organizational and managerial processes—coordination/integrating, learning, and reconfiguring—as core elements of dynamic capabilities. These processes are a subset of the processes that support sensing, seizing, and managing threats. Together they might be thought of as asset "orchestration" processes. A key strategic function of management is to find new value-enhancing combinations inside the enterprise, and between and amongst enterprises, and with supporting institutions external to the enterprise. Because many of the most valuable assets inside the firm are knowledge related and hence nontradable, the coordination and integration of such assets create value that cannot be replicated in a market. This establishes a distinctive role for managers in economic theory and in the economic system. Managers seek new combinations by aligning cospecialized assets. The need to sense and seize opportunities, as well as reconfigure when change occurs, requires the allocation, reallocation, combination, and recombination of resources and assets. These are the key strategic function of executives. Indeed, skills used to identify and exploit complementarities and manage cospecialization are scarce. Figuring out how to increase value from the use of the assets the

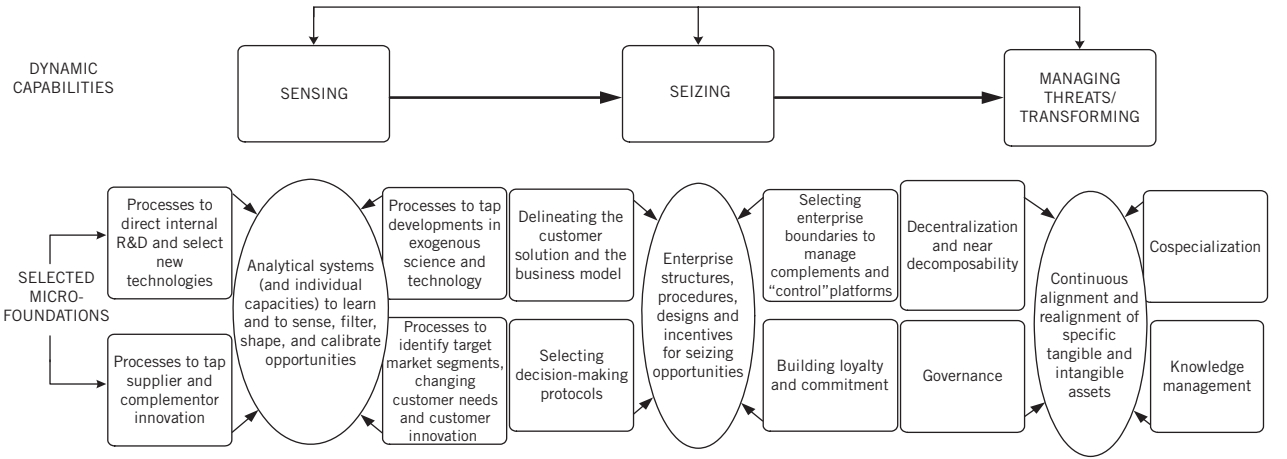

Fig. 1.4. Foundations of dynamic capabilities and business performance

enterprise owns involves knowing the fine-grained structure of the firm's asset base, and filling in the gaps necessary to provide superior customer solutions. Gap filling may involve building new assets, or acquisitions and strategic partnerships (Ettlie and Pavlou, 2006).

The dynamic capabilities framework recognizes that the business enterprise is shaped but not necessarily trapped by its past. Management can make big differences through investment choice and other decisions. Enterprises can even shape their ecosystem. In this sense, the framework is quite Chandlerian (Chandler, 1990a, 1990b). Managers really do have the potential to set technological and market trajectories, particularly early on in the development of a market (David, 1992). Indeed, the enterprise and its environment frequently coevolve. However, because of the assumed context—regimes of rapid technological change exposed to the full force of international competition—there is little room for big mistakes.

Hence, the dynamic capabilities framework is partially but not entirely in the spirit of evolutionary theorizing. The dynamic capabilities framework endeavors to capture the key variables and relationships that need to be "manipulated" to create, protect, and leverage intangible assets so as to achieve superior enterprise performance and avoid the zero-profit trap. However, building and assembling tangible and intangible assets and effectuating change is seen as difficult. Long-run success is likely to require achieving necessary internal creative destruction, possibly involving spin-outs and spin-offs to help sustain superior performance. Decision biases must also be neutralized. In short, enterprises may be more like biological organisms than some economists, managers, and strategy scholars are willing to admit; but they are also more malleable than some organizational ecologists are willing to recognize.

The enterprise will need sensing, seizing, and transformational/reconfiguring capabilities to be simultaneously developed and applied for it to build and maintain competitive advantage. Simultaneity may not be necessary at the product level—indeed, Helfat and Peteraf (2003) distinguish between capability development and subsequent honing, grafting, and branding. Endeavoring

to simultaneously achieve sensing, seizing, and reconfiguring at the individual product level could lead to chaos and lack of effectiveness, as routines and rules in the organization would likely be in a continuous state of flux.

The first two capabilities recognized as fundamental—sensing and seizing—are related to but different from March's (1991, 1996) concepts of exploration and exploitation. March seems clear that both are necessary for adaptation, but he has recognized the tensions, if not incompatibilities, between the two. His argument in part is that incompatibilities flow from the fact that exploration and exploitation compete for resources and that the mindsets and organizational routines needed for one are different from the other, making simultaneous pursuit difficult, if not impossible. While there is merit to each assumption, both need to be put in perspective. With respect to competition for resources, sensing does not necessarily involve large commitments of resources, at least not relative to seizing. Certain aspects, such as monitoring the environment, can be a low-cost activity. Early-stage exploratory research is also relatively inexpensive. Mansfield *et al.*'s (1971: table 6.2) studies of new product development showed that the cost of early-stage research activities was a small percentage of the total new product development costs. For instance, the costs of pharmaceutical development typically far exceed those of pharmaceutical discovery. Also, with respect to the different mindsets and routines, while there are undoubtedly tensions, these can be relieved by having different organization units (or different parts of an organizational unit) specializing to some degree in sensing as compared to seizing. As Gupta, Smith, and Shalley (2006: 697) note: "exploration or exploitation in one domain may coexist with high levels of exploration or exploitation in the other domain". Of course, the outsourcing of manufacturing and other aspects of seizing reconciles the issues even more starkly, as the routines needed for proficient manufacturing then lie external to the firm.

The need for both exploration and exploitation is well accepted for adaptive systems, and is embedded in the literature on ambidexterity (e.g. O'Reilly and Tushman, 2007). This literature

recognizes that both exploration and exploitation can be assisted by differentiated but partially or weakly integrated subunits (divisions, departments). Sensing activities need to be decentralized with the information rolling up to top management. Tight planning will be a part of seizing, but less so of sensing.

To summarize, an enterprise's ability to manage competitor threats and to reconfigure itself is dependent on its investment activity, which is in turn dependent on its ability to sense an opportunity. This aspect of dynamic capabilities indicates that the likelihood of achieving financial success depends on events and responses to them. Formally, let the probability of a high economic profits ranking for an enterprise, conditional on some extraordinary event E (e.g. an exogenous technological change that opens up the possibility of a new business opportunity) occurring,[28] be P_r (Π|E). Then: P_r (Π|E) = P_r (sense|E) $\times$ P_r (seize|E, sense) $\times$ P_r (manage threats/transform|E, sense, seize,) $\times$ P_r ((Π|E), sense, seize, manage threats/transform).

As indicated throughout this chapter and throughout earlier treatments by this author, it is also necessary to assess the issue of the "sustainability" or nonimitability of both assets and capabilities. This in turn depends upon a number of factors summarized adequately by the twin concepts of "isolating mechanism" and "appropriability regimes".[29] When the appropriability regime is "tight" and the business enterprise's own isolating mechanisms are strong, differential performance can be sustained, at least for a time. Dynamic capabilities of course require the creation, integration, and commercialization of a continuous stream of innovation consistent with customer needs and technological opportunities.

Note that in the dynamic capabilities framework, enterprises must employ sensing, seizing, and reconfiguring mechanisms to direct their financial resources consistent with marketplace needs and imperatives. However, as a matter of pure theory, enterprises need not continuously reinvent themselves. The need to reinvent depends on events, anticipated or otherwise. If the ecosystem in which the enterprise is embedded remains stable, the need to change can be modulated accordingly.[30] Indeed, if an

enterprise controls standards, or can somehow help stabilize its own environment, then it may not need to engage in the continuous and costly exploration of radical alternatives (March, 1991). Selecting suitable business models, making the right strategic investment decisions, and pursuing incremental innovation can keep an enterprise highly competitive for a decade or so (e.g. Boeing's decision to build the 747, which 30 years later is much improved and still competitive in some configurations on some routes) if the environment is stable. Excessive internal change for the sake of it can lead to internal chaos and performance failure.

8. *Resources/Competences Distinguished from Dynamic Capabilities*

The dynamic capabilities framework advances a neo-Schumpeterian theory of the firm and organizational decision making that is recognizable to those familiar with the behavioral theory of the firm, with evolutionary theorizing in economics, and with a Schumpeterian characterization of the innovation process. It also builds on what has come to be known as the resource-based approach. While the resource-based approach is inherently static, it is nevertheless relevant to dynamic capabilities. As noted by Teece, Pisano, and Shuen (1990a: 9):

> the resource-based perspective also invites consideration of strategies for developing new capabilities. Indeed, if control over scarce resources is the source of economic profits, then it follows that such issues as skill acquisition and learning become fundamental strategic issues . . .

Zott (2003: 120) similarly recognizes that "dynamic capabilities are more than a simple addition to the resource-based view since they manipulate the resources and capabilities that directly engender rents". Collis (1994) and Winter (2003) also note that one element of dynamic capabilities is that they govern the rate of change of ordinary capabilities.[31] However, the notion advanced here is that, at least analytically, dynamic capabilities can be disaggregated into

sensing, seizing, and transformational activities. Enterprises with good dynamic capabilities will have entrepreneurial management that is strategic in nature and achieves the value-enhancing orchestration of assets inside, between, and amongst enterprises and other institutions within the business ecosystem. Dynamic capability is a meta-competence that transcends operational competence. It enables firms to not just invent but also to innovate profitably.

The dynamic capabilities framework is integrative. Dosi, Nelson, and Winter (2000: 4) noted at one point the "terminological flotilla" in the literature on organizational competences. However, perhaps there is now an emerging consensus that resources/competences map well into what historically we have thought of as the enterprise's operational capabilities, which help sustain technical fitness. Dynamic capabilities, by contrast, relate to high-level activities that link to management's ability to sense and then seize opportunities, navigate threats, and combine and reconfigure specialized and cospecialized assets to meet changing customer needs, and to sustain and amplify evolutionary fitness, thereby building long-run value for investors.

If an enterprise possesses resources/competences but lacks dynamic capabilities, it has a chance to make a competitive return (and possibly even a supra-competitive return) for a short period; but it cannot sustain supra-competitive returns for the long term except due to chance. It may earn Ricardian (quasi-)rents when demand increases for its output, but such quasi-rents will be competed away. It does not earn those Schumpeterian rents associated with "new combinations" and subsequent recombination, or Kirznerian rents associated with bringing markets back into equilibrium. It might earn short-term Porterian rents associated with "building defenses against competitive forces" (Porter, 1991: 22), but this is far too reactive for long-term success. Dynamically competitive enterprises don't just build defenses to competition; they help shape competition and marketplace outcomes through entrepreneurship, innovation, and semi-continuous asset orchestration and business reconfiguration.

The archetypical enterprise with competences/resources but lacking dynamic capabilities will in equilibrium "earn a living by producing and selling the same product, on the same scale and to the same customer population" (Winter, 2003: 992). Such an enterprise might even be good at invention, but it will likely fail to capitalize on its technological accomplishments. The operational/technical competences possessed might include basic ones such as order entry (to communicate what needs to be made/supplied), billings (to collect from customers), purchasing (to decide what inputs to buy and then to pay suppliers), financial controls (to restrict behavior and prevent theft), inventory controls (to minimize inventory costs), financial reporting (to access capital), marketing (to identify customers), and sales (to obtain orders). Management of these functions is commonly considered operations management.

Operations management is arguably at the foundation of basic management functions; but while knowledge of modern production systems took generations to develop, it is now widely diffused. The division of labor, uniform standards, the moving assembly line, measurement techniques for inspection, and control all of course had to be invented and they now constitute what we now think of as the (American) system of production.

Competitive advantage can in theory flow from superior operations, or what was referred to earlier as "technical fitness". Indeed, the Industrial Revolution saw significant differentials open up between craft systems and modern production systems, and these innovations led to an almost complete reordering of the industrial landscape. As Charles Babbage (1835: 3) noted almost 200 years ago: "[W]e shall notice, in the art of making even the most insignificant of [articles], processes calculated to excite our admiration by their simplicity, or to rivet our attention by their unlooked-for results."

However, the postwar period has led to great progress in the understanding of how production systems work. Many useful techniques have been developed and improved. With developments in the field of management science and operations research, precise answers to narrow problems exist. Much is known about

inventory management, scheduling, planning, quality control, and about managing isolated subsystems. The pursuit of "benchmarking" and the adoption of "best practices" has helped with the diffusion of discrete skills, protocols, and procedures. However, according to one of the field's pioneers, "we have not learned very much about the relationships between these subsystems" (Buffa, 1982: 2). This is one place where dynamic capabilities come into play.

One implication is that special know-how—know-how that is difficult to obtain and apply—is needed to sense opportunities, execute plans, and configure and reconfigure assets and systems as necessary. Skill in putting things together to capture cospecialization benefits is important. Even with respect to operations management, it seems the pay-off today is in understanding how subsystems are related and interact together. Put differently, the understanding of the basic business functions that constitute business administration and operations management is widely diffused and hence well known, at least in advanced economies. The wide diffusion of knowledge with respect to such functions means that much can be outsourced or implemented inside any enterprise with relative facility. However, by running hard at this, an enterprise may manage only to stand still—what some refer to as the "Red Queen" effect. Absent a broader overarching set of dynamic capabilities, a firm that is merely competent in operations will fail. However, understanding how to enhance performance of the enterprise through sensing future needs, making quality, timely, and unbiased investment decisions inside a well-designed business model, executing well on those decisions, effectuating productive combinations, promoting learning, reengineering systems that no longer work well, and implementing good governance remains enigmatic. The requisite managerial services that undergird dynamic capabilities cannot be outsourced. Understanding and implementing the processes and structures that undergird dynamic capabilities is enterprise specific, and requires intimate knowledge of both the enterprise and the ecosystem in which the enterprise cooperates and competes.

In this regard, a useful distinction can be made between entrepreneurs, managers, and administrators. Administrators are responsible for the day-to-day operations and the routine; they help ensure that the enterprise is technically fit, in the sense defined earlier. They are not expected to engage in entrepreneurial activities; for example, they are not relied on to sense new business opportunities. Nor are they typically expected to discover the need for and to design new enterprise-wide operating routines, as this constitutes evolutionary fitness. The distinctions made earlier are implicitly recognized by Porter (1996: 61) when he claims that operational effectiveness is not strategy. He recognizes that both operational effectiveness and strategy are essential to superior performance, but notes:

> The quest for productivity, quality, and speed has spawned a remarkable number of management tools and techniques, total quality management benchmarking, time-based competition, outsourcing, partnering, reengineering and change management. Although the resulting operational improvements have been dramatic, many companies have been frustrated by their inability to translate gains into sustainable profitability. And bit-by-bit, almost imperceptibly, management tools have taken the place of strategy. As managers push to improve on all fronts, they move farther away from viable competitive positions.

Yet it is perhaps an overstatement to say that "operations management" tools and procedures cannot be the basis of competitive advantage, or work against it. If there is a significant, tacit, noninimitable component of an enterprise's superior operational competence, it has the potential for a time to support superior performance (it will, in fact, generate Ricardian rents).[32] Nevertheless, superior operational efficiency, while valuable, is not a dynamic capability.

9. Conclusion

For open economies exposed to rapid technological change, the dynamic capabilities framework highlights organizational and

(strategic) managerial competences that can enable an enterprise to achieve competitive advantage, and then semi-continuously morph so as to maintain it. The framework integrates and synthesizes concepts and research findings from the field of strategic management, from business history, industrial economics, law and economics, the organizational sciences, innovation studies, and elsewhere.

Implicit in the dynamic capabilities framework is a recognition that relatively open regimes of free trade and investment, global dispersion in the sources of new knowledge, and the multi-invention or systemic character of such innovation have "upped the ante" for modern management. Improving quality, controlling costs, lowering inventories, and adopting best practices ("technical fitness") will no longer suffice for long-run competitive success. Nor do traditional scale economies in production always have the differentiating power they might once have had. More than scale and scope advantage are needed. Success requires the creation of new products and processes and the implementation of new organizational forms and business models, driven by an intensely entrepreneurial genre of management constantly honing the evolutionary and entrepreneurial fitness of the enterprise. Entrepreneurial managers can sense and even help shape the future, unshackle the enterprise from the past, and stay ahead by augmenting knowledge assets, protecting them with intellectual property rights, establishing new value-enhancing asset combinations, and transforming organizational and, if necessary, regulatory and institutional structures. Dynamic capabilities reside in large measure with the enterprise's top management team, but are impacted by the organizational processes, systems, and structures that the enterprise has created to manage its business in the past.

Maintaining dynamic capabilities thus requires entrepreneurial management. The entrepreneurial management in question is different but related to other managerial activity. Entrepreneurship is about sensing and understanding opportunities, getting things started, and finding new and better ways of putting things together. It is about creatively coordinating the assembly of disparate and usually cospecialized elements, getting "approvals" for

nonroutine activities, and sensing business opportunities. Entrepreneurial management has little to do with analyzing and optimizing. It is more about sensing and seizing—figuring out the next big opportunity and how to address it.

We have come to associate the entrepreneur with the individual who starts a new business providing a new or improved product or service. Such action is clearly entrepreneurial, but the entrepreneurial management function embedded in dynamic capabilities is not confined to startup activities and to individual actors. It is a new hybrid: entrepreneurial managerial capitalism. It involves recognizing problems and trends, directing (and redirecting) resources, and reshaping organizational structures and systems so they create and address technological opportunities while staying in alignment with customer needs. The implicit thesis advanced here is that in both large and small enterprises entrepreneurial managerial capitalism must reign supreme for enterprises to sustain financial success. Nor is entrepreneurial management merely "intrapreneurship", as there is a large role for the entrepreneurial manager in external activities, including shaping the ecosystem.

As discussed, there are obvious tensions and interrelationships between and amongst the three classes of capabilities identified. The managerial skills needed to sense are quite different from those needed to seize and those needed to reconfigure. All functions have a significant "entrepreneurial" and "right brain" component. Successful enterprises must build and utilize all three classes of capabilities and employ them, often simultaneously. Since all three classes are unlikely to be found in individual managers, they must be somewhere represented in top management, and the principal executive officer must succeed in getting top management to operate as a team. Of course, if the principal executive officer has depth in all three classes of capabilities, the organization has a better chance of success.

The dynamic capabilities framework goes beyond traditional approaches to understanding competitive advantage in that it not only emphasizes the traits and processes needed to achieve good positioning in a favorable ecosystem, but it also endeavors to

explicate new strategic considerations and the decision-making disciplines needed to ensure that opportunities, once sensed, can be seized; and how the business can be reconfigured when the market and/or the technology inevitably is transformed once again. In this sense, dynamic capabilities aspire to be a relatively parsimonious framework for explaining an extremely seminal and complicated issue: how a business enterprise and its management can first spot the opportunity to earn economic profits, make the decisions and institute the disciplines to execute on that opportunity, and then stay agile so as to continuously refresh the foundations of its early success, thereby generating economic surpluses over time. If the framework has succeeded in some small measure, then we have the beginnings of a general theory of strategic management in an open economy with innovation, outsourcing, and offshoring.

Notes

1. The reference here is to the resource-based theory of the enterprise advanced by Rumelt (1984), Wernerfelt (1984), Amit and Schoemaker (1993), and others. Some of my earlier work (Teece, 1980a, 1982) was also in this vein.
2. The management functions identified are analogous to that of an orchestra conductor, although in the business context the "instruments" (assets) are themselves constantly being created, renovated, and/or replaced. Moreover, completely new instruments appear with some frequency, and old ones need to be abandoned. While flexibility is certainly an element of orchestration, the latter concept implies much more.
3. *Fortune*, December 11, 2006: 4.
4. *Business Week*, April 24, 2004: 64.
5. Chairman Alan Greenspan also noted recently, "over the past half century, the increase in the value of raw materials has accounted for only a fraction of the overall growth of U.S. gross domestic product (GDP). The rest of that growth reflects the embodiment of ideas in products and services that consumers value. This shift of emphasis from physical materials to ideas as the core of value creation appears to have accelerated in recent decades" (Remarks of

Alan Greenspan, Stanford Institute for Economic Policy Research, 2004).

6. In a limited sense, that is about decision making under uncertainty. As Knight observes, with uncertainty there is "a necessity to act upon opinion rather than knowledge" (Knight, 1921: 268). The problem is not just about knowledge asymmetries and incentive problems as Alchian and Demetz (1972) seem to suggest. Rather, it involves filtering and interpreting information about evolving technologies and marketplaces.
7. The Five Forces framework undergirds "industry" analysis in business school curriculum and in practice. However, the very concept of an industry is itself of questionable value. If industry boundaries exist, they are faint, at least in technologically progressive environments. For instance, the telecommunications "industry" may have had distinct boundaries over half a century ago around the telegraph and the telephone and associated regulated services. However, by the 1960s, facsimile and data services had begun to be overlaid on the public telephone network. Today telephony is routinely carried by the Internet (using voice-over IP) and cable TV networks.
8. Indeed, the (basic) market structure–conduct–performance paradigm from industrial economics that undergirds the Five Forces approach has been in need of revision for quite some time. Phillips (1971) was perhaps the first to recognize that causation is the reverse of what is assumed, with market structure being shaped by innovation.
9. Developed in the 1930s, 1940s, and 1950s, it is still relevant to some of the "rust belt" industries that experience low rates of technological innovation where complementors are not important, and where the coevolution of technologies and institutions is not significant (Teece, 1990).
10. Consider the development of civilian jet transport aircraft in the USA in the 1950s. As Phillips (1971: 126) noted: "Any one of Boeing, Douglas, Lockheed, or Corvair might have been first . . . The technology was there to adapt to . . . not risklessly or costlessly to be sure, but it was there. Perhaps the biggest risk in 1953 was not technological in character. Instead, it was risk with respect to what sort of jet to build and when to build it."
11. The decision skills required of management have limited commonality with those of an investor. One difference is the illiquidity and

irreversibility of most managerial investment decisions. Another is the need to achieve continuous alignment amongst the assets at work in the enterprise. Both public and private equity investors typically lack this kind of orchestration and integration capability or capacity. Moreover, their skills are most applicable when investments are liquid.

12. Cospecialization is defined and discussed in Teece (1986a) and explored further in the section below entitled "Managing Threats and Reconfiguration".
13. Monteverde and Teece's (1982) study of the automobile industry showed that "systems integration" considerations impacted make–buy decisions. This evidence hints at the value to be created from figuring out heuristics and protocols likely to aid decisions involving interrelated investments. Evans *et al*. (2006) recognize multisided market interdependencies which likewise require a systems perspective.
14. Ghemawat (1991) and many others have examined uncertainty and irreversibilities. However, cospecialization has received very little attention.
15. Let us take another example. A rock star might decide to use concerts as the key revenue generator, or the concert may be used primarily to stimulate sales of recordings. The star could decide to spend less time performing at concerts, and more time in the recording studio. There is clearly a choice of various media to extract value: live productions, movies, sale of CDs through stores, online sale of music through virtual stores such as the iTunes store offered by Apple, etc. The emergence of the Internet, Napster, and Napster clones in turn requires artists (and record companies) to rethink their business models. The ability to reconfigure business models for delivering and pricing music profitably is undoubtedly a dynamic capability for both the record companies and the artists.
16. Indeed, a critical element of Dell's success is not just the way it has organized the value chain, but also the products that it decides to sell through its distribution system. The initial products were personal computers, but now include printers, digital projectors, and computer-related electronics.
17. Quoted in Chesbrough and Rosenbloom (2002: 529).
18. A recent effort to establish a new business model is exemplified by the efforts of Rambus to rely exclusively on patent licensing to capture value from its significant technological contributions to the design of semiconductor memory devices. Such an approach avoids

building fabrication facilities (which are extremely expensive) but its viability depends entirely on Rambus's ability to enforce its patents in an environment in which courts are sometimes reluctant to enjoin infringers and where enforcing broad patents may engender antitrust challenges.

19. The model identified transaction costs, the locus of capabilities (inside or outside the enterprise), and appropriability regimes as three relevant classes of factors driving enterprise boundary decisions. In particular, it was noted that transaction cost factors "must be weighed against any losses in productive efficiency that result from being less skilled than specialists in the relevant stages of production".
20. I would like to thank Dan Lovallo for inspiration and help in this section.
21. As Capron *et al.* (1998) explain, failures in the market for resources sometimes cause enterprises to buy and sell business. What they refer to as market failure appears to relate to the "thin market" problem discussed by the author in this chapter and elsewhere (Helfat *et al.*, 2007).
22. Schumpeter wrote (1934: 223) that innovations/new combinations carried out by entrepreneurs "are not, as one would expect according to general principles of probability, evenly distributed through time . . . but appear, if at all, discontinuously in groups or swarms". This "swarming" of innovations and innovative activity occurs "exclusively because . . . the appearance of one or a few entrepreneurs facilitates the appearance of others, and these the appearance of more, in even increasing number" (Schumpeter, 1934: 228). Recent studies that analyze patent races have also reinforced the view that innovations are substitutes, not complements.
23. Lippman and Rumelt's (2003a, 2003b) recent work on developing the microfoundations for resource-based theory is very complementary to my development of the microfoundations of dynamic capabilities. I acknowledge their efforts in modeling cospecialized and complementary assets. In particular, they use the concept of supermodularity to bring in the tools of cooperative game theory. The idea of supermodularity was introduced by Donald Topkins as a way to formalize complementarity, and is also used by economists such as Milgrom and Roberts (see, in particular, Milgrom and Roberts, 1990) and evolutionary game theorists to model (strategic) complementarities (for instance, in models of R&D spillovers).

24. Complete cospecialization is a special case of economies of scope where not only are complementary assets more valuable in joint use than in separate use, but they may, in fact, have zero value in separate use and high value in joint use. Cospecialization may stem from economies of scope, but they could also stem from the revenue enhancement associated with producing a bundled or integrated solution for the customer.
25. Even if they are cognizant, they do not have the bargaining power to take advantage of the situation.
26. This was not because the companies feared holdup in the face of highly specific assets. Rather, it was because they actively denied the desirability of the diesel and fought its introduction at every step. GM was forced to create its own capabilities in locomotive manufacturing.
27. For a discussion of systemic innovation, see Teece (1988, 2000).
28. Alternatively, one could assess the unconditional probability P_r (Π) of earning such profits. $P_r(\Pi) = P_r(\Pi|E) + P_r(\Pi| \sim E)$ with P_r ($\Pi| \sim E$) defined analogously to the definition of $P_r(\Pi|E)$ in the text. In competitive markets without dynamic capabilities, $P_r(\Pi| \sim E)$ is likely to be zero.
29. Intellectual property protection, the tacit nature of know-how, and the inherent difficulty of the technology, all affect the ease of imitation. Another factor developed in this chapter is the unique coalignment of specific assets. Achieving such combinations may be difficult for imitators to effectuate.
30. This assumes that the ecosystem remains attractive. If it does not, the enterprise will have to consider migrating to a different ecosystem, or reshaping the ecosystem itself. Both are very challenging tasks.
31. As discussed here, dynamic capabilities certainly include this element, as well as several others.
32. Wal-Mart and Dell Inc. have both used differentiated business models to anchor their competitive advantages.

Chapter 2

The (Entrepreneurial) Function of the Manager in a Developed Market Economy

This chapter endeavors to identify fundamental functions of the (strategic) manager. Whereas other treatments focus on the undisputed role managers play in resolving conflicts and establishing standard operating procedures and rules of thumb to guide decisions, this chapter sees the role of management as going beyond such basic operating issues and embraces creating value by orchestrating the building and acquisition of cospecialized assets selected so as to respond to, or shape, marketplace dynamics. This asset orchestration function is both necessary and desirable because the assets in question are too idiosyncratic to be traded in markets, or accessed through markets. Viewed this way, strategic management itself

can be seen in an entrepreneurial light that helps explain the distinctive role of strategic managers in a market economy.

1. Introduction

The concept of dynamic capabilities highlights organizational and managerial competences. Key ingredients of dynamic capabilities include organizational processes directed toward learning and innovation, the basic manner in which a business is designed, as well as the decision frames and heuristics that inform firms' investment choices over time. Once assets come within the orbit of management rather than the market, their effective utilization and orchestration becomes essential. Indeed, orchestration directed at achieving new combinations and coalignment of assets is central to the dynamic capabilities framework. Such orchestration requires astute decision making and entrepreneurial capacity. Managers play a critical role in such orchestration and therefore have particular importance for dynamic capabilities.

Dynamic capabilities of all types perform an economic function: they affect how well business enterprises function within an economic system. An analysis of dynamic capabilities would be incomplete if it did not address this economic function. In this chapter, we analyze what economic theory and logic does and does not tell us about (strategic) managers in general and the asset orchestration function that they perform in particular. We also suggest promising directions for an economic theory of the firm that incorporates the dynamic capabilities of managers in a central way. This economic approach to understanding the managerial processes that underpin dynamic capabilities complements the following chapter, which focuses on organizational research on managerial and organizational processes. Together these two chapters provide a backdrop for the empirical analyses of managerial and organizational dynamic capabilities in subsequent chapters.

2. *Understanding the Fundamental Economic Problems "Solved" by Management*

It is an understatement to say that economic theory underplays the role of the manager; in fact, the strategic manager simply does not exist in any recognizable form. True, shareholders appoint agents (managers) to stewardship roles in the enterprise, but economic theory says little about what executives actually do and the economic function, if any, that they perform.[1] Sometimes executives manage workers through the employment relationship; but otherwise the executive in economic theory is rather a lackluster being who is almost completely invisible, and doesn't really perform an economic function, other than standing in for the owner/investor.

At least one well-known economist has commented on this lacuna. William Baumol notes that in economic theory:

> There is no room for enterprise or initiative. The management group becomes a passive calculator that reacts mechanically to changes imposed on it by fortuitous external developments over which it does not exert, and does not even attempt to exert, any influence. One hears of no clever ruses, ingenious schemes, brilliant innovations, of no charisma or of any of the other stuff of which outstanding entrepreneurship is made; one does not hear of them because there is no way in which they can fit into the model. (Baumol, 1968: 67)

The cavalier treatment of entrepreneurship and management in economics stems in part from a failure to understand the importance of managing organizations and the absence of well-developed and well-functioning markets for intangibles and other idiosyncratic assets, particularly those of the cospecialized variety. Because markets are often viewed, at least in the neoclassical paradigm, as working rather frictionlessly, the special role the managers play in transactions and in asset deployment, business model design, strategy formulation and implementation, and leadership seems quite unnecessary. In a perfectly competitive world with homogeneous inputs and outputs and technology that are ubiquitously available for all, the functions identified above aren't

needed. The manager is left simply as a calculator, setting marginal revenue equal to marginal cost. Of course, if this is all managers do, a reasonably simple software program and a set of rules for the organization would void the need for managers and management.

On closer examination, however, executive management performs several distinctive and important roles, which help the economic system overcome special problems, problems that might otherwise result in "market failures". That is, but for the actions of astute managers, competitive markets wouldn't function very well. Moreover, business organizations couldn't function either. Seven particular classes of economic functions can be assigned in economic theory to management. They are: (1) orchestrating cospecialized assets; (2) selecting organizational/governance modes and associated incentive systems; (3) designing business models; (4) nurturing change (and innovation) processes/routines; (5) making investment choices; (6) providing leadership, vision, and motivation to employees; and (7) designing and implementing controls and basic operations. None of these functions can be performed well, if at all, by computers or by naked market processes. Managers are needed to make markets work well, and to make organizations function properly.

The first six classes of decisions are "strategic" and/or entrepreneurial and must be performed astutely for firms to compete effectively. They relate to issues of strategic "fit" between the company and its competitive environment, as well as between and amongst the assets that comprise the resource base of the firm. We do not discuss the seventh set of decisions at length in this chapter, as it focuses on more operational issues. The management skills required for successful execution of operational decisions are conceptually different from those required for strategic management. The fact that they are not at the essential core of this book does not make them unimportant. Operational capabilities can provide a strong point of differentiation and advantage for a particular company. Nevertheless, we largely ignore these considerations in this chapter, which focuses on strategic management in general and decisions around resource allocation and asset alignment in particular.

If managers did not perform strategic functions within and among business enterprises, the entire adjustment and resources allocation function in the economy would fall on the price system. However, it is also generally accepted that a complete set of contingent claims markets does not exist, and even when markets do exist, trading volumes are often thin. If certain assets are rarely if ever bought and sold, then how can the economic system be restructured and assets brought into alignment?

The economics literature contains some general recognition that "internal organization" solves the problem. Exactly how internal organization solves the problem is never explained very well, if at all. Williamson and others have suggested that, with internal organization, adaptive behavior is facilitated and "managerial fiat" can be used to make decisions and coordinate and allocate resources. Unfortunately, the extant literature doesn't go much further. In this chapter, we seek to identify the functions of the executive that matter in a fundamental economic sense, and with regard to dynamic capabilities in particular. In this manner, we may better understand the distinctive role of managerial activity.

3. Asset Orchestration (in the Face of Thin Markets)

In early management scholarship, Chester Barnard and others stressed the role of management in limiting conflict and effectuating cooperation inside the firm. Barnard saw formal organization and the business firm as a system of consciously coordinated activities of two or more persons. In Barnard's view, achieving successful cooperation should by no means be taken for granted, as it is by no means the norm. As he notes, "most cooperation fails in the attempt, or dies in infancy, or is short lived" (Barnard, 1938: 5). The particular functions of management that Barnard recognizes include control, supervision, and administration (Barnard, 1938: 6), which are operational activities that relate to the business of keeping an organization functioning. Although these (managerial) functions must be performed,

they ignore the importance of the strategic functions that managers perform in dynamic environments.[2] Today, many of the firm's assets are intangibles, and flexibility, entrepreneurship, and adjustment and adaptation to competition and changing consumer needs are paramount. We address these functions in more detail below.

4. General Considerations Regarding Asset Orchestration

One of the most touted virtues of a private enterprise economy is its ability to achieve the coordination of disparate actors external to the enterprise itself—both consumers and producers—without central planners (Hayek, 1945). The price system of course serves as the mechanism that supposedly facilitates coordination. Prices act as signals of scarcity or abundance. Consumers adjust to price increases by reducing consumption; producers react to the same signal by increasing production, and the market clears. This simple mechanism means that a good deal of resource allocation can take place via market mechanisms—quickly and efficiently. Prices rise and resources will move to the higher valued activity; ditto when prices fall. Commodity markets usually behave in this fashion; and if all markets were commodity like, then the role and importance of (strategic) management would be limited.

A very large proportion of goods, assets, and services, however, are not exchanged in open, organized, and well-developed markets. For many transactions—forward, contingent, term, and spot—markets do not exist or are occasional at best. In these circumstances, markets are "thin", offering limited liquidity for asset holders. Assets are not automatically allocated to their first best use. As we discuss below, this creates the opportunity for managers to use the firm's financial and other resources and to build value inside firms. These functions are also socially desirable in most instances because they assist in aligning certain types of complementary assets—alignment which is necessary for systemic innovation and enhanced competition. If the economic system fails

in these functions, firm performance and the economy at large will suffer.

Thin markets are exposed to transactional complexity and contractual hazards; or even if not exposed to hazards, may experience liquidity discounts—the difference between "bid" and "ask" prices is likely to be large. Frequently, transactions in these markets don't occur at all because the services that an idiosyncratic asset provides may be difficult to describe, to define, and to access. If the asset is a competence, the valuation may be difficult to assess if the value of the competence depends on complementary and/or cospecialized assets owned by the seller, the buyer, or third parties. All of this is to say that certain assets tend to be built rather than bought (because there may not be a market) and to be deployed and redeployed inside the firm rather than sold (because sale in a market is not a good way to extract value). Because assets are bundled together and often tightly linked inside incumbent firms, it may be difficult to obtain assets in the desired configurations through asset purchase or sale in mergers and acquisitions. This is not to say that mergers and acquisitions (M&A) are not an important component of asset reconfiguration. Indeed, Capron, Dussauge, and Mitchell (1998) argue that market failures that constrain the exchange of discrete resources create incentives to use mergers and acquisitions in order to accomplish asset reconfiguration. Put differently, asset purchases/sales are often infeasible, absent purchasing or selling corporate entities in which many such assets are bundled together.

A striking example of thin or nonexistent markets is the market for know-how and for intangible assets more generally. As the author (Teece, 1981b) noted more than two decades ago, "unassisted markets are seriously faulted as institutional devices for facilitating trading in many kinds of technological and managerial know-how. The imperfections in the market for know-how for the most part can be traced to the nature of the commodity in question." The same is true with respect to intellectual property and other intangibles. Mutually beneficial trades frequently don't happen because the property rights may be poorly defined (fuzzy),[3] the asset difficult to transfer, or its use difficult to meter. When

arm's-length market trading is impaired, internal resource allocation and asset transfer within the firm achieves greater significance. This is of course a managerially directed activity.

Accordingly, resource allocation inside the firm substitutes and complements resource allocation by markets when markets for particular assets are thin or nonexistent. Relatedly, because of cospecialization, or because of differing perceptions about future demand and technological innovation, or because of differing asset positions of buyer and seller, there may be wide disparities between how the existing owner of an asset values it and the manner in which another agent or potential owner might value it.

Because many intangible assets are idiosyncratic, they may be more valuable when they can coevolve in a coordinated way with other assets. The ability to assemble unique configurations of cospecialized assets therefore can enhance value. In short, managers often create great value by assembling particular constellations of assets inside an enterprise, because by employing such assets, they frequently can produce highly differentiated and innovative goods and services that consumers want. This process of assembling and orchestrating particular constellations of assets for economic gain is a fundamental function of management.

Effectuating systemic innovation (Teece, 2000) provides a good example of asset orchestration. Systemic innovation occurs when deep cospecialization exists between parts of a system requiring in turn the tight coordination across subsystems for innovation to occur. Systemic innovation contrasts with autonomous innovation, in which technological development can occur without immediate and direct coordination with other elements of a system.

Consider the automobile. New types of tires (such as tubeless tires, and later radial tires) have over time been developed without immediate regard for other developments in the automobile. Notwithstanding that some "components" can be developed independently of other parts of the system, it is frequently the case that innovation in one component will facilitate innovation elsewhere. For example, radial tires permitted cars to be designed for higher speeds, without compromising safety.

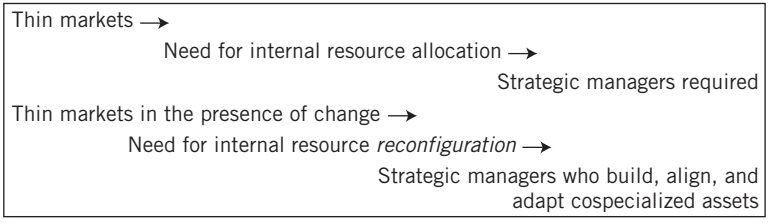

Fig. 2.1. Thin markets and strategic managers

Systemic innovation, on the other hand, almost always requires common managerial control of the parts for success, since innovation activity must be highly coordinated across subsystems. Contractual mechanisms will rarely suffice to achieve the necessary coordination between or amongst firms (Teece, 1988). For instance, the Lockheed L1011 wide-bodied aircraft's late entry into the market was caused by the inability of Rolls-Royce to develop the RB211 engine on time—and the aircraft design was cospecialized to the new, still undeveloped, engine. Indeed, the failure of Rolls-Royce to develop the RB211 on time was a major contributing factor not only to the slow launch of the L1011, but also to the bankruptcy of the Lockheed Corporation.

In short, fuzzy property rights (as with intangibles), appropriability issues, and cospecialization are among the reasons why asset markets can be thin. This renders market transactions difficult. Whenever this occurs, managers have a distinctive role that differs from the role of traders and arbitrageurs. (See Figure 2.1.)

5. Asset Orchestration versus Coordination and Adaptation

Coordination as an economic problem is only necessary because of change (Hayek, 1945). In a static environment, a short period of "set up" would be required to organize economic activity; but absent change in consumer tastes or technology, economic agents (both traders and managers) would sort out the optimal flows of goods and services (together with methods of production). Thereafter, there would be no need for their services.

Now introduce change. If there were a complete set of forward and contingent claims markets, adjustments would occur automatically; absent a complete set of futures and contingent claims markets, there is the need for economic agents to engage in trading activities, and for managers/entrepreneurs to "integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece *et al.*, 1997). That is why what Adner and Helfat (2003) termed "dynamic managerial capabilities"[4] hold particular importance.

Dynamic Managerial Capabilities Include Asset Orchestration

Coordinating and adapting effectively to changing environments (Cyert and March, 1963) is an important managerial function that is an element of a firm's dynamic capabilities. Barnard (1938) and Richardson (1960) developed this theme early. Chester Barnard viewed the firm fundamentally as a structure to achieve coordination and adaptation. But as Williamson (1995) observes, Barnard did not compare the firm with markets in terms of their coordinative or adaptive capabilities. As noted above, one key difference is that the firm, by employing astute managers and good incentive design, can achieve coordination and adaptation with respect to nontraded or thinly traded assets; the market on the other hand enables rapid adaptation with respect to assets that are actively traded in thick markets.

However, the strategic management function involves much more than "coordination" and "adaptation". The functions of the (strategic) executive go well beyond what Barnard and Williamson identified. In particular, "coordination" and "adaptation" as management functions do not fully capture the essence of critical managerial activity in dynamic markets. Such managerial activity involves, *inter alia*, orchestrating complementary and cospecialized assets, inventing and implementing new business models, and making astute investment choices (including with regard to R&D and M&A) in situations of uncertainty and ambiguity.[5] Nor do traditional perspectives convey the importance of asset

alignment, opportunity identification, and accessing critical cospecialized assets. These are all important managerial functions that create value.

Put another way, the importance of strategic management stems in a fundamental sense from what can be thought of as "market failures".[6] The "market failures" arise not just from high transaction costs and contractual incompleteness.[7] Rather, they have to do with the thinness of asset markets, and the need to identify, "build", align, adapt, and coordinate activities and assets, especially complementary/cospecialized assets. Managers perform these important functions in the economic system.

G. B. Richardson (1960) has remarked on the information problems associated with achieving coordination and investment decisions. However, he focused on industry-level coordination of investment. He identified situations where limited information about competitors' investment decisions may impede efficient investment. In contrast, the essential coordination task identified here involves assembling and reassembling other idiosyncratic firm assets (including through strategic alliances with other firms).

Asset orchestration

Needless to say, the proficient achievement of the necessary coordination by no means occurs automatically. Decision-makers need information about changing consumer needs and technology. Such information is not always available; or if it is available, decision-makers must collect information, analyze it, synthesize it, and act on it inside the firm. Situations are dealt with in many ways, sometimes by creating rules which specify how the organization will respond to the observations made (March and Simon, 1958). If this path is chosen, then rules may become codified and routinely applied (Casson, 2000: 129) whenever certain changes are detected.[8] However, such rules need to be periodically revised, which entails dynamic capabilities.

The coordinating and resource-allocating activities performed by managers shape markets[9] as much as markets shape the business. Put simply, the business enterprise and markets coevolve. Managers shape this coevolution. The need for asset coordination and

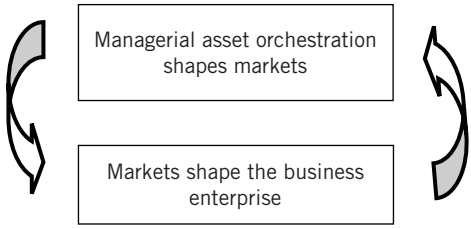

Fig. 2.2. Coevolution of markets and the business enterprise

orchestration and associated investment choices is a fundamental economic problem that the firm's managers help address. In this regard, the evolutionary fitness of a business enterprise may be endogenous to its technical fitness. By using technically proficient asset orchestrations capabilities, managers may be able to shape the external environment to the firm's advantage, leading to evolutionary fitness.

The emergence/development of competitive markets is thus important for strategic management. As markets become developed and highly efficient, managers have less room to build competitive advantage (Barney, 1986). The emergence of competitive intermediate product markets in petroleum and chemicals, for example, has been identified as a major leveler in global competition (Teece, 2000). Competitive advantage is illusory when all markets are highly competitive. However, changes in markets and technologies create new market opportunities. As long as idiosyncratic assets abound, this will create thin market situations and provide opportunities for competitive advantage.

6. *Toward a Dynamic Capabilities (Economic) Theory of the Firm*

Ronald Coase in his classic (1937) article on the nature of the firm described firms and markets as alternative modes of governance, the choice between them made so as to minimize transaction costs. The boundaries of the firm were set by bringing transactions into the firms so that at the margin the internal costs of organizing

equilibrated with the costs associated with transacting in the market.

Initiated by Coase's (1937) seminal paper, a substantial literature has emerged on the relative efficiencies of firms and markets. This literature, greatly expanded by Oliver Williamson (1975, 1985) and others, has come to be known as transaction cost economics. It analyzes the relative efficiencies of markets and internal organization, as well as intermediate forms or organization such as strategic alliances.

Contractual difficulties associated with asset specificity are at the heart of the relative efficiency calculations in transaction cost economics. When specific assets are needed to support efficient production, then the preferred organizational mode is internal organization. Vertical and other forms of integration are preferred over contractual arrangements when efficient production requires investors to make irreversible investments in specific assets. The structures used to support transactions are referred to as governance modes. Internal organization (doing things inside the firm) is one such governance mode.

The dynamic capabilities approach is very consistent with Coase in some ways but not others. It is accepted that it is useful to think of the firm and markets as alternative modes of governance. Relatedly, the selection of what to organize (manage) internally or via alliances or via the market depends on the nontradability of assets and what Langlois has termed "dynamic transactions costs".

But it is not enough to convert the notion of nontradability entirely into the concept of "transaction costs", defined by Arrow (1969: 48) as the "costs of running the economic system". Others have tried to operationalize the concept of transaction costs, with Alchian and Demsetz (1972) proposing technological nonseparabilities and Williamson (1985) focusing on specific assets. There is indeed a strong relationship between specific assets and nontraded or thinly traded assets.

However, there are reasons why assets are not traded (or are thinly traded) that do not relate to asset specificity. For instance, the land on the corner of Park Avenue and 59th Street in New York

City rarely comes onto the market. The ability to write highly creative and efficient software for computer operating systems is not widely distributed. Brands that signal particular values (e.g. Lexus) are likewise thinly traded. Uniqueness and asset specificity aren't quite the same. In addition, the concept of cospecialization is important (Teece, 1986a). Assets that are cospecialized to each other need to be employed in conjunction, often inside the firm.[10] This isn't the emphasis of Coase, Alchian and Demsetz, or of Williamson.

Assembling cospecialized assets inside the firm in the dynamic capabilities framework is not done primarily to guard against opportunism and recontracting hazards, although in some cases that may be important. Instead, because effective coordination and alignment of these assets/resources is difficult to achieve through the price system, special value can accrue to achieving good alignment within the firm. This is different from what Barnard (1938) has suggested with his emphasis on the functions of the executive as rooted in cooperative adaptation of a conscious and deliberate kind. Here the focus is on the "orchestration" of cospecialized assets by strategic managers. It is a proactive process designed to: (1) keep cospecialized assets in value-creating coalignment, (2) select new cospecialized assets to be developed through the investment process, and (3) divest or run down cospecialized assets that no longer help yield value. Rather than stressing opportunism (although opportunism surely exists and must be guarded against), the emphasis in dynamic capabilities is on change processes, inventing and reinventing the architecture of the business, asset selection, and asset orchestration.

One might reasonably ask the reasons for this significant difference in emphasis. Clearly, in dynamic capabilities, a comparative institutional framework is adopted. "Small numbers" bargaining is at the core, as in Williamson (1975). However, the emphasis on dynamic capabilities is not just on protecting value, but also on creating it. Barnard wouldn't naturally see the importance of this emphasis, because his laboratory was the regulated Bell Telephone operating companies.

Alchian and Demsetz and Williamson have all emphasized opportunistic free riding. Indeed, their human actors are assumed to be boundedly rational, self-interest seeking, opportunistic, and full of guile. The dynamic capabilities framework adds other (arguably less ubiquitous) traits of human nature: (1) intrapreneurship and entrepreneurship, and (2) foresight and acumen. Williamson appears to recognize that such skills ought to influence the theory of economic organization, when he quotes businessman Rolf Sprecket: "Whenever I see something badly done, or not done at all, I see an opportunity to make a fortune." Williamson comments: "Those instincts, if widely operative, will influence the practice and ought to influence the theory of economic organization" (1999: 1089). This statement opens the door to dynamic capabilities.

There are other differences as well. Williamson makes the transaction the unit of analysis; in dynamic capabilities, the currency of interest includes complementary and cospecialized assets. The utility of transaction cost economics and related frameworks to make–buy–ally decisions and related governance decisions are not in dispute. But transaction cost economics leaves us without an understanding of the distinctive role of strategic management. Executives must not only choose governance models (as between market arrangements, alliances, and internal organization), but they must also understand how to design and implement different governance structures, and to coordinate investment activities.

Just as the governance of markets is not preordained by the economic system, nor is the selection of governance modes. Many elements of internal organization, business model design, and alliance structure require managers to select and design methods of governance. For example, as Chapter 5 explains in more detail, a relational capability for alliances includes selection and design of alliance governance. Again, dynamic capabilities come to the fore.

7. Conclusion

In this chapter, we have argued that any robust economic theory of the firm must include a primary role for strategic managers and their dynamic capabilities. Critical dynamic managerial capabilities include asset orchestration, frequently involving cospecialized and complementary assets within the resource base of an organization. Not only must managers assemble these bundles of resources, but also they must design appropriate governance and incentive structures.

Notes

1. Oliver Williamson has noted that supplying a coherent theory of effective coordination and resource allocation, and of entrepreneurship and technical progress is a "tall order" (Williamson, 1991: 19). This chapter endeavors to make progress toward this goal, which has important ramifications for management theory and the theory of the firm. It implies a very different set of economic activities as the essence of the enterprise than the literature has heretofore featured.
2. It is perhaps of interest to note that Barnard's perspectives were no doubt shaped by his experience as an executive in the Bell System. Barnard served as President of New Jersey Bell. At the time, it was a regulated telephone company.
3. See Teece (2000) for a discussion of the fuzzy boundaries associated with intellectual property rights.
4. Dynamic managerial capability *is the capacity of managers to purposefully create, extend, or modify the resource base of an organization*.
5. Milgrom and Roberts (1990: 525) also note that "non convexities and significant complementarities provide a reason for explicit coordination between functions such as marketing and production".
6. The use of the term "market failure" is only relative to the theoretical norm of absolute static and dynamic efficiency. Of course, a (private) enterprise economic system as a whole achieves an efficient allocation of resources, as strategic managers and the organization they lead are an inherent part of the economic system. However, the framework does highlight the fact that management systems and corporate governance must function well for a private enterprise market-oriented system to function well.

7. To the extent that transaction costs are relevant, it is of the dynamic variety (see Langlois, 1992).
8. Casson argues that rule making is entrepreneurial, but that rule implementation is routine, and is characterized by managerial and administrative work.
9. For example, both Priceline and eBay set out to alter the structure of existing markets, and to some extent did so.
10. Dynamic capabilities centrally concern the strategic management function, which transcends the question of the optimal firm boundaries. Value can be created by astutely organizing assets both inside and outside the firm. In this sense, one should not expect a theory of dynamic capabilities to uniquely provide a theory of the firm.

Chapter 3

The Foundations of Dynamic Capabilities

(with Mie Augier)

This chapter (co-authored with Mie Augier) discusses the intellectual roots of the dynamic capabilities framework. We draw on insights from Edith Penrose as well as others in order to help explain the essence of the business enterprise, and how it can escape the zero-profit trap. We see the business enterprise as being in part a product of its own history, but not completely so. Managers can shape outcomes and are not completely trapped by prior decisions and investments. We call this "evolution with design", leaving room for both evolutionary processes as well as intentional design.

1. Introduction

This chapter begins with some notes on the development of strategic management concepts in general, and the dynamic capabilities framework in particular. The dynamic capabilities framework

draws from many intellectual streams, including entrepreneurship, the behavioral theory of the firm and behavioral decision theory, organization theory, transaction cost economics, and to some extent evolutionary economics. It emphasizes the role of entrepreneurial managers in identifying emerging opportunities and seizing upon them while simultaneously effectuating continuous corporate renewal.

Four central themes are developed. First, as noted in Chapters 1 and 2, the dynamic capabilities framework can be used to highlight the importance of strategy and organization, as well as leadership and management, to enterprise performance. Second, there is an important theoretical as well as practical role for entrepreneurs, managers, and leaders not just in the business enterprise, but also in the economic system. They play an essential role by (a) identifying and capturing new strategic opportunities, (b) orchestrating the necessary organizational assets, (c) and by inventing business models and new organizational forms. Third, organizational structures must be designed to support and accommodate unbiased decision making.

In much of the economics and strategic management literature, incentive alignment suffices to enable good decisions. In more sociologically oriented treatments, "trust" and "organizational culture" play a bigger role. We will argue that both incentive-based approaches and notions of trust and culture are each important in well-functioning business enterprises. Also, enterprises must avoid decision traps that lead to biased decisions. Fourth, it is our hope that an approach that combines both incentive and nonincentive issues may help move capabilities research toward a real paradigm. The approach we outline embraces elements of both evolution and design. We hope by doing so to capture the essence of the strategy processes.

2. Strategic Management

The focus of the field of strategic management is on choices with respect to the direction of the evolution of the business enterprise.

It covers subjects of primary concern to senior executives, and to anyone interested in the success and failure of the business enterprise. The field is grounded in practice and exists because of the importance of the subject, and the need for frameworks that can help managers think through business decisions. The field studies the choices enterprises must make in order to continue to survive and prosper in the long run in an environment where it is assumed that there is competition for customers, technology, people, financial capital, and other inputs.

Technological innovation and changing customer tastes are part of the landscape in which strategic decisions are made. Strategic choices include the selection of products and services to offer customers, the market segments to address, the business models to employ, the appropriate level of diversification, and organizational structures, policies and practices needed to coordinate activities. It is a basic proposition of the field of strategy that these choices are interrelated and should not therefore be made in isolation. The field views the enterprise as both adapting to its environment, and in some cases even shaping that environment.

The assumption adopted in the field of strategic management that the enterprise has meaningful choices, and that managers make a difference, is in contrast to organizational ecology that presumes that path dependencies are so strong that the enterprise simply cannot adapt, and managers are rather helpless in the face of strong technological, market, and social determinism. Instead of adaptation, organizational ecology sees a population of business enterprises that changes in composition over time. Some flourish and others perish while still others are born. Organizational ecology does recognize strategy, but mainly when choices are made at the time the enterprise is founded.

The strict ecological view is at odds with the field of strategic management and with frameworks that recognize that managers can make strategic (investment) choices, and engage in organizational renewal and transformation. However, change is not automatic or costless, and is often thwarted by various kinds of organizational inertia and decision-making biases. Nevertheless, entrepreneurs and managers can affect outcomes. This is

particularly true when positive feedback situations exist, and opportunities to make value-enhancing cospecialized investments are present. As David (1992) notes, such situations are especially prone to appear at early stages in the development of integrated production and distribution systems.

Strategic management as a field has grown significantly over the past two decades. It has moved closer to getting established as a scientific field, including establishing its own journal and professional society, and gaining some acceptance from other disciplines (Rumelt *et al.*, 1994). Although the roots of the field can be traced back to the ideas of Sun Tzu, Leo Tolstoy, and Clausewitz, the field really took off in the early 1980s. A research agenda began to emerge around the importance of analyzing competitive forces; and then later around ideas on resources, competencies, and capabilities.[1]

While borrowing from economics, the field of strategic management has been eclectic in its employment of economic paradigms because (neoclassical) economics cannot explain a number of phenomena that are of interest to scholars in the field of strategic management (such as firm heterogeneity, industry dynamics, entrepreneurship, and competitive advantage) (Teece and Winter, 1984). Because it is pragmatic, the field of strategic management is also forced to be interdisciplinary. Indeed, the problems addressed in the practice of strategic management require insights from multiple disciplines.

3. Escaping the Zero-Profit Condition

The economic theory of (perfect) competition explains that in "equilibrium" firms will make only just enough to cover their cost of capital. This is sometimes referred to as the zero-profit condition. It occurs in the model because there are no points of differentiation amongst firms with respect to technology, markets, information, or skills. With homogeneity amongst firms, and with markets in equilibrium, not a penny of profit is earned beyond that which is necessary to keep the enterprise alive. The (economic) theory of

perfect competition does not provide a great deal of guidance for managers, except that it does underscore the result (zero profit) that will occur unless the enterprise can somehow differentiate itself from its competitors and provide a product or service to its customers that is in some way superior to its competitors or cheaper to produce. In this sense it contains an important message; but the theory of (perfect) competition provides few clues as to how best to avoid the zero-profit condition.

The first serious effort to apply economic analysis to strategic management in a systematic and an avowedly normative way was Porter (1980). His Five Forces framework implicitly advised that the way to escape the zero-profit condition and earn supernormal profits was (1) to pick an attractive industry (e.g. one that is growing, faces limited competition, and isn't exposed to a squeeze from buyers or suppliers), (2) to enter or expand output in that industry while (3) building defenses to shield oneself from competitors who will undoubtedly try and compete away supernormal profits, and leave the enterprise with zero economic profit. Shields available to defend from competition include product differentiation or achieving the lowest cost.

Porter's Five Forces framework is insightful but limited because it is devoid of any meaningful conceptualization of the firm. With respect to how firms actually differentiate, the Porter framework sees this occurring basically through the product choices they make. There is little attention given to the enterprise itself and its capabilities.

Since Porter, other approaches have emerged. The resources approach anchors differentiation upstream, basically noting that if a firm is going to be able to differentiate its products, it must be different in its capabilities and/or business model. This approach was embedded in Penrose's ([1959] 1995) work. She saw the business enterprises as possessing bundles of fungible resources, generated in part from its prior activities. These resources could be deployed to produce a variety of final products. Managers would endeavor to reconfigure the firm's portfolio of products so as to meet customer needs. Profits would flow from achieving differentiation and putting excess or unused resources to work (Teece, 1982).

The resources approach provides another way out of the zero-profit trap. Profits can flow from the possession of scarce and difficult to imitate resources or assets, the services of which are in demand by customers. However, the framework is somewhat static in that there is little consideration given to how the firm would sustain the sources of its success. While learning (particularly managerial learning) is embedded in the approach, a more robust framework is needed.

A more robust framework is developing with the dynamic capabilities approach, which endeavors to explain how firms achieve sustainable competitive advantage in a changing environment exposed to strong competition. Dynamic capabilities necessarily end up identifying organizational (and individual) capabilities that enable the business enterprise to build and maintain value-enhancing points of differentiation. At the heart of the framework is an effort to define managerial traits, management systems, and organizational designs that will keep the enterprise alert to opportunities and threats, enable it to execute on new opportunities, and then constantly morph to stay on top once it has put the systems in place to capture the fruits of its first round of success.

The dynamic capabilities framework contains a richer description of features and factors than is contained in Penrose or in the resource-based approach. The framework pulls together many disparate literatures—entrepreneurship, decision theory, organizational behavior, innovation—to identify the key classes of capabilities firms must possess if they are to succeed longer term in generating superior profits. It goes further and describes the underpinnings (microfoundations) too.

4. Dynamic Capabilities Defined

As discussed in Chapter 1, dynamic capabilities refer to the particular (nonimitability) capacity business enterprises possess to shape, reshape, configure, and reconfigure assets so as to respond to changing technologies and markets and escape the zero-profit condition. Dynamic capabilities relate to the enterprise's ability to

sense, seize, and adapt in order to generate and exploit internal and external enterprise-specific competences, and to address the enterprise's changing environment (Teece and Pisano, 1994; Teece *et al.*, 1997). As Collis (1994) and Winter (2003) note, one element of dynamic capabilities is that they govern the rate of change of ordinary capabilities. If an enterprise possesses resources/competences but lacks dynamic capabilities, it has a chance to make a competitive return for a short period, but superior returns cannot be sustained. It may earn Ricardian (quasi-)rents, but such quasi-rents will be competed away, often rather quickly. It cannot earn Schumpeterian rents because it hasn't built the capacity to be continually innovative. Nor is it likely to be able to earn monopoly (Porterian) rents since these require exclusive behavior or strategic manipulation (Teece, 1984).

An illustration of some of the issues involved in the dynamic capability framework is found in the story of the British pop group, the Spice Girls. The group made pop history in the late 1990s with their successes (being the first female group to win nine number 1 hit singles—only Elvis, Cliff Richard, Madonna, and the Beatles ever had more). The band was the result of two entrepreneurial and innovative management gurus (Bob and Chris Herbert) who in 1994 handpicked the five members to sing in a team (at first called "Touch", the band name (and the manager) was changed in 1996). After a few years of success, the band broke up and the individual band members tried to pursue solo careers. However, none of them was able to replicate the success of the band as a team (or organization), and pop-industry experts commented that only if the band got together again would they be able to return to the success of previous years. In other words, it was the dynamic orchestration of individual skills and knowledge in the organization of the band that created the success. Once apart, their individual capabilities were no longer productive. The solo careers of several of the Spice Girls ended abruptly.

The term dynamic capabilities came into the literature with Teece, Pisano, and Shuen (1990a, 1990b). At that time clear linkages to the resource-based approach were noted. It was put this way:

if control over scarce resources is the source of economic profits, then it follows that such issues as skill acquisition and learning become fundamental strategic issues. It is in this second dimension, encompassing skill acquisition, learning, and capability accumulation that we believe lies the greatest potential for the resource-based perspective to contribute to strategy. We will refer to this as the "dynamic capabilities approach", recognizing of course that it is part of the overall resource-based perspective. (p. 9)

The treatment has subsequently broadened.

In order to position important themes in the dynamic capability framework, we outline below relevant theories that have been important inputs to the development of the dynamic capabilities framework. Our purpose is to show the behavioral foundations of dynamic capabilities, and linkages (and tensions) with evolutionary theorizing in economics.

Relationship to the Behavioral Theory of the Firm

Like most scholarship in economics and organizations, the behavioral theory of the firm wasn't intended to inform the field of strategic management. In fact, while strategic planning was a field of practice, the field of strategic management as we know it today didn't exist until the 1970s or thereabouts (Rumelt *et al.*, 1994, chapter 1).

The behavioral theory of the firm was built around a political conception of organizational goals, a bounded rationality conception of expectations, an adaptive conception of rules and aspirations, and a set of ideas about how the interactions among these factors affect decisions in a firm (Cyert and March, 1963). Whereas goals in economic theory are pictured as given alternatives, each with a set of consequences attached, goals within behavioral theory are pictured as reflecting the demands of political coalitions inside organizations, changing as the composition of that coalition changes. Thus, the theory treats the demands of shareholders, managers, workers, customers, suppliers, and creditors as components of the operational goals of a firm. At the same time, not all goals are salient at all times. Rather, specific goals are evoked by

the presence of coalition members in the decision neighborhood, by the divisional organization of the firm, and by the recognition of particular problems. Aspirations with respect to each dimension of the goals were pictured as changing in response to the experience of the organization and its components as well as the experience of others to whom they compare themselves. Thus, it is the dynamic nature of aspirations which enables the generation of new decision alternatives. Therefore, the firm must engage in active search and imagination to create sustainable strategic opportunities (Winter, 2000). In the behavioral theory of the firm, agents have only limited rationality, meaning that behavior in organizations is intendedly rational; neither emotive nor aimless (March and Simon, 1958). Firms are seen as heterogeneous, boundedly rational entities that have to search for relevant information. Since information is costly, it is generated by search activity. The intensity of search depends on the performance of the organization relative to aspirations and the amount of organizational slack (March and Simon, 1958: 47–52). The direction of search is affected by the location (in the organization) or search activity and the definition of the problem stimulating the activity. Thus, the search activity of the organization furthers both the generation of new alternative strategies, and facilitates the anticipation of uncertain futures.

Decision making in the behavioral theory is seen as taking place in response to a problem, through the use of standard operating procedures and other routines, and also through search for an alternative that is acceptable from the point of view of current aspiration levels for evoked goals. Choice is affected, therefore, by the definition of a problem, by existing rules (which reflect past learning by the organization), by the order in which alternatives are considered (which reflects the location of decision making in the organization and past experience), and by anything that affects aspirations and attention.[2]

Cyert and March (1963) emphasized the uniqueness in firms; organizations and organizational actors differ in terms of their aspirations, their knowledge, and their decisions. In terms of relevance to dynamic capabilities, the most basic contribution of the behav-

ioral theory of the firm is the importance of firm heterogeneity (Teece *et al.*, 2002), and notions of adaptation (although as discussed later dynamic capabilities have an entrepreneurial as well as an adaptive component). Winter (2000) also uses ideas on satisficing and dynamic aspiration levels to suggest an ecological and evolutionary perspective in which learning is a dynamic capability.

Relationship to Transaction Cost Theory

The transactions cost approach is widely accepted as a framework for understanding aspects of economic organization. This perspective sees markets and hierarchies as alternative mechanisms for organizing economic activity. In order to economize on transaction costs, production is frequently required to be organized in firms. Transaction cost economics builds on the assumptions of bounded rationality and opportunism (Williamson, 1975, 1985). Internal organization is likely to be superior to market transactions when specific assets need to be deployed to get the job done.

There is much utility and some explanatory power in the transaction cost framework. However, the contractual scheme upon which it is built deals with existing resources and does not examine how new resources are discovered, how they are accumulated, and how firms learn. Opportunism rather than opportunity is the central focus.

The structure and behavior of the modern business firm cannot be fully explained by appealing to transaction costs alone. The focus for the "main case" in transaction cost economics is governance—that is, how things should be organized. Governance is an important element of management; but good governance alone is unlikely to be sufficient to support sustained competitive advantage. While it is important to make good choices with respect to governance (which in Williamson's definition includes choice of organization boundaries and contractual arrangements), it is of equal—if not greater—importance for management to make the right investment choices, select the right assets to "govern",

and establish the correct business model. Superior organizational capabilities require not just astute initial asset selection; they also require continuous reconfiguration and improvement. The transaction cost framework, by contrast, is primarily about asset or value protection, not value creation.

The way in which governance (choice of firm boundary) issues do come into play in strategic management is well illustrated in Teece (1986a), where there is extensive discussion of complementary assets and whether or not these should be internalized. Deciding whether to "own" or "rent" (i.e. integrate or outsource) complementary assets depends on whether the assets were available in competitive supply. A concern to focus on is the distribution of gains (and losses) between the innovator and the owners of the complementary assets. Williamson also explores appropriability through *ex post* recontracting. However, the appropriability issues of most concern to business managers do not come from a pure form of what Williamson calls "the fundamental transformation". With this transformation, an *ex ante* large numbers bargaining situation is transformed into a small numbers situation after idiosyncratic irreversible investment assets are deployed, and recontracting hazards result. Rather, it is simply that technological innovation changes the demand for certain inputs (resources) and their complements. The entity that can cleverly bargain to obtain a "long" position in those assets on favorable terms will be able to appropriate a greater share of the gains from innovation. Put differently, in Teece (1986a), it is asset selection based on value creation that shapes firm boundary selection issues—not just the minimization of transaction costs.

Williamson (1985) clearly recognizes that even in the world of transaction cost economics, governance costs are not the only costs that are relevant to the firm. "Production costs" are indeed mentioned, but not analyzed deeply. However, much lies hidden within Williamson's "production costs" that economists and management scholars need to understand. They include not just operational issues, but strategic issues too. Some production-related issues are operational—such as the establishment of flexible procurement, enabling the firm to take advantage of changing competitive

pricing—and some highly strategic, such as whether or not to invest in a new plant, or whether to advance a new generation of products now, later, or never. Clearly, the performance of a business is going to be very significantly impacted by production and investment choices, as well as by governance choices. For instance, Langlois (1992) highlights the case of the diesel-electric locomotive, where in the 1920s Charles Kettering had developed advanced lightweight diesel technology at the GM Labs. The earliest use was in submarines. Alfred P. Sloan, GM's Chairman, saw the possibility of applying the technology to make diesel-electric locomotives. (Steam power was, at the time, completely dominant.) GM needed capabilities resident in the locomotive manufacturers, and at Westinghouse Electric. As Langlois notes:

> The three sets of capabilities might have been combined by some kind of contract or joint venture. But the steam manufacturers—Alco, Baldwin, and Lima—failed to cooperate. This was not, however, because they feared hold-up in the face of highly specific assets. Rather, it was because they actively denied the desirability of the diesel and fought its introduction at every step. General Motors was forced to create its own capabilities in locomotive manufacturer. (p. 115)

The (dynamic) capabilities framework indicates that the scope of the business enterprise's activities should not be determined solely by transaction cost considerations. Rather, asset selection (internalization) decisions must also make reference to opportunity and to complementarities and cospecialization—for position reasons, as well as for reasons of scope economies, and also to achieve appropriability of returns from innovation.

The complementarity between transaction cost economics and dynamic capabilities has been recognized by many, including Williamson, Winter, and the author.[3] Williamson notes that transaction cost and internal firm perspectives "deal with partly overlapping phenomenon, often in complementary ways" (1999: 1098). Indeed, the very first empirical study to show the predictive power of asset specificity in setting firm boundaries (Monteverde and Teece, 1982) also showed that even greater predictive power was associated with cospecialization or "systems integration" causing

the author (Teece, 1990) to observe that: "[I]n order to fully develop its capabilities, transaction cost economics must be joined with a theory of knowledge and production" (p. 59; also see Winter, 1988).[4] As a result, scholars began looking elsewhere to develop more robust theories of the firm. In recent years, the role of product architecture in shaping enterprise architecture has been explored (Teece and Pisano, 2007). Behavioral and evolutionary economics has been recognized as another source of useful insights (Winter, 2003). These traditions also address another, and perhaps deeper, feature of transaction cost theory: that it attempts to explain organizational design issues as fundamentally the result of concerns about opportunism and contractual incompleteness. These are certainly important sets of factors. However, thwarting opportunism and getting incentives right are necessary but not sufficient for superior enterprise performance.

Relationship to Evolutionary Theories of the Firm (and Strategy)

The evolutionary theory of the firm goes back to (at least) Alfred Marshall's construction of industry equilibrium. He saw populations of firms in disequilibrium while industry level supply–demand equilibrium was maintained. He frequently used biological analogies.[5] "[F]irms rise and fall", Marshall said, "but the representative firm remains always of the same size" (1925: 367).

Many ideas significant for the development of the evolutionary view were also introduced by Joseph Schumpeter. For instance, although the idea of rules-based or bounded rationality became associated with Simon (1955) and March and Simon (1958) (and then later embedded in Nelson and Winter, 1982), Schumpeter was early to recognize that bounded rationality is necessary for a theory of innovation and dynamics:

> The assumption that conduct is prompt and rational is in all cases a fiction. But it proves to be sufficiently near to reality, if things have time to hammer logic into men. Where this has happened, and within the limits in which it has happened, one may rest content with this fiction and

build theories . . . Outside of these limits our fiction loses its closeness to reality. To cling to it there also as traditional theory does, is to hide an essential thing and to ignore a fact which, in contrast with other deviations of our assumption from reality, is theoretically important and the source of the explanation of phenomena which would not exist without it. (Schumpeter, 1934: 80)

Evolutionary ideas also surfaced during the profit maximization debate in economics involving Fritz Machlup, Milton Friedman (1953), Armen Alchian (1950, 1953) and Edith Penrose (1952, 1953). The debate (concerning, among other things, the role of intentionality in economic selection and the use of a population of heterogeneous firms as a basis for selection) led to the formal evolutionary work by Winter (1964, 1971, 1975).[6] Despite these prominent predecessors, an evolutionary view of the firm wasn't developed until decades later. In what was first intended to be entitled "a Neo Schumpeterian Theory of the Firm", Nelson and Winter (1982) integrated insights from Schumpeter with ideas from Armen Alchain, Friederich Hayek, and Cyert and March (1963). The firm in their view is seen as a profit-seeking entity whose primary activities are to build (through organizational learning processes) and exploit valuable knowledge assets. Firms in this view also come with "routines" or "competencies", which are recurrent patterns of action which may change through search and learning. Routines will seldom be "optimal" and will differ among agents, and behaviors cannot be deduced from simply observing the environmental signals (such as prices) that agents are exposed to. The resultant variety drives the evolutionary process, since firms develop rent-seeking strategies on the basis of their routines and competencies, and competition in the product market constitutes an important part of the selection environment of competing firms.

In order to fully understand these (and related) issues and their implications for theories of the firm and strategic management, scholars have appealed to the idea of firms as knowledge-creating and learning entities. The firm is seen as endogenously helping to generate its productive opportunity set. This line of thought was

developed by Edith Penrose ([1959] 1995) who argued that the firm is a repository of capabilities and knowledge, and that learning is central to firm growth (see Pitelis, 2000, 2006, for a good discussion of Penrose's work). Productive knowledge is often related to other organizational (material) assets.[7] According to Penrose, the firm is "both an administrative organization and a collection of productive resources, both human and material" (p. 320). The services rendered by these resources are the primary inputs into a firm's production processes and are firm specific in the sense that they are a function of the knowledge and experience that the firm has acquired over time. When services that are currently going unused are applied to new lines of business, these services fuel the growth engine of the firm. Learning enables the organization to use its resources more efficiently. As a result, even firms that maintain a constant level of capital may nevertheless be able to grow as services are freed up for new uses as a result of organizational learning.

My paper on the multiproduct firm (Teece, 1980a: 982) was the first to apply Penrose's ideas to strategic management issues. I focused on her observation that human capital in firms is usually not entirely "specialized" and can therefore be (re)deployed to allow the firm's diversification into new products and services. I also recognized Penrose's perspective that firms possess excess resources, which can be used for diversification. Later, Wernerfelt (1984) cited Penrose for "the idea of looking at firms as a broader set of resources . . . [and] the optimal growth of the firm involves a balance between exploitation of existing resources and development of new ones".

Perhaps in part because of her training with the economist Fritz Machlup, Penrose was enlightened enough to see a role in economic theory not only for managers but for entrepreneurs. "A theory of the growth of firms is essentially an examination of the changing productive opportunities of firms . . . " (pp. 31–2). Penrose furthermore saw the business environment as an "image" in the entrepreneur's mind. This is an important insight about entrepreneurship as well as leadership (and the importance of having an entrepreneurial element in leadership). Innovation follows in part

from the ability of the entrepreneur to look at markets, technologies, and business models and sense opportunities that others miss. Being able to see market and technological opportunities through different lenses (and in new ways) is an important entrepreneurial capability.

Penrose also recognized that as managers embrace growth, they are forced to decentralize, thereby shifting responsibility down the hierarchy. "New men are brought in and the existing personnel of the firm all gain further experience"[8] (p. 52). Critically, "many of the productive services created through an increase in knowledge that occurs as a result of experience gained in the operation of the firm as time passes will remain unused if the firm fails to expand" (p. 54). These unused resources aren't manifested in the form of idleness, but "in the concealed form of unused abilities" (p. 54). Penrose therefore saw the capacities of management—not exhaustion of technologically based economies of scale—as setting the limit to which a firm could grow. In her view, there was always a limit to the amount of expansion any firm, no matter how large, could undertake in a given period.[9]

5. *Dynamics Capabilities as a Theory of Entrepreneurial Management*

We now return to the dynamic capabilities perspective which builds on ideas from all of the above traditions. In addition to synthesizing ideas from different theoretical traditions, the dynamic capabilities approach seeks to provide a coherent framework which can both integrate existing conceptual and empirical knowledge, and facilitate prescription. First published in Teece and Pisano (1994) and elaborated in Teece *et al.* (1997),[10] a paper which had circulated for seven years as a working paper (Teece, 1990),[11] the dynamic capabilities approach builds, in particular, upon the theoretical foundations provided by Schumpeter (1934), Penrose ([1959] 1995), Williamson (1975, 1985), Cyert and March (1963), Rumelt (1984), Nelson and Winter (1982), and Teece (1982). In particular, it is consistent with the view that the emergence of new

products and processes results from new combinations of knowledge and that processes of organizational and strategic renewal are essential for the long-term survival of the business firm. Enterprises must also match the exploration of new opportunities with the exploitation of existing ones.

In the dynamic capabilities approach, competitive success arises from the continuous development and reconfiguration of firm-specific assets (Teece and Pisano, 1994; Teece *et al.*, 1997; Teece, 2007). Whereas Penrose and the resource-based scholars recognize the competitive importance of firm-specific capabilities, researchers within the dynamic capabilities paradigm attempt to outline specifically how organizations develop, sustain, and renew internal competencies. The dynamic capabilities approach is concerned with how firms identify opportunities, create new knowledge, disseminate it internally, embed it in new business models and/or new goods and services, and launch new products and services in the market. The framework by its very nature involves understanding both technological and organizational change. Processes are shaped by environmental evolution as well as organizational design—what we might call "Evolution with Design".

The dynamic capability perspective follows Hayek (1945) (and the behavioral and evolutionary theorists) in emphasizing that coordination is an economic problem primarily because of change. In a static environment a short period of "set up" would be required to organize economic activity; but absent change in consumer tastes or technology, economic agents (both traders and managers) would permanently sort out the optimal flows of goods and services (together with methods of production). Thereafter, there would be no need for their services, as matters would be taken care of, once and for all.

Now introduce change. If there were a complete set of forward and contingent claims markets, adjustments in the economic system would occur weekly and risks would be allocated efficiently; even if there were a complete set of futures and contingent claims markets, there is still the need for managers/entrepreneurs to "integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece *et al.*,

1997). Coordinating and adapting effectively to changing environments (Cyert and March, 1963) is an element of a firm's dynamic capabilities. Barnard (1938) and Richardson (1960) were early to hint at these themes, but they did not embellish them far enough, and make innovation and entrepreneurship sufficiently central to their frameworks.

Indeed, Chester Barnard's view of the firm was that it was fundamentally a structure to achieve coordination and adaptation. There is no mention of opportunity identification, or entrepreneurship, or orchestrating new asset combinations. As Williamson (1990) observes, Barnard did not compare the firm to markets in terms of their coordinative or adaptive capabilities. One key difference is that the firm achieves coordination and adaptation with respect to non-traded or thinly traded assets; the market on the other hand enables rapid adaptation with respect to assets which are actively traded in thick markets.

However, dynamic capabilities views the business enterprise as providing much more than "coordination" and "adaptation"; as discussed in Chapter 2, the functions of the (strategic) manager go beyond what Barnard and Williamson have identified. In particular, coordination and adaptation do not convey very well notions such as proactive search, selection, and subsequent implementation of particular courses of action critical to the firm's business strategies. Nor do they convey the importance of asset alignment, opportunity identification, access to critical cospecialized assets, and the interrelationship amongst the various elements of enterprise strategy. These are all critical elements of management's dynamic capabilities, and are important to value creation.

Put another way, in the theory of a private enterprise economy, firms with dynamic capabilities help patch up market "failures".[12] The market "failures" at issue are not only those due to high transaction costs and contractual incompleteness.[13] Rather, they are associated with the nonexistence of certain markets and the need to identify, align, adapt, and coordinate activities and assets (especially complementary assets) in order to create value.

Complementarities frequently exist amongst activities and investments inside the firm, and frequently exist with activities

and investments outside the firm. These complementarities are easy to manage when markets are "thick",[14] as standard purchase and sale agreements or term contracts ought to suffice. But when markets are thin, or nonexistent, alignment cannot necessarily be achieved by market activity. It's the job of the (strategic) manager to decide what investments are to be made and what assets are to be purchased and how complementarities are to be managed and to design the business model that will make all of this work in a value-enhancing way for the customer.

G. B. Richardson (1960) has hinted at many issues that animate the dynamic capabilities framework. He has remarked upon the information problems associated with achieving coordination with investment decisions. However, his focus is on the industry-level coordination of investment. He identified situations where limited information about competitors' investment decisions may impede efficient investment. However, this is not quite the focus with dynamic capabilities. The essential coordination task identified in the dynamic capabilities framework is internal to the firm, though it may well involve strategic alliances with other firms too. A fundamental challenge for management is to figure out how best to employ the firm's existing assets, and how to reconfigure and augment those assets and tie them together in a viable business model to help augment the value proposition being brought to customers.

Needless to say, the proficient achievement of the necessary coordination is by no means assured. Decision-makers need information on changing consumer needs and technology. Such information is not always available; or if it is available, is likely to be incomplete, or highly subjective (Casson, 2000: 119; Simon, 1993a, 1993b). Managers are of course decision-makers and they must collect information, analyze it, synthesize it, and act upon it inside the firm. Situations are dealt with in many ways, sometimes by creating rules which specify how the organization will respond to the observations made (March and Simon, 1958). If this path is chosen, then rules may become codified and routinely applied (Casson, 2000: 129) whenever certain changes are detected.[15]

However, such rules are likely to be periodically revised for the firm to maintain its dynamic capabilities.

In some circumstances, new information and new situations may be best dealt with by forming a new firm (Knight, 1921).[16] Those who discover the new information, and can figure out the appropriate response, need not in theory be the same individual(s) who start a new enterprise; but given the absence of a well-functioning market for information about new market opportunities, the discoverer and the enterprise founder may need to be one and the same.

The coordinating and resource-allocating capabilities performed by management and featured in dynamic capabilities can shape markets, as much as markets shape the enterprise (Chandler, 1990a, 1990b; Teece, 1993; Simon, 1991). Put simply, firms and markets coevolve. Hence, while the need for asset coordination and orchestration and associated investment choices may be the fundamental problem, the firm's dynamic capabilities—particularly its ability to introduce new products and services into the market—not only shape markets; they also require firm-level responses by competitors, suppliers, and sometimes customers.

The emergence/development of new markets for new asset types is thus important for strategic management. Elsewhere (Teece, 1998a, 2000) the emergence of an expanded (and global) set of "thick" intermediate product markets was identified as a major leveler in competition, enabling more specialist firms to compete and provide a limited kind of innovation, called autonomous innovation. There are parts of the value chain which ought to be outsourced when well-functioning intermediate (product) markets exist.[17]

6. *Implications for Future Research on the Firm, the Role of the Manager, and Ecosystems*

Based on the discussion of the intellectual roots and current content of the dynamic capabilities research program, we can outline at

least the following important implications for research on strategic processes and organizational change.

Finding a Place for the Manager in Economic Theory

Ronald Coase was well aware that economists have neglected the role of management in the theory of the firm when he noted that "economists have tended to neglect the main activity of the firm, running a business" (1988: 38). Indeed, there simply is no role for the manager in the economic theory of the firm. Although Williamson claims that the role of management is "significant" in transaction cost economics (1999: 1101), his support for the assertion makes reference to the adaptive properties of organization, and recognition that management can exercise "fiat". This is a beginning, but it is inadequate.

In the dynamic capabilities framework, management plays distinctive roles in sensing opportunities, making investment choices, in orchestrating nontradable assets into combinations that yield economies of scope, and in bringing about continuous organizational renewal. This is a more robust role for management than transaction cost economics has so far afforded.

But whatever differences may exist between transaction cost economics and dynamic capabilities with respect to the role of the manager, they pale next to economic models of the neoclassical firm where managers and the management function have essentially been blotted out.[18] As Baumol puts it:

> Obviously, the entrepreneur has been read out of the model. There is no room for enterprise or initiative. The management group becomes a passive calculator that reacts mechanically to changes imposed on it by fortuitous external developments over which it does not exert, and does not even attempt to exert, any influence. One hears of no clever ruses, ingenious schemes, brilliant innovations, of no charisma or of any of the other stuff of which outstanding entrepreneurship is made; one does not hear of them because there is no way in which they can fit into the model. (Baumol, 1968: 67)

Teece and Winter (1984) likewise observed that entrepreneurship had been suppressed in the theory of the firm. Serious questions are raised with respect to the value of neoclassical models in management theory, management education, and, by implication, management practice.[19]

Developing the Behavioral Foundations of Dynamic Capabilities

Williamson is clear with respect to the behavioral assumptions of transaction cost theory. They are bounded rationality and opportunism (1985). The dynamic capabilities framework has broader behavioral foundations than transaction cost theory (leading to a more integrative and interdisciplinary framework). It shares an emphasis on limited rationality; but we would argue that we need a richer notion of human behavior that invites analysis of economic organization not just in terms of opportunism and incentives—but also involves issues of organizational identification, loyalty, and even culture.

The modern business organization is a complex entity; and understanding and improving its performance requires more than good incentive design. It involves creating internal organizational systems that support the creation of organizational identification and loyalty. As Simon noted: "It requires organizational identification, as well as sticks and carrots, to direct behavior towards achieving organizational objectives, and in highly effective organizations, the former plays the dominant role. To state the matter in classical terms, if members of organizations are maximizing their utilities, the organizational goals must constitute major parts of their utility functions" (1947: 201).

The mechanisms of organizational identification aren't just motivational. If organizational identification is strong, it can counteract opportunistic behavior. Simon (2002) has suggested that relatively decentralized and "decomposed" organizational structures are better mechanisms of identification (Simon, 2002). Dynamic capabilities recognize that organization identification is important to the efficient and effective functioning of business organizations.

Entrepreneurial Management

Entrepreneurial management also plays a critical role in the dynamic capabilities framework. If, as Winter (2003) and others suggest, dynamic capabilities are defined mainly around high-level routines, perhaps the role of (strategic) management is reduced and relegated to selecting new routines. Certainly, if innovation were to ever become a routine in the business enterprise, then the manager/intrapreneur has a modest role to play after the routines are in place. The dynamic capabilities framework indicates a bigger role because it also references asset selection and asset orchestration as a critical organizational capability.

In an economic system, principals and/or their agents must design and implement processes to manage change, must direct the reinvestment of cash flow, and must configure asset portfolios, including allocating resources between exploitation and exploration (March, 1991, 1994). They must also stand ready to reconfigure asset portfolios and organizational systems as circumstances change. In a strict evolutionary view of the world, there is no specific agent and no hierarchy responsible for regulating the evolutionary process (Cohendet *et al.*, 2000).

However, except in a pure ecological view of organizations, there is room for value to be added by the managerial and entrepreneurial functions. The manager/entrepreneur need not be an individual; in the modern corporation it is a function. As Schumpeter (1949) noted: "The entrepreneurial function may be and often is filled cooperatively—in many cases, therefore, it is difficult or even impossible to name an individual that acts as 'the entrepreneur' (pp. 71–2).

The manager/entrepreneur must articulate goals, help evaluate opportunities, set culture, build trust, and play a critical role in the key strategic decisions. Clearly the role of the entrepreneur and the manager overlap to a considerable extent. Sometimes they are one and the same. As Simon (1991) recognized:

> Especially in the case of new or expanding firms, the entrepreneur does not face an abstract capital market. He or she exerts much effort to induce potential investors to share the company's views (often optimistic) about

its prospects. This executive is much closer to Schumpeter's entrepreneur than to the entrepreneur of current neoclassical theory. Whether the firm expands or contracts is determined not just by how its customers respond to it, but by how insightful, sanguine and energetic its owners and managers are about its opportunities. (p. 31)

The manager/entrepreneur plays a key role in asset selection and the "coordination" of economic activity, particularly when complementary assets must be assembled. The manager/entrepreneur can bargain and negotiate and buy or sell or swap investments/assets, orchestrate internal assets (intrapreneurship), and transact with the owners of external assets (entrepreneurship). He is likely to have strong skills in working out new "business models" which define the architecture of new businesses (Chesbrough and Rosenbloom, 2002). The astute performance of this function will help achieve what Porter (1996) calls "strategic fit", not just with internally controlled assets, but with the assets of alliance partners.[20] The manager/entrepreneur can also shape learning processes with the firm. These are not functions which can be achieved by markets divorced from managers/entrepreneurs.

Thus the entrepreneur/manager in the dynamic capabilities framework is in part Schumpeterian (the entrepreneur introduces novelty and seeks new combinations) and in part evolutionary (the entrepreneur endeavors to promote and shape learning). Whether intrapreneur or entrepreneur, they sense new opportunities and lead the organization forward to seize them. The entrepreneur/manager must therefore lead. These are roles not recognized by economic theory; but these roles are the essence of dynamic capabilities and are critical to the theory of strategic management.

7. Strategy as Evolution with Design

In 1978, Ronald Coase wrote in a comment in the *American Economic Review*: "The IQ of Natural Selection is zero. The IQ of businessmen and politicians may not be too high but it is not zero." While Coase was referring to the debate about the role of natural section versus intentionality in the theory of the firm that had

taken place for decades, his statement captures what we refer to as "evolution with design": strategy processes are evolutionary by nature, but they involve significant elements of intentional design and orchestration of assets by managers.

Edith Penrose's work is remarkably consistent with many of the core insights in the dynamic capabilities framework; and with Coase's insight too. In her contributions to the debate about biological analogies, she expressed distaste for adaptations of biological reasoning without also recognizing the key differences between biological and firm evolution. As she put it:

> The purpose of analogical reasoning in which we consciously and systematically apply the explanation of one series of events to another very different series of events is to help us better to understand the nature of the latter, which presumably is less well understood than the former. If the analogy has really helpful explanatory value, there must be some reason for believing that the two series of events have enough in common for the explanation of one, mutatis mutandis, to provide at least partial explanation for the other. (1952: 807)

Penrose worried that biological analogies abstracted from intentionality and that observed evolution was not blind evolution. Neglecting intentionality meant (according to Penrose) that the analogy between innovations and mutations breaks down since mutations in biology are not correlated with the environment. Mutation in biology is not explained. Yet, in economics one can relate innovative activity to profit-seeking behavior (Penrose, 1952: 815). As she noted:

> But mutations are "alterations in the substance of the hereditary constitution" of an organism, while innovations, though they may consist of changes in the constitution of firms, more often than not are directly related to the environment of firms whereas the biologists tell us that genetic mutations are apparently completely unrelated either to the environment or to the agent inducing the mutation. The biologist cannot explain why motivations take the course they do while the economist, if he can assume with some justification that the activity of firms is induced by a desire for profits, has a plausible partial explanation of innovation.

Several decades of research on organizational and strategic change and capabilities have brought a shifting focus to fundamental issues in strategy. Not only has economics, management, and strategy become enriched with ideas from other fields, but also concepts such as routines, competencies, capabilities, and learning rose from neglected subfields to attain near parity with old concepts of organization and management theory. Ideas on competences and capabilities have begun to emerge as viable complements not only of neoclassical economics, but also of much of transaction cost theory (Dosi, 2004). Most of this new discussion takes place within the analytical framework of evolutionary and behavioral theory, broadly speaking. In this chapter we have tried to emphasize some of the roots of branches of this research agenda, focusing in particular on dynamic capabilities. It is an integrative and interdisciplinary framework designed to accommodate ideas from transaction cost theory as well as evolutionary theory in order to develop an empirically relevant theory of strategy that sees strategic processes as involving *evolution with design*.

Such a framework invites attention to entrepreneurship, organizational learning, and the role of the manager/leader of the firm. The dynamic capability view sees the firm as an incubator and repository for difficult to replicate technological and organizational assets. Distinctive processes support the creation, protection, and augmentation of firm-specific assets and competences; all vital elements in the strategic renewal process. These assets and competences reflect both individual skills and experiences as well as distinctive ways of doing things inside firms. To the extent that such assets and competences are difficult to imitate and are effectively deployed and redeployed in the marketplace (reflecting dynamic capabilities), they can provide the foundations for competitive advantage.

The dynamic capability perspective is still developing. It offers an integrative framework and perspective in which several theoretical traditions are combined. Understanding and utilizing ideas from different traditions—transaction cost theory, evolutionary economics, and behavioral theory—provides a unique intellectual platform. Such an integrative approach is also consistent with

March's call for using both exploration and exploitation in organizational processes. As he said:

> [Organizations as well as theories] that engage in exploration to the exclusion of exploitation are likely to find that they suffer the costs of experimentation without gaining many of its benefits. They exhibit too many undeveloped new ideas and too little distinctive competence. Conversely [organizations and theories] that engage in exploitation to the exclusion of exploration are likely to find themselves trapped in suboptimal stable equilibria. As a result, maintaining an appropriate balance between exploration and exploitation is a primary factor in . . . survival and prosperity. (1991: 71)

8. Conclusion

The dynamic capabilities approach was intended from the beginning to be a framework to integrate ideas around flexibility, adaptability, integration, reconfiguration, etc. Increasing focus on the role of knowledge assets, new technology, etc. has spurred attention to organizational change and how environments and histories of business firms shape organizational forms, practices, and competencies. As a result, the dynamic capability perspective seeks to explore how changes in the world are likely to result in changes in business firms, and how organizations can shape their environments and improve their capabilities.

The future relevance of competences and capabilities within strategic management will depend on whether developments in the field will bring us closer to an empirically relevant paradigm. This in turn will depend on the ability of the scholars within strategic management to work together and for the research program to accommodate an interdisciplinary vision, and to be disciplined. Such an (interdisciplinary, yet disciplined) vision is the first step toward realizing a coherent research program in strategic management; and we see the dynamic capability framework as taking a small step toward establishing a coherent and rigorous (as well as empirically relevant) research program in strategic management. By integrating ideas from other traditions, the dynamic capability

framework sets a challenging research agenda for future studies in strategic management.

Notes

1. See Rumelt *et al.* (1994) for a brief history of the field.
2. Within this framework, four concepts were developed. The first is the quasi-resolution of conflict, the idea that firms function with considerable latent conflict of interests but do not necessarily resolve that conflict explicitly. The second is uncertainty avoidance. Although firms try to anticipate an unpredictable future insofar as they can, they also try to restructure their worlds in order to minimize their dependence on anticipation of the highly uncertain future. The third concept is problemistic search, the idea that search within a firm is stimulated primarily by problems and directed to solving those problems. The fourth concept is organizational learning. The theory assumes that firms learn from their own experiences and the experiences of others.
3. For other relevant and informative—although perhaps a bit more skeptical—discussions of the complementarity between transaction cost theory and capability ideas, see Dosi and Marengo, 2000; Dosi, 2004.
4. Various studies have now shown that competences/cospecialization also play a role in the make or buy decision (Walker and Weber, 1984; Jacobides and Hitt, 2001).
5. As Marshall explains in his *Principles*: "we may read a lesson from the young trees in the forest as they struggle upwards through the benumbing shade of their older rivals. Many succumb on the way, and a few only survive; those few become stronger with every year, they get a larger share of light and air with every increase of their height, and at last in their turn they tower above their neighbors. One tree will last longer in full vigor and attain a greater size than another; but sooner or later age tells on them all. And as with the growth of trees, so was it with the growth of business as a general rule before the great recent development of vast joint-stock companies, which often stagnate, but do not readily die" (Marshall, 1925: 315–16). For excellent discussions of Marshall's evolutionary ideas, see the work of Brian Loasby (1976, 1989).
6. In contrast to the position of Friedman and others, evolutionary theory emphasizes that selection does *not* always lead to efficient outcomes

because firms operate in a context or environment of other firms. "In fact", Nelson and Winter writes, "there is good reason to expect the opposite, since selection forces may be expected to be 'sensible' and to trade off maladaptation under unusual or unencountered conditions to achieve good adaptations to conditions frequently encountered. In a context of progressive change, therefore, one should not expect to observe ideal adaptation to current conditions by the products of evolutionary change" (1982: 154).

7. As Penrose writes: "For physical resources the range of services inherent in any given resource depends on the physical characteristics of the resource, and it is probably safe to assume that at any given time the known productive services inherent in a resource do not exhaust the full potential of the resource . . . The possibilities of using services change with changes in knowledge . . . there is a close connection between the type of knowledge possessed by the personnel in the firm and the services obtainable from its material resources" ([1959] 1995: 76).
8. This has subsequently come to be known as the "Penrose Effect".
9. In her own words, describing the limits of growth as being generated by the same dynamics underlying the growth process itself: "[B]ecause the very nature of a firm as an administrative and planning organization requires that the existing responsible officials of the firm at least know and approve, even if they do not in detail control, all aspects of the plans and operations of the firm . . . the capacities of the existing managerial personnel of the firm necessarily set a limit to the expansion of that firm in any given period of time, for it is self-evident that such management cannot be hired in the market place" (p. 45).
10. According to *Science Watch* (Thompson Scientific Essential Science Indicators), this is the most cited paper in economics and business for the decade 1995–2005.
11. This explains why references to dynamic capabilities began before the publication of this paper. In the early to mid 1990s, the working paper versions were quoted. See for instance Mahoney and Pandian (1992). The most recent elaborations of this framework are in the author's "Explicably Dynamic Capabilities" forthcoming *Strategic Management Journal*, 2007.
12. The use of the term "market failure" is only relative to the theoretical norm of absolute static and dynamic efficiency. Of course, a (private) enterprise economic system as a whole achieves an efficient allocation

of resources, as strategic managers and the organization they lead are an inherent part of the economic system. However, the framework does highlight the fact that management systems and corporate governance must function well for a private enterprise market-oriented system to function well.

13. To the extent that transaction costs are relevant, it is of the dynamic variety (see Langlois, 1992).
14. By "thick", we mean that transactions in the market for an asset are frequent, and so liquidity is present.
15. Casson argues that rule making is entrepreneurial, but that rule implementation is routine, and is characterized by managerial and administrative work.
16. Frank Knight was (probably) the first to argue for a distinct entrepreneurial theory of the firm (Langlois and Cosgel, 1993). In particular, Knight thought of entrepreneurs as possessing different judgments (and different capacities for judgments) and acting upon (and profiting from) genuine uncertainty and unpredictability: "[I]t is true uncertainty which by preventing the theoretically perfect outworking of the tendencies of competition gives the characteristic form of 'enterprise' to economic organization as a whole and accounts for the peculiar income of the entrepreneur" (Knight, 1921: 232).
17. The creation of intermediate markets is not readily explained by asset-specificity concerns, as implied by transaction cost economics. The absence of standards, or simply the decisions by incumbent firms to size production so as to avoid the need to sell intermediate products, are possible explanations for the enigma of markets for intermediate inputs.
18. Consider the nature of the model of the firm. In its simplest form, the theoretical firm must choose among alternative values for a small number of well-defined variables: price, output, perhaps advertising outlay. In making this choice, management is taken to consider the costs and revenues associated with each candidate set of values, as described by the relevant functional relationships, equations, and inequalities. Explicitly or implicitly the firm is then taken to perform a mathematical calculation which yields optimal (i.e. profit-maximizing) values for all of its decision variables and it is these values which the theory assumes to be chosen—which are taken to constitute the business decision. There matters rest, forever or until exogenous forces lead to an autonomous change in the environment. Until there is such

a shift in one of the relationships that define the problem, the firm is taken to replicate precisely its previous decisions, day after day, year after year.

19. In Edith Penrose's work, the reason for firms' existence and expansion is not the same as with Coase (1937). She does not formulate the problem by assuming that "in the beginning there were markets". Her perspective is more in keeping with Simon's (1991) perspective that "in the beginning there were firms"; entrepreneurs create new markets by starting entrepreneurial organizations because the relevant external capabilities simply aren't there (cf. Langlois, 1992).
20. As Porter (1996) notes, "[S]trategic fit among many activities is fundamental not only to competitive advantage but also to sustainability of that advantage. It is harder for a rival to match an array of interlocked activities than it is merely to imitate a particular sales force approach, match a process technology, or replicate a set of product features" (p. 73). [And] "when activities complement each other, rivals will get very little benefit from imitation unless they successfully match the whole system—frequent shifts in positioning are costly—strategy is creating a fit among a company's activities. The success of strategy depends on doing many things well—not just a few in an integrating among them. If there is not fit among activities, there is not distinctive strategy and little sustainability" (p. 77).

Chapter 4

Resources, Capabilities, and Penrose Effects

(with Mie Augier)

This chapter expands Chapter 3's descriptions of the intellectual roots of the dynamic capabilities framework. In particular, it explores the special contribution of Edith Penrose's work which led to the resource-based theory of the firm.

Edith Penrose's legacy is a curious one. Much cited, but little read, her work is recognized as one of the main intellectual foundations for modern resource-based theories of business strategy and theories of organizational routines and capabilities.

However, Penrose did not aim to contribute to the field of strategy; her goal was to advance understanding of the nature of the firm and its growth. Nevertheless, there are important insights in Penrose's work that have implications for international business and for strategy. This chapter summarizes and assesses those contributions.

1. Introduction

Edith Penrose's many and varied contributions to business studies deserve recognition. In her later years, she focused on the oil industry and on multinational enterprises (MNEs).[1] In this chapter, we note some of her earlier contributions which helped initiate important streams of research, including the resource-based theory of the firm. Her influence has also extended to new streams of research on dynamic capabilities and entrepreneurship. We discuss some implications for MNEs of the dynamic capabilities framework.

In her most important scholarly journey, Edith Penrose set out to develop a theory of the growth of the firm. Indeed, this was the title of her now well-known ([1959] 1995) treatise.[2] Along the way she made several other astute observations about firms that turned out to be provocative to scholars interested in the theory of the firm and business strategy. It is these observations—particularly the notion that the firm is best thought of as a bundle of resources—which now constitute her better-known legacy.

2. The Resource-Based Theory of the Firm

Penrose defined the internal resources of the firm as "the productive services available to a firm from its own resources, particularly the productive services available from management with experience within the firm" (p. 5). She presents the firm as an "autonomous administrative planning unit, the activities of which are interrelated and are coordinated" by management (pp. 15 ff.). "A firm is more than an administrative unit; it is a collection of productive resources the disposal of which between uses and over time is determined by administrative decision—the physical resources of the firm consist of tangible things—there are also human resources available in a firm—strictly speaking, it is never resources themselves that are the 'inputs' in the productive process, but only the services that they render" (pp. 24 ff.).

Put succinctly, Edith Penrose saw the firm as a "pool of resources the utilization of which is organized in an administrative

framework. In a sense, the final products being produced by a firm at any given time merely represent one of several ways in which the firm could be using its resources" (pp. 149 ff.).

As with the dynamic capabilities approach (which we shall discuss again later), Penrose was enlightened enough to see a role in economic theory not only for managers but for entrepreneurs. "A theory of the growth of firms is essentially an examination of the changing productive opportunities of firms . . ." (pp. 31 ff.). Penrose furthermore saw the business environment as an "image" in the entrepreneur's mind. This is an important insight about entrepreneurship as well as leadership (and the importance of having an entrepreneurial element in leadership). Innovation is very much about the ability of the entrepreneur to look at markets, technologies and business models and to interpret them "differently". Being able to see market and technological opportunities through different lenses (and in new ways) is an important entrepreneurial capability. It enables one to see opportunities that others might miss.

Penrose also recognized that as managers embrace growth, they are forced to decentralize, thereby shifting responsibility down the hierarchy. "New men are brought in and the existing personnel of the firm all gain further experience" (p. 52).[3] Critically, "many of the productive services created through an increase in knowledge that occurs as a result of experience gained in the operation of the firm as time passes will remain unused if the firm fails to expand" (p. 54). These unused resources aren't manifested in the form of idleness, but "in the concealed form of unused abilities" (p. 54). Penrose therefore saw the capacities of management—not exhaustion of technologically based economies of scale—as setting the limit to which a firm could grow. In her view, there was always a limit to the amount of expansion any firm, no matter how large, could undertake in a given period.[4]

It was the unused capacities of management, coupled with the tangibility of certain resources, which also enabled diversification in the Penrosian firm. Industrial R&D could assist by drawing firms into entirely new areas, particularly if the firm focused on more generic R&D activities. Sales and marketing relationships

could also be leveraged to support the roll out of new products (pp. 116 ff.).

Edith Penrose's ideas influenced the work of the author (Teece, 1980a, 1982) on diversification. In particular, the author (Teece, 1982) built on Penrose's observation that "[o]f all outstanding characteristics of business firms, perhaps the most inadequately treated in economic analysis is the diversification of their activities" (Penrose, [1959], 1995: 104) in outlining a theory of the multi-product firm. This in turn alerted the strategy field to her work on resources, impacting Wernerfelt (1984) and others. But it wasn't so much her claim that managers learn and develop unused capacities that has received the most attention in recent years.[5] Rather, it was her representation of the firm as a pool of resources that has caught the imagination of scholars in the field of business strategy.

However, what Penrose precisely meant by resources remains rather vague.[6] Moreover, the Penrosian view that growth is fueled primarily by underutilized managerial capabilities can be challenged.[7] In particular, enterprise growth can be attributed to market and technological factors as well as to the strong financial rewards that both managers and shareholders receive as the business enterprise grows. Growth also flows from investment in R&D, as pointed out by several business historians and economists.[8]

From the perspective of modern (strategic) management, a missing dimension in Penrose is an understanding of the basis for competitive advantage. Penrose implicitly adopts a profit-seeking framework; but other than a very general discussion of the competitive strength of small and large firms, she does not address the question of how firms develop competitive advantage. While she does recognize the importance of managerial skills, she underplays the role of intangible assets, though they are mentioned.[9] In this sense, she is not "modern"; but she was ahead of her time in many ways, not least of which is that she did recognize the importance of the entrepreneurial activities of management. However, this was only mentioned in passing, along with the importance of managerial action in sensing and seizing emerging opportunities and managing threats.

The importance of knowledge assets is also underplayed. This ought not be surprising since the world Penrose was observing was one in which there were still significant barriers to trade and investment, and in such environments know-how is less critical as a factor in determining competitive advantage (Teece, 2000, chapter 1). Outsourcing and offshoring debates were not center stage in the early postwar economy which was her laboratory.

Nevertheless, the Penrosian conceptualization of the firm remains relevant. Her insights remain good starting points for developing a theory of the firm, and for understanding the role of the manager. Her perspective is compatible with the recent emphasis on the importance of routines and processes. Routines and processes can be thought of as providing underutilized capacity that management can leverage for growth.

3. Penrose and the Theory of Dynamic Capabilities

As noted, and with the benefit of hindsight, Penrose appears to have underplayed growth driven by the entrepreneurial elements of management. She seems to recognize that know-how can be used to convert physical assets to different uses.[10] The firm, she said, was "both an administrative organization and a collection of productive resources, both human and material" (p. 320). The services rendered by these resources are the primary inputs into a firm's production processes and are firm specific in the sense that they are a function of the knowledge and experience that the firm has acquired over time. This is in essence a recognition of the path-dependent nature of organizational processes and routines and their roles in carrying knowledge (later emphasized by Cyert and March, 1963, and Nelson and Winter, 1982).[11]

When services that are currently going unused are applied to new lines of business, these services can also function as a growth engine for the firm through diversification (Teece, 1980a, 1982). Learning likewise enables the organization to use its resources more efficiently. As a result, even firms that have weak balance sheets may nevertheless be able to grow as managerial capacity is

freed up for new uses as a result of managerial and organizational learning.[12] Penrose appears to be articulating a weak form of what is now referred to as the dynamic capabilities approach.

The dynamic capabilities approach seeks to provide a coherent (and evolutionary) framework for how firms develop competitive advantage, and maintain it over time. In essence, dynamic capabilities are about identifying the foundations that undergird long-run enterprise growth and prosperity. First outlined in working papers by Teece, Pisano, and Shuen (1990a and 1990b), and then published in Teece and Pisano (1994) and in Teece, Pisano, and Shuen (1997),[13] the dynamic capabilities approach builds upon the theoretical foundations provided by Schumpeter (1934), Williamson (1975, 1985), Cyert and March (1963), Rumelt (1984), Nelson and Winter (1982), Teece (1982), and Teece and Pisano (1994). As discussed above, it is consistent with certain elements of Penrose's framework too. If one can explain the foundations of long-run profitability, one is quite some distance down the road to a theory of the growth of the enterprise. This was of course Penrose's ambition.

Dynamic capabilities refer to the (inimitable) capacity firms have to shape, reshape, configure, and reconfigure the firm's asset base so as to respond to changing technologies and markets. Dynamic capabilities relate to the firm's ability to proactively adapt in order to generate and exploit internal and external *firm-specific competences*, and to address the firm's changing environment (Teece *et al.*, 1997). As Collis (1994) and Winter (2003) note, one element of dynamic capabilities is that they govern the rate of change of ordinary capabilities.[14] If a firm possesses resources/competences but lacks dynamic capabilities, it has a chance to make a competitive return for a short period, but superior returns cannot be sustained. It may earn Ricardian (quasi-)rents, but such quasi-rents will be competed away, often rather quickly. It cannot earn Schumpeterian rents because it hasn't built the capacity to be continually innovative. Nor is it likely to be able to earn monopoly (Porterian) rents since these require market power coupled with exclusive behavior or strategic manipulation (Teece *et al.*, 1997). Dynamic capabilities thus not only include an organization's (nonimitable)

ability to sense changing customer needs, technological opportunities, and competitive developments, but also its ability to adapt to—and possibly even to shape—the business environment in a timely and efficient manner. A significant element of intentionality is involved.

The development and astute management of intangible assets/intellectual capital is now central to sustained enterprise competitiveness, requiring new conceptual frameworks for business and economic analysis. As former US Federal Reserve Chairman Alan Greenspan remarked, "we must begin the important work of developing a framework capable of analyzing the growth of an economy increasingly dominated by conceptual products".[15] Dynamic capability theory is a framework that is well equipped to meet this challenge (Teece, 2006a).

Penrose's framework is consistent with elements of the dynamic capabilities framework. Her emphasis on the fungible nature of resources obviously provides scope for the notion that a firm's competencies can be reshaped. But as noted, her framework was bereft of considerations of competitive advantage.[16] The whole inimitability story is missing.[17] Nor did she emphasize the role of the changing environment and the constant need to improve and renew capabilities. She saw learning as an opportunity, not a necessity. She also underplayed the resource allocation role of management. She recognized the importance of entrepreneurship but did not develop this concept much nor did she show how entrepreneurship could be important to the erection of new markets.

4. Other Growth Issues and the Penrose Effect

We have emphasized Penrose's contribution to the resource-based theory of the firm. Some of her ideas are consistent with the dynamic capabilities framework; yet until two decades ago when strategy scholars picked up on this work (Teece, 1982), Penrose's emphasis on fungible resources had not received much attention in either the economics or the strategic management literature. Rather, it was her work on constraints on firm-level growth and on

the role of learning that received attention. While she recognized how the fungible nature of a firm's resources could create the foundation for lateral enterprise expansion, it was her emphasis on the administrative and managerial constraints on growth that captured the attention of scholars.

Penrose argued that the human resources required for firm growth and the management of change are firm specific. As a corollary, at any moment in time these resources are constrained by their internal availability. Put differently, managerial capacity cannot be expanded indefinitely and at will. Rather, expansion requires the recruitment and development of additional high-level human resources.[18] Accordingly, the level of current efficiency will, beyond a point, diminish with the rate of change in size.

The above constraints on firm growth became known as the "Penrose effect". Both microeconomic and macroeconomic scholars recognized the Penrose effect in the 1960s. These scholars incorporated Penrosian thinking into their work (e.g. Marris, 1964; Uzawa, 1969). However, as noted above, we think the more enduring legacy will be Penrose's conceptualization of the firm as a bundle of (quasi-fungible) resources.

Interestingly, the *Economic Journal* (1961) predicted that the "Theory of the Growth of the Firm" would be an influential book; however, that influence has been far greater in the field of strategy than in the field of economics. Economists in the main are resistant to her teachings, as they imply the total inadequacy of the neoclassical theory of the firm.[19]

5. *Entrepreneurship, Enterprise Design, and the Role of Markets*

As implicitly recognized by Penrose, firms need to be viewed as human organizations, not computer-controlled machines. As such, firms must confront challenges in the realm of organizational design including imperfect incentive alignment, imperfect governance, and bureaucratic decision-making. Organizations facilitate

decisions because they constrain the set of alternatives as well as the relevant parameters to be considered. Organizations can be rendered more effective and efficient by improving the ways in which those limits are defined and imposed (Simon, 1947; March and Simon, 1958).

While Penrose may have recognized the human element in organizations, she did not really explore issues of organizational *design*. As noted by Herbert Simon, "[d]esign calls for initiative, focus of attention on major problems, search for alternatives. One cannot choose the best, one cannot even satisfice, until one has alternatives to choose from." Nowhere is this clearer than in the *entrepreneurial* activities of organizations. As Simon has observed:

> Especially in the case of new or expanding firms, the entrepreneur does not face an abstract capital market. He or she exerts much effort to induce potential investors to share the company's views (often optimistic) about its prospects. This executive is much closer to Schumpeter's entrepreneur [and to the Penrosian manager] than to the entrepreneur of current neoclassical theory. Whether the firm expands or contracts is determined not just by how its customers respond to it, but by how insightful, sanguine and energetic its owners and managers are about its opportunities—by how much they possess of the "animal spirits" that Keynes was obliged to introduce into his account of the trade cycle (Nelson/Winter 1982). (1991: 35 ff.)

These factors go beyond the managerial elements highlighted by Penrose. Arguably, they are more important.

One example of the importance of design is in the development of the "architecture" of a business firm. This element of design is embedded in part in management's choice of (or creation of) a business model. A business model defines the manner in which a business enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit. It reflects the firm-specific assumptions about what customers want and how an enterprise can be profitable as a result of the value delivered. The business model determines: (1) how the revenue and cost structure of business is to be "designed" and then possibly "redesigned" to meet customer needs; (2) the ways in which the resources are to

be assembled and the relevant market segments can be identified; (3) the mechanisms through which value can be created and captured. The purpose of a business model is to "articulate" the value proposition, identify targeted market segments, define the structure of the value chain, and estimate the cost structure and profit potential (Chesbrough and Rosenbloom, 2002: 533 ff.). In short, a business model is a plan for the financial and organizational "architecture" of a business that makes valid assumptions about costs, scale, and customer and competitor behavior. It outlines the contours of the solution required to win in the marketplace. Getting the business model right is critical to the success of a new business; adjusting and/or improving the model is likely to be critical for continued success. However, the importance of "business models" has been largely neglected in the management and economics literature, at least until recently. A firm's capacity to create, adjust, hone, and replace business models is a critical building block of this firm's dynamic capabilities.

Design issues are also important when considering the *changing nature and dynamics* of international business. In recent decades, increased globalization, and in particular outsourcing and offshoring, appear to have gained momentum. However, while globalization has expanded, it is by no means "complete". Precisely because cross-border integration is incomplete (i.e. the world is characterized by semi-globalization) the study of international business and multinational enterprise remains an important scholarly activity.[20] Otherwise, mainstream strategy and management content would suffice for international business too. Because of incomplete integration and differences in business environments, locational factors and institutional differences must be taken into account. Such differences do not merely indicate the presence of barriers to the internationalization of business; they can also be beneficial to MNEs.

In recent decades, the MNE has been shaped by three key developments critical to its nature and scope: (i) the simultaneous increase in both the outsourcing and the offshoring of production, (ii) the emergence of a distributed and open innovation model, that is, not only are production and manufacturing being

outsourced, but so is innovation, and (iii) the development of low-cost information and computer technology, which enables small firms to perform transactions, and adopt business models, previously only available to large enterprises. For instance, Internet-based companies such as Amazon, eBay, Google, and Yahoo make it possible for small businesses to reach global markets that were previously inaccessible, except at considerable cost. This has led to the emergence of what might be thought of as "mini"-multinationals, sometimes employing only a handful of workers, and using Internet-based technology to anchor the coordination of their global activities. In short, information and computer technology has enabled efficient global operations for very small as well as small, medium, and large enterprises. Small enterprises in particular may be launched from multiple jurisdictions—rendering the home/host country dichotomy irrelevant from the time of organizational founding. Also, these mini-multinationals are often founded by individuals collaborating across boundaries, and they exhibit MNE characteristics from their birth. Designing and orchestrating the business model and organizational structure of such firms has become increasingly complex. In the realm of the external environment, markets for such expanding firms must be "seized" and, sometimes, created.

Although Penrose did recognize the importance of creating markets as a result of entrepreneurship, she did not address the *simultaneous* role of entrepreneurs in creating markets and designing organizations.[21] An essential characteristic of organizations/firms is that they embody knowledge which can't easily be bought and sold. Sometimes, the only way to capitalize on knowledge is to start a firm and build the necessary complementary assets (Teece, 1986a).[22] Profit flows from innovation, buttressed by the development of complementary technologies, and the astute deployment of complementary assets.

Penrose's work differs from Coase's (1937), in terms of the rationale for the firm's existence and expansion. She does not assume that "in the beginning there were markets". Her perspective is more in keeping with Simon's (1991) perspective that "in the beginning there were firms"; entrepreneurs create new markets by starting

entrepreneurial organizations because the relevant external capabilities simply aren't there (cf. Langlois, 1992).[23]

Penrose emphasized entrepreneurial imagination and the nonmarket nature of entrepreneurial knowledge. She noted that it is: "evident that such management [entrepreneurship] cannot be hired in the market place" (p. 45). A few decades earlier Frank Knight (1921) perceptively linked the existence of firms to entrepreneurs seizing opportunities for profit in the face of uncertainty: "It is . . . true uncertainty which . . . gives the characteristic form of 'enterprise' to economic organization as a whole and accounts for the peculiar income of the entrepreneur" (1921: 232).[24]

Her vision of entrepreneurship is very close to that of Frank Knight. She emphasized entrepreneurship as explicitly an organizational phenomenon: "The productive activities of . . . a firm are governed by what we shall call its 'productive opportunity', which comprises all of the productive possibilities that its 'entrepreneurs' can see and take advantage of" (p. 31). Entrepreneurs have "intimate knowledge of the resources, structure, history, operations and personnel of the firm" (p. 54).

There are other ideas in strategic management that were not directly anticipated by Penrose, perhaps in part because she did not self-consciously endeavor to provide normative frameworks for managers. Hence, her neglect of certain issues now considered important to the field of management today should not be construed as a criticism, but merely as an observation. One such example is the idea that markets need to be developed. It is common in economics to assume that markets exist. As Arrow (1974) observed: "Although we are not usually explicit about it, we really postulate that when a market could be created, it would be." If it is not, this reflects market failure, and such failure can in turn be attributed to "transaction costs" or "adverse selection". The absence of certain insurance markets is a typical example. As a general rule, economics suggests that markets fail because inputs or outputs are not priced properly. For example, gasoline that pollutes is consumed "too much" because the costs of using it are not fully internalized. Arrow (1962) and Arrow and Debreu (1954) do discuss the absence of fully developed contingent claims

markets, but in the main such lacunae are explained by the absence of demand, or just simply transaction costs.

Moreover, in commercializing new technologies, pioneering entrepreneurs often find that formal market research and expert forecasts, however sophisticated from a methodological perspective, fail to predict which new markets will come into existence, and where and when these markets will actually materialize. Christensen (1997), Mintzberg (1994) and others have documented a wide variety of cases that illustrate this unpredictability in business. Human history also attests to this unpredictability in other areas—such as Columbus's discovery of the New World or the fall of the Berlin Wall.

There is little in economics to suggest that markets can be shaped by the purposeful decisions of managers, that is, by firms. Penrose chose not to develop that point either. For her theory of the growth of the firm, markets were not specifically treated. However, firm behavior shapes markets just as markets shape firm behavior and firm growth. Consistent with this view, Herbert Simon argued that perhaps we should not assume an explanation is needed of why *firms* actually exist. Simon uses the illustration of a visitor from Mars approaching earth observing economic exchanges, with organizations appearing as green areas, and market transactions as red lines in between. What does the visitor see? Organizations, green areas, would be dominant. We live in an "organization economy" rather than a "market economy", and organizations are more ubiquitous than market transactions; even more so if we go back in history (Simon, 1991). Simon suggests that the more natural question to ask than the Coasian one, is "why do markets exist?" Instead of focusing on theories to explain the existence of firms, Simon raises questions such as, why do particular organizational forms (such as professional services firms) exist, and how should they be structured? How do these organizational forms relate to broader processes of (technological, cultural, etc.) change in the modern economy? What motivates people in real organizations (authority, rewards, loyalty, identification, coordination)? These are issues to be addressed by strategic management in the future; not all of these are Penrosian themes *sensu stricto*.

6. Dynamic Capabilities, Resources, and Competitive Advantage: Implications for MNEs

While Penrose may not have fully developed the capability concept, the subsequent development of the (dynamic) capabilities approach can be usefully applied to MNEs. Somewhat underresearched in mainstream MNE theory (at least as far as internalization theory is concerned), has been consideration of the importance and the particulars of the firm's managerial and organizational capabilities, although this is now being addressed.[25] To the extent that notions of organizational capability have been around for decades, and have received much attention recently, more efforts to embed the capability concept into MNE theory would appear useful so as to align more closely academic research on the MNE and strategic management theory.

As discussed above, Edith Penrose had provided elements of a resource-based/capabilities perspective. She viewed the firm as an administrative organization, and as a pool of production resources: "At all times there exist, within every firm, pools of unused productive resources and these together with the changing knowledge of management, create a productive opportunity which is unique to each firm. Unused productive services are, for the enterprising firm, at the same time a challenge to innovate, an incentive to expand, and a source of competitive advantage" (Penrose, 1960: 2). As Pitelis (2000) notes, unused resources are critical to Penrose's theory of internal or "organic" endogenous enterprise expansion.

Penrose certainly did not overplay, from a theoretical perspective, the international aspects of large corporations, believing that the differences do not, in fact, require theoretical distinction (1987: 56). However, she did note that "the managerial, technological, or financial contribution from the parent may be considerable and generally make new real resources available to the local economy" (1968: 43).

The general framework advanced by dynamic capability theory sees difficulty-to-imitate and globally exercised dynamic capabilities (and resources) as foundational to the competitive advantage of MNEs.[26] The greater the diversity and rate of change in business

environments, the more critical dynamic capabilities become for the MNE's financial performance.

Some observers have identified a modality of competition, referred to as hypercompetition. It is a modality "characterized by intense and rapid competitive moves, in which competitors must move quickly to build [new] advantages and erode the advantages of their rivals" (D'Aveni and Gunther, 1994: 217 ff.). Hypercompetition appears to be the result of rapid innovation, globalization, and deregulation. Dynamic capabilities are likely to be essential to the survival of MNE in industries and environments characterized as hypercompetitive.

As noted above, it is necessary that the MNE build capabilities that are "sustainable", that is, inimitable. Inimitability is more likely to occur in the presence of "isolating mechanisms" and "tight appropriability regimes" (Rumelt, 1987; Teece, 1986a, 2000).[27] When the appropriability regime is "tight", differential performance can be more readily sustained, at least for some length of time.[28]

The dynamic capabilities perspective on the MNE addresses more than simply the need for rapid innovation, adaptation, and flexibility. It also identifies the importance of proactive entrepreneurial behavior shaping the MNE's footprint. In the presence of significant gaps between the cost structures and growth rates of national economies, the MNE's ability to respond to—and shape—the changing kaleidoscope of opportunities at home and abroad is critical to success. Outsourcing and offshoring activities to foreign subsidiaries and alliance partners involves establishing quality control and product/service evaluation protocols on a global basis.

Indeed, dynamic capabilities are resident in a firm's processes and routines as well as within the firm's top management team. Maintaining dynamic capabilities within the MNE requires continuous entrepreneurial activity on a global scale. Entrepreneurial activity is different from—but related to—managerial activity. It is about understanding opportunities, getting things started, and finding new and better ways of putting things together. It is about coordinating on a global basis the assembly of disparate and usually cospecialized resources, getting "approvals" for non-routine

activities, sensing business opportunities, and finding ways to deploy capabilities globally as well as locally. We have come to associate the entrepreneur with the individual who starts a new business providing a new or improved product or service. Such action is clearly entrepreneurial; but the entrepreneurial function required in the MNE context should not be thought of as confined to new enterprise startup activities.

The replication of capabilities involves transferring or redeploying competences (technological or organizational) from one concrete economic setting to another. Since productive knowledge is usually embodied, the transfer of skill 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 in the home market is poorly appreciated, so unless the MNE has already replicated its systems of productive knowledge in other markets, 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 usually rather difficult to replicate. Even understanding what all the relevant routines are that support a particular competence may not be transparent. Indeed, Lippman and Rumelt (1982) have argued that some sources of competitive advantage are so complex that the firm itself, let alone its competitors, does not understand them.**??** As Nelson and Winter (1982) and Teece (1981b) have explained, many organizational routines are quite tacit in nature. Imitation can also be hindered by the fact that 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) be accompanied by 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 states 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 e.g. 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).[29] Replication in a different context may thus be rather difficult.[30]

At least two types of strategic value flow from replication. One is the ability to support geographic expansion, and has been emphasized here. The other is the ability to support product-line expansion. To the extent that the capabilities in question are relevant to customer needs elsewhere, replication can confer value.[31] Another is that the ability to replicate also indicates that the enterprise 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.

Factors that make replication difficult also make imitation difficult. Thus, when the MNE's productive knowledge is more tacit, it becomes harder for the MNE itself to replicate it, and for competitors to imitate it. When the tacit component is high, imitation may well be impossible, absent the hiring away of key individuals and the transfer of key organizational processes.

In conclusion, the concept of dynamic capabilities, when applied to the MNE, highlights organizational and managerial competences, critical to achieve superior performance. Key ingredients are difficult-to-replicate routinized processes, the basic manner in which a business is designed, as well as the decision frames, heuristics, and protocols that enable MNEs to avoid poor investment choices and embrace astute ones. Once assets are within management's orbit, their effective utilization and continuous orchestration on a global basis becomes essential. Indeed, orchestration

directed at achieving new combinations and new asset coalignments is central to the dynamic capabilities framework. Preventing imitation and internal rent dissipation are key elements too.

Lying at the heart of dynamic capabilities are several fundamental management/organizational skills, including: (1) learning and innovation processes; (2) business "design" competence (what business model to employ); (3) investment allocation decision heuristics; (4) asset orchestration, bargaining, and transactional competence; and (5) efficient governance and incentive alignment (Teece, 2007). Buttressing these is an understanding of the processes of imitation and the strategies and processes that can be used to protect intellectual property. Widely diffused managerial and organizational competence cannot be core elements of an MNE's dynamic capabilities.

Note that dynamic capabilities flow from more than just learning and technological accumulation. This is not meant to downplay the importance of technological accumulation. Technological innovation and learning remain important mechanisms by which firms build from specific (technological) capabilities. However, in a world where the global outsourcing of R&D is common (Teece *et al.*, 1988; Chesbrough, 2003) it becomes problematic to rely too much on in-house R&D as the sole foundation of competitive advantage. Orchestrating a global portfolio of technological assets inside and outside the enterprise is now essential.

The dynamic capabilities framework relegates an MNE's administrative competence to secondary importance, unless such competence is embedded in distinct and difficult-to-replicate business processes. Stable administrative functions can typically be outsourced to multiple vendors. Of course, there may well be circumstances where administration is complex, novel, and difficult to imitate, in which case it can be the source of competitive advantage.

The distinct skills which constitute an MNE's dynamic capabilities cannot generally be bought or "outsourced"; they must be built, or at least assembled. Once cospecialized assets are assembled, they must be skillfully orchestrated on a global basis. Such orchestration skills require astute decision-making on a global basis

and an entrepreneurial capacity built into the management team. These skills and processes are instrumental to long-run enterprise performance and cannot be outsourced without loss of competitive advantage. They lie at the core of the MNE's capabilities. MNEs possessing dynamic capabilities are able to quickly respond to—and shape—evolving technologies and marketplaces. Accordingly, such firms should exhibit superior enterprise performance over multiple product life cycles.

While Penrose did not anticipate most and certainly not all elements critical to successful international expansion, she did play an important role by being an important inspiration to dynamic capabilities. Her search for a theory of the growth of the firm is in some measure answered by the dynamic capabilities framework.

7. Conclusion

Within the field of strategic management, Penrose's work has often been extensively cited while also being mis-characterized. What is needed is careful scholarship, initiated by a careful reading of her work, especially *The Theory of the Growth of the Firm*. In this chapter, we have discussed some of her insights relevant to strategic management, entrepreneurship, international business, and industrial organization. We have also indicated certain limitations to her framework and analyses. A critical reading of her writings can nevertheless provide fresh insights to economics and management.

Notes

1. For an extensive coverage of Penrose's overall contribution, see Penrose and Pitelis (1999).
2. Less well known, but also elaborating the theme of the growth of the firm, is her case study of the Hercules Powder Company, published in 1960. It was originally intended for inclusion in *The Theory of the Growth of the Firm* but was omitted to keep down the size of the book though the case study was designed to illustrate the theory outlined in the book.

3. This has subsequently come to be known as the "Penrose Effect".
4. In her own words, describing the limits of growth as being generated by the same dynamics underlying the growth process itself: "[B]ecause the very nature of a firm as an administrative and planning organization requires that the existing responsible officials of the firm at least know and approve, even if they do not in detail control, all aspects of the plans and operations of the firm . . . the capacities of the existing managerial personnel of the firm necessarily set a limit to the expansion of that firm in any given period of time, for it is self-evident that such management cannot be hired in the market place" (p. 45). Note the emphasis on the missing markets for management—we shall return to that issue later in this chapter in Sections 4 and 5.
5. This is discussed in more detail in Section 4 below.
6. Teece *et al.* (1997) tried to tighten this by defining resources as firm-specific assets that are difficult if not impossible to imitate. Trade secrets and certain specialized production facilities are examples. These assets are difficult to transfer because of transfer and transaction costs, amplified in the presence of tacit knowledge.
7. The flip side of this is of course that a firm's growth is limited by the capabilities of its incumbent management (the "Penrose Effect" discussed later).
8. Moreover the use of "excess resources" may involve positive costs; see Pitelis (2002).
9. At least industrial R&D is discussed along with customer relationships.
10. As Penrose writes: "For physical resources the range of services inherent in any given resource depends on the physical characteristics of the resource, and it is probably safe to assume that at any given time the known productive services inherent in a resource do not exhaust the full potential of the resource . . . The possibilities of using services change with changes in knowledge . . . there is a close connection between the type of knowledge possessed by the personnel in the firm and the services obtainable from its material resources" ([1959], 1995: 76).
11. The links between Penrose and Cyert and March are discussed in Pitelis (2006).
12. The author's paper on the multiproduct firm (Teece, 1982) was the first to apply Penrose's ideas to strategic management issues. This paper focused on developing further Penrose's idea that human capital in firms is usually not entirely "specialized" and can therefore

be (re)deployed to allow the firm's diversification into new products and services. He also extended the Penrosian notion that firms possess excess resources which can be used for diversification. Later, Wernerfelt (1984) cites Penrose for "the idea of looking at firms as a broader set of resources . . . [and] the optimal growth of the firm involves a balance between exploitation of existing resources and development of new ones".

13. This explains why references to dynamic capabilities began before the publication of this paper. In the early to mid 1990s, the working paper versions were quoted. See for instance Mahoney and Pandian (1992).
14. For the particulars on the specific nature of different types of dynamic capabilities, see Teece (2006a).
15. Chairman Alan Greenspan also noted recently, "over the past half century, the increase in the value of raw materials has accounted for only a fraction of the overall growth of U.S. gross domestic product (GDP). The rest of that growth reflects the embodiment of ideas in products and services that consumers value. This shift of emphasis from physical materials to ideas as the core of value creation appears to have accelerated in recent decades" (Remarks of Alan Greenspan, Stanford Institute for Economic Policy Research, 2004).
16. See also Rugman and Verbeke (2002).
17. Except perhaps for her discussion on "impregnable bases" see Pitelis (2004).
18. As an example, consider Google's expansion of online network advertising into new markets around the world. According to Google's CEO Eric Schmidt, this is limited only by the speed at which the company can hire local staff, "set up bank accounts and collect the money". "Google sees no limit to global drive", *Financial Times*, February 3, 2005, p. 17.
19. See also Penrose and Pitelis (1999).
20. See also Rugman and Verbeke (2003, 2004b).
21. The dynamic process of market creation is illustrated in Penrose's study of the Hercules Powder Company where she talks about "the creation of consumer demand as a consequence of entrepreneurial desire to find a use for available productive resources" (Penrose, 1960: 9).
22. That was essentially also what Frank Knight had in mind: "The receipt of profit in a particular case may be argued to be the result of superior judgment. But it is judgment of judgment, especially one's own judgment, and in an individual case there is no way of telling

good judgment from good luck, and a succession of cases sufficient to evaluate the judgment or determine its probable value transforms the profit into a wage. . . . If . . . capacities were known, the compensation for exercising them can be competitively imputed and is a wage; only, in so far as they are unknown or known only to the possessor himself, do they give rise to a profit" (1921: 311). For a discussion of Knight's theory of the firm, see Langlois and Cosgel (1993).

23. She did also recognize the role of intentionality, an important part of entrepreneurship, as reflected in her early contributions to the debate in the *American Economic Review* about biological analogies.
24. His full argument is as follows: "With uncertainty entirely absent, every individual being in possession of perfect knowledge, there would be no occasion for anything of the nature of responsible management or control of productive activities. . . . its [business firm's] existence in the world is a direct result of the fact of uncertainty" (p. 271).
25. See, e.g. the various contributions by Rugman and Verbeke (2001, 2003, and 2005). In addition, others have emphasized management expertise in the theory of the MNE, e.g. Hood and Young (1979: 56), in discussing firm-specific factors, reference management expertise. Indeed, they state clearly (p. 92) that "large corporations do possess, and lay much store by, acquired managerial experience through which profit opportunities are diagnosed. Such experience is an important dimension of an MNE's comparative advantage". The framework developed here endeavors to specify what particular management expertise is likely to be critical.
26. For applications of Penrose's ideas to the MNE, see Pitelis (2000, 2004), Dunning (2003), Rugman and Verbeke (2002, 2004a) and various contributions in this special issue.
27. In addition to the importance of intellectual property rights protection, the tacit nature of know-how, and the inherent difficulty of technology transfer, another factor is the importance of the unique coalignment of specific assets. Specific assets may not simply be ubiquitously available.
28. Competitive advantages are continuously eroded by actions of other players that lead again to higher levels of competition and the need to react faster. In the end, these dynamic interactions between firm learning and adaptation, on the one hand, and higher levels of competition and selection, on the other hand, can cancel each other out. This is often dubbed an "arms race" or "the Red Queen effect" (Kaufman,

1995) after the comment to Alice: "it takes all the running you can do to keep in the same place" (Carroll, 1946). Companies adapt faster and faster, but as a consequence of the resulting increase in competition, they do not make any progress. When isolating mechanisms are operative and appropriability regimes are tight, Red Queen effects can be overcome.

29. See also Bartlett and Ghoshal (1989), Rugman and Verbeke (2005).
30. See e.g. Rugman and Verbeke (2004b).
31. 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. Nestlé'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.

Chapter 5

Dynamic Capabilities and the Essence of the Multinational Enterprise

This chapter reviews now classical theories of multinational enterprise and endeavors to show how the capabilities framework can be injected into the theory of the multinational enterprise. The effective conveyance of capabilities across borders, and the global orchestration of intangible assets, are today the essence of what makes the multinational enterprise distinctive.

1. Introduction

This chapter is an effort by the author to revisit the theory of the multinational enterprise (MNE) after almost three decades (Teece, 1981c, 1985, 1986b). In particular, I will endeavor to

assess the contribution of Stephen Hymer while at the same time making efforts to incorporate into the theory of the multinational enterprise (hereafter MNE) some of the recent developments in the field of strategic management, particularly those relating to enterprise capabilities.[1] While recognizing Hymer's contributions—and in particular, his examination of the MNE from an industrial organization perspective—at the same time it can be shown that his basic paradigm, built as it was on the structuralist approach to industrial organization—has many of the shortcomings of that approach. Indeed, it led him to miss important elements of the MNE, and to make policy errors with respect to the impact of the multinational enterprise on host and home countries.

I will also show that the internalization school,[2] which is conceptually distinct from the Hymer/Kindleberger approach,[3] is a more robust approach to the study of the MNE. This is particularly true once internalization concepts became embedded in broader frameworks such as Dunning's eclectic paradigm. As an organizing framework, internalization ideas have stood the test of time reasonably well. However, in order to come to grips with the evolving nature of the multinational enterprise, the internalization framework and related approaches need to be supplemented by a better understanding of the role of an enterprise's resources and also its dynamic capabilities. Fortunately this is now possible as there have been significant improvements in the (strategic) theory of the firm which can help one refine and improve the theory of the MNE. Moreover, because many national systems of production have become transformed by increased "outsourcing" and "offshoring" during the 1980s and 1990s (in part due to the global distribution of knowledge effectuated by the MNE itself), the theory of the MNE needs to be modified to capture the essence of global enterprise and intrafirm international trade today.

The modern corporation as we know it is multinational. Being multinational is no longer the preserve of large firms; moderately sized firms as well as quite small firms have global operations and employees and investments in multiple jurisdictions.[4] By definition, an MNE operates in the global marketplace through a network of organizational units and subunits (e.g. divisions, offices).

The MNE has the ability to monitor and manage business units in multiple jurisdictions. This in turn requires a communication and control system that is global in its reach.[5] The MNE may or may not have a heavy commitment of fixed tangible assets abroad. The environments in which MNEs operate are likely (though need not be) more diverse than domestic environments. In particular, language, laws, customs, and cultures display more variability internationally than domestically. The essence of the MNE is that it accepts and adapts to institutional, cultural, and market heterogeneity while simultaneously trying to capture economies and other advantages associated with leveraging some kind of (scalable) advantage in certain assets or processes it owns or is currently developing. A robust theory of the business enterprise must be able to embrace its global scope. Indeed, a domestic enterprise is a special case of a multinational enterprise. Accordingly, the study of international business should not be divorced from the study of domestic business, and the theory of the multinational enterprise should not be a distant cousin to the theory of the business enterprise more generally.

2. The Essence of the MNE and Hymer's Thesis

Before Hymer, many economists viewed the MNE as simply an arbitrageur of capital, transferring equity capital from countries where returns were low to those where it was higher, earning the arbitrageurs rents and contributing to efficient resource allocation. The capital arbitrage theory of the MNE predicted the MNEs would be headquartered in countries where the domestic marginal productivity of capital was relatively low, from which they will transfer capital to subsidiaries where the marginal productivity was higher.[6]

As Hymer (1976) first observed, however, there are several features of direct foreign investment (DFI) and the MNE which are inconsistent with this theory. The MNEs overwhelmingly finance their host-country operations in host-country capital markets. Furthermore, there are substantial cross-flows of direct foreign

investment, as well as substantial concentration of DFI in particular industries. These observations would be consistent with a capital arbitrage theory only if domestic capital markets were highly balkanized, which they generally are not.

In searching for a plausible theory of DFI, Hymer's primary tenet was that DFI was motivated by domestic firms' attempts to increase the returns from the utilization of firms' special advantage (Hymer, 1976: 33).[7] Hymer suggested that the sources of the advantage could be in product market power, superior production techniques, and imperfections in input markets (which allow lower buying prices for incumbent firms), and first-mover advantages. Possessing such special advantages, a national firm could be profitable outside the home country despite the higher costs resulting from its relative ignorance of local conditions abroad.

What made Hymer's thesis appealing was its apparent predictive power. Hymer showed that foreign direct investment tended not to occur in those industries best approximated by perfect competition. Rather, direct foreign investment was clustered in (i) natural resource industries and (ii) industries where there was some significant level of industry concentration.[8]

Hymer's insights laid the foundation for a new paradigm of the multinational enterprise. Admittedly, there was not much if anything in place at the time that might be characterized as a theory of the MNE. Hymer's key contribution was to transport the theory of direct foreign investment out of international trade and finance and into industrial organization and the theory of the firm.

Unfortunately, the field of industrial organization at the time he was writing (*c*.1960) did not have quite the richness it has today, and was dominated by monopoly rather than efficiency explanations of business behavior and complex organizational forms.[9] Furthermore, the library of concepts from which Hymer could borrow was especially sparse with respect to the economics of new organizational forms. His crude approach to the MNE reflected this rather crude state of understanding of competition policy and what Coase has referred to as the "inhospitability tradition" that prevailed in antitrust economics at the time.[10]

Hymer was furthermore handicapped by the absence of realistic welfare criteria for evaluating the MNE. In the absence of alternatives, Hymer seized upon perfect competition as his benchmark. However, perfect competition is an unrealistic and impractical policy benchmark; so Hymer inevitably arrived at awkward policy recommendations. He saw the raison d'être of the MNE as stemming from the "impurities of the market [that] would not arise in competitive industries" (1976: 86). This led him to the conclusion that "a restriction on direct investment or a policy to break up multinational corporations may be in some cases the only way of establishing a higher degree of competition in that industry—the underdeveloped countries need to devote an important share of their scarce resources to building up national enterprises . . ." (Hymer, 1970: 444).

However, if an MNE possesses special advantages, then perfect competition simply cannot prevail.[11] Perfect competition is rarely a realistic welfare standard. Indeed, there is simply no place for Hymer's MNEs in the theory of perfect competition. Moreover, the evident failure of national enterprises around the globe and the positive impact that foreign investment and the activities of MNEs have had on economic development is further evidence that Hymer was wrong with respect to this aspect of his assessment of this particular form of business enterprise.

In short, Hymer's policy error was to view departures from perfect competition as undesirable market imperfections, and to then conclude that the MNE (being necessarily implicated with markets in which competition was imperfect) must be instruments of pernicious market power.[12] As modern antitrust economics teaches us, there is a substantial gap between finding a market imperfection and finding monopoly or monopolistic competition that would warrant a public policy response.[13] Put differently, there is quite some distance between finding monopoly and identifying behavior that warrants legal or public policy intervention and sanctions. In this regard, Hymer's analysis is at odds with the teachings of modern competitive economics, and also with competition policy.

Despite these shortcomings, there is no doubt that Hymer's work represents a major contribution to the positive economics of

the multinational enterprise. At the same time, it is important to recognize that his theory of the MNE is misdirected in its heavy emphasis upon market power as the explanation for the global expansion of firms. As indicated below, MNEs need to develop unique assets/resources and capabilities to be successful. (This is a basic point accepted by Hymer.) This leads to some degree of uniqueness in the MNE's product or service offerings. Accordingly, the individual MNE's demand curve is unlikely to be horizontal, and in that sense MNEs will all have "market power"; but as noted above, such market power is unlikely to be troublesome from a competition policy perspective. Rather, it is likely to reflect the fact that the firm has something unique to offer in domestic and foreign markets, possibly leveraging technology and other intangibles. Such uniqueness is likely to be an indicator of the desirability of direct foreign investment.

3. Hymer and the Emergence of the Internalization School

As noted above, Hymer's basic argument was that an MNE needed some special advantage to offset the hypothesized higher costs[14] (relative to indigenous firms) of operating abroad. Given the industrial organization theories advanced at the time (in the Mason-Bain[15] tradition) the visceral answer he provided was that special advantages led to market power; and the exercise of monopoly or market power could suffice to offset the higher costs of operating abroad. Unfortunately, Hymer didn't probe hard enough for the nature, sources, and extent of any such market power. If it stemmed from innovation, or from superior skill, foresight, and knowledge, then it ought to be viewed differently from market power stemming from exclusionary behavior (Teece and Coleman, 1998).

Interestingly, Hymer appears to have been aware of the (Chicago school) work on transaction costs. I refer of course to the Coasian view that the firm substitutes (internalizes) the market where transactions can be organized more efficiently inside the firm rather than in a market.[16] Indeed, in his thesis at p. 48 he notes

that "the firm internalizes or supersedes the market—decentralized decision-making (i.e. a free market) is defective when there are certain types of interactions between firms; that is each firm's behavior noticeably affects the other firms". The subsequent discovery of his French-language paper "The Large Multinational Corporation" (1968) demonstrates conclusively that Hymer was familiar with the Coasian arguments, and as Casson notes, "he clearly anticipates by several years the work of McManus (1972), Buckley and Casson (1976) and others".

While he may have been aware of Coase's work, Hymer apparently didn't fully appreciate the efficiency implications of Coase's theories and their relevance to MNE. He was not able to properly connect and fully explore the fact that if MNEs possessed special advantages, they might find it advantageous to deploy their advantages via internal transfer rather than through contractual mechanisms.[17]

Hymer instead embraced the view that the MNE, if it has a special advantage, must somehow restrict competition, noting that "Direct investment in a foreign processing industry protects a firm against competition" (1976: 21). While he recognizes that the entry of competitors from abroad may shake up the industry, he concludes that "after a while it is more than likely that a certain stability will be achieved and that the industry will adopt some formula for market sharing" (p. 27). This view is entirely speculative, and no historical evidence was cited to support it.

Interestingly, Hymer does observe with prescience that "at the present time, the main formulae used amongst world scale firms are being tested because of reductions in trade barriers . . . " (p. 27). Indeed, his article is very insightful in many ways. One statement that I was previously unaware of foreshadowed my own work:

> What we are most interested in, however, are the economic motives for which a firm organizes on a multinational basis. First, the advantage the firm owns may be so complex and defined that it is extremely difficult and sometimes impossible to sell it. For instance, if the foreign firm needs occasional assistance in the field of management and technology in order to face various problems as they arise, it may prove to be impossible to specify in advance the nature of the help it expects from the American

firm and the remuneration it will get for each intervention. On the contrary, it will probably be more efficient to make a long run cooperation agreement based on sharing, with decisions being taken on an administrative basis rather than negotiated each time. The strength of a multinational enterprise stems from the fact that it can trade knowledge internally more quickly than two firms which have to negotiate conditions each time.

Pitelis correctly notes that Hymer's emphasis on the role of market power in explaining the international scope of the business enterprise was "a matter of choice, not ignorance" (p. 13). But it was the wrong choice, in terms of the subsequent development of the theory of DFI, in terms of intellectual developments in the theory of the firm,[18] and in terms of development in the field of strategic management.

It does indeed appear that Hymer flirted with the internalization approach to the MNE; but he did not embrace it. McManus (1972) and Buckley and Casson (1976) did so. As Buckley and Casson succinctly put it "when markets in intermediate products are imperfect, there is an incentive to bypass them by creating internal markets. This involves bringing under common ownership and control the activities which are linked to the market. Internalization of markets across national boundaries generates MNEs" (p. 33). Buckley and Casson highlight the significance of industry-specific factors. They recognized knowledge markets as a domain in which "the incentive to internalize is particularly strong" (p. 39).

The Buckley–Casson treatment of know-how focused on market power/pricing issues, less so on efficiency issues. They claim that "knowledge is a 'natural monopoly'—and is best exploited through discriminatory pricing of some kind. Licensing systems cannot usually be designed to satisfy the discriminatory criteria, so that internalization is indeed appropriate. They also stressed monopoly/monopsony issues with respect to negotiating and noted that "the bargaining conflict may require some form of joint ownership to resolve it" (p. 39). Their suggestion that knowledge confers natural monopoly is perhaps too strong. Only when essential to production (i.e. there are no substitute technologies)

and protected by patents (or other factors which make imitation difficult) is know-how likely to be a troublesome source of market power. But these circumstances are rare. My own work on the MNE, coming out of a study on technology transfer, emphasized not so much market control issues with respect to know-how, but the benefits associated with leveraging unique assets in new markets:

> If the multinational firm possesses a distinct competitive advantage in the form of unique assets, then the exploitation of this advantage will typically enhance consumer welfare. The principal considerations which arise with respect to multinational rather than indigenous enterprises relate merely to the distribution of quasi rents associated with the employment of the firm's unique assets. (Teece, 1981a: 12)

and

> an important attribute of the multinational firm is that it is an organizational mode capable of internally transferring knowhow among its various business units in a relatively efficient and effective fashion. Given the opportunities that apparently exist for international trade in knowhow, and given the transactional difficulties associated with relying on markets, one should expect to find multinational enterprises (MNEs) frequently selecting internal channels for technology transfer. (1981b: 87)

In a later paper (Teece, 1986b) and referencing Dunning (1981) I summarized the situation as follows:

> A firm is likely to become multinational if (a) it has certain special assets which give it a competitive advantage over indigenous firms (the strategic advantage factor), (b) these assets are more economically utilized in production facilities in parts of the world beyond the firm's domestic markets (the location factor) and (c) the best way to obtain full value from employing the asset in foreign markets is to transfer the asset internally within the firm to another affiliated business unit (the transaction cost factor). All three must be present to explain foreign direct investment. (p. 27)

The work of the internalization school was a significant advance over Hymer. Hymer not only failed to explore internalization issues; he also failed to specify very well the sources of the MNE's special advantage. Buckley and Casson (1976), Teece (1981a,

1981b, 1985, 1986b), and others stressed the role of intangibles and other difficult-to-imitate assets.[19]

The internalization thesis has taken criticism from a number of scholars, most notably Kogut and Zander (1993). However, their critique is more apparent than real. They too appear to embrace the major point of the internalization thesis; namely, certain know-how can be transferred more effectively, conveniently, and efficiently inside the firm than through an arm's-length license arrangement. Kogut and Zander stress that the firm is a social community for the creation and sharing of know-how. Accordingly, their emphasis is on how well firms can transfer technology internally compared to their competitors, and they suggest that this vitiates market failure considerations (Kogut and Zander, 1993: 627). However, this would seem to be a false attack or a misunderstanding of transaction cost economics. If MNEs do indeed have valuable tacit and codified knowledge which is relevant to business opportunities in other jurisdictions, then they will wish to (and need to) transfer know-how in order to stay competitive. In this sense it is true that the decision to transfer know-how will be driven by competitive considerations. However, the choice of mode of technology transfer ought still to depend upon the relative efficiencies of market (i.e. licensing) versus internal transfer. Whether one calls this market failure analysis is a matter of indifference or choice of terms. And, as Williamson (1975) notes, "market failure" ought to be a *relative* term as no mode of organization (market or internal transfer) is perfectly efficient. It's relative efficiency that matters. Indeed, Kogut and Zander can be thought of, perhaps, as being earlier proponents of the capabilities approach advanced below, inasmuch as they do emphasize the relative capabilities of firms as an explanation for their DFI activities.

4. Dunning's Eclectic Paradigm

Dunning correctly notes that internalization alone is not sufficient to explain the (productive) activities of MNEs outside their own borders, or the production of foreign-owned firms in the MNE's

home country.[20] The author (Teece, 1985) did recognize that MNEs will consider location factors in their decisions with respect to DFI, that is, DFI decisions are driven not just by "governance" or transaction costs, but by "production cost" considerations too. Accordingly, an MNE may set up a foreign subsidiary to access lower-cost inputs. Cost factors could thus drive DFI decisions. This is hardly a revolutionary idea, but it is not explicitly made in most versions of the internalization theory of the MNE.

The most comprehensive effort to date to bring various explanatory factors together remains that of John Dunning. As Dunning puts it, his eclectic paradigm "is not a theory of the MNE per se, but rather of the activities of enterprises engaging in cross border and value-adding activities" (1993: 76). It accepts that the propensity of firms to own foreign-income-generating assets may be influenced by financial and/or exchange rate variables (p. 76). Dunning presents his framework as being descriptive and not normative. The tenets of Dunning's eclectic paradigm are that three classes of factors[21] jointly determine whether a firm is likely to engage in production activities abroad. These are now examined.

(1) *Ownership (asset) advantages vis-à-vis other firms in particular markets* This class of factors ties rather closely to the resources/dynamic capabilities theory developed in the field of strategic management.[22] Dunning makes reference to intangible assets and "the resource (asset) structure of the firm" (p. 81) and to product innovations, production management, organizational and marketing systems, innovation capacity, organization of work, non-codifiable knowledge. He also references economies of scale and scope, favored access to resources, ability to include productive interfirm relationships. Practically all of Dunning's examples align with the now extensive treatment of resources/dynamic capabilities literature applied in Section 6 below. What's missing in Dunning's treatment and ought to be added is a consistent recognition that (i) it is only the nonimitable elements of this capacity that can anchor competitive advantage; (ii) that there ought to be mechanisms to orchestrate, sustain, and renew such resources/assets;

(iii) dynamic capabilities are resident in the firm's ability to create and refine its business models, routines, and procedures, while using investment protocols which ensure quality decisions free of bias. Amit and Schoemaker (1993) lay out a litany of decision-making biases; the ability of top management to avoid biases, make astute assessments about the future evolution of markets and technologies, and actually shape market outcomes can also be a measure of their dynamic capabilities.

(2) *Internalization advantages* Assuming condition (1) is satisfied, the question then arises as to how best to exploit ownership advantages. In particular, ought the assets to be commercialized offshore through direct investment, or through arm's-length contracts with nonaffiliated enterprises? To the extent that the enterprise sees advantage in exploiting these assets through internalization, it will lead to increased scope for its international activities.

Internalization advantages have several dimensions. One is the contractual efficiency side, adequately explored by a long list of authors including Buckley and Casson, Rugman, Teece, and Williamson. However, internalization cannot be considered independent of ownership/resource issues, and few have provided frameworks for doing so. One exception is the author (Teece, 1986a, 1986b) where a decision framework is provided which could be applied in a global context.[23]

(3) *Location-specific-factors* Assuming conditions (1) and (2) are satisfied, one must then take into account the spatial distribution of natural and created resource endowments. The condition of local infrastructure and the quality and cost of local inputs are what Dunning appears to have in mind. Clearly, in a world in which there are significant differences in factor costs, procurement in low-wage countries will incentivize MNEs to obtain supply offshore; but if competition and the nature of the procured product is such that small numbers bargaining conundrums are unlikely, then supply is likely to be outsourced, that is, the transactions will not be internalized.

The generalized predictions of Dunning's paradigm are that the greater the relative ownership advantages of an enterprise, the

greater the incentive to internalize, the more an enterprise finds it beneficial to exploit its ownership advantages from a foreign location, then the more likely it is to engage in outbound DFI. Conversely, a country is more likely to attract investors by foreign MNEs when the reverse considerations apply (p. 80). In short, this framework enables one to disaggregate the location decision and mode (governance) decisions.

This is analytically useful, and/or close to the approach used in Teece (1986b). The framework suggests that firms with specific assets that can be employed abroad will do so and profit. The paradigm would suggest that it is not only the possession of technology that gives the firm an edge overseas; it's the ability to commercialize it internally.

The problem with the paradigm is that the three factors are presented as exogenous when the very transfer of technology and capability renders them endogenous, that is, it is frequently necessary for the MNE to transfer technology abroad in order to effectively access lower-cost inputs. Clearly, there is a need for a "dynamic" theory of the MNE.[24]

5. Challenges to the Theory of the MNE

Changing Nature of International Business

In recent decades, increased globalization, and in particular outsourcing and offshoring, appear to have gained momentum. This can be exemplified by industries from clothing to electronics. As a consequence, international trade in intermediate products has increased, enabled by the global dispersion of knowledge and capabilities, as well as by progress in transportation and communication. The existence of some degree of industry maturity and the emerging of standards has also played an important role. The later development facilitates specialization through modularity; modularity in turn lowers entry barriers for both domestic and foreign firms.

Table 5.1. Imports into the USA by trade categories, as percentage of total imports

	1992	1997
Intermediate Inputs/Final Goods		
Percent intermediate inputs	37%	38%
Percent final goods	63%	62%
Intrafirm/Arm's Length		
Percent intrafirm	43%	52%
(a) Percent US MNEs	17%	30%
(b) Percent foreign MNEs	26%	22%
Percent arm's length	57%	48%
Addendum: total imports $ Billions	505	748

Source: Bardhan *et al.* (2003).

Intrafirm trade can include both intermediate goods and final goods. Table 5.1 (from Bardhan *et al.*, 2003) shows that in 1997, 37 percent of all US goods imported were intermediate goods. More importantly, intrafirm imports had risen from 43 percent in 1992 to 52 percent in 1997. For home-based (US) multinationals, the increase was much larger, from 17 percent in 1992 to 30 percent in 1997. Such data are merely suggestive—but there seems to be more than a hint in the data that intermediate product flows are an increasing proportion of all trade, at least for US-based MNEs operating in the USA.

Not surprisingly, the activities of MNEs have changed dramatically too. In particular, the nature and national origin of MNEs have changed. US and European MNEs haven't grown as fast as MNEs from Japan and the Asian newly industrializing countries (NICs) (e.g. Samsung, Hyundai, TSMC, and CNOOC). It appears that the geographic as well as the organizational locus of manufacturing has changed—away from the USA and Europe toward Asia (especially Japan, Korea, and China), and away from the MNE itself, that is, what has occurred is both "offshoring" and "outsourcing". Especially from the US perspective, there has not

only been a change in the geographic location of production in many industries (offshoring); there has also been a change in the organizational locus of production ("outsourcing").

Two key developments relevant to the nature and scope of MNEs would appear to include: (i) the simultaneous increase in both the outsourcing and the offshoring of production; (ii) the emergence of a distributed and open innovation model, that is, not only is production or manufacturing being outsourced, so is innovation. These trends aren't that well addressed or explained by internalization theories alone. However, the Dunning (1981) and Teece (1986b) frameworks,[25] with their explicit recognition of the dynamic interplay of asset positioning and internalization factors, are able to explain these developments better than some.

First, using the definitions of the Dunning eclectic framework, it appears that the (relative) locational advantages of some incumbent MNEs in the USA and Europe have deteriorated. The logic of the framework suggests that as the capacity for both globally competitive R&D and globally competitive production migrates away from the USA and Europe and toward Asia, then incumbent MNEs would, *ceteris paribus*, experience some degree of erosion of their competitive advantage. This could well, in the first instance, manifest itself in outsourcing (of R&D and production, respectively). Put differently, even if there is no deterioration in the internalization advantages of the MNE, the amount by which an MNE could rely on its own in-house capabilities in order to compete would tend to decline.

In an earlier paper (Teece, 1986b) I made the point as follows:

> Setting aside for the moment the question of whether production should be controlled by a multinational or a domestic firm, it ought to be apparent that if production techniques and knowledge are uniformly distributed internationally, the location of production will simply depend on differences in factor costs, tariffs, taxes, transportation costs, and the size of markets.[26]

This could have been presented from the opposite perspective too. Namely, if technology isn't ubiquitously available, and a firm has

a sustainable difference in a superior manufacturing technology, then the MNE may be able to continue to utilize its domestic manufacturing. The relevance here is that large multinational business enterprises in the USA and Europe have both expanded outsourcing and offshoring. However, this "hollowing out", as some have put it, does not mean that the incentives for MNE activity have declined. Indeed, they may well have increased. However, the direct investment component may have declined as offshore producers establish their ability to engage in competitive supply. The fact that US companies have moved production offshore, to both subsidiaries and to nonaffiliated suppliers, is fully consistent with what both the Dunning and Teece frameworks would suggest. It doesn't mean that internalization/vertical integration benefits *per se* have declined. It may simply indicate that the locus of certain organizational capabilities has migrated offshore.

I do not mean to suggest, however, that the Dunning, Teece, and related approaches are robust enough to explain all relevant developments. In particular, one element missing from both is an understanding of the role of standards and modularization. The emergence of standards, for example the GSM standard in wireless communications, the RDRAM and DDR SDRAM standards for semiconductor memory devices, have facilitated the modularization of systems, which in turn have untethered the location of product development from the location of production.

With standardization, innovation can occur at the modular level, that is, so long as the standard is adhered to, designers and developers are free to engage in innovation at the subsystem/module level, and then either "bolt it on" or let others bolt it on to other (compatible) modules. Compatibility standards can allow a plethora of new entrants into an industry; large multinationals in turn need to somehow access this innovation. Put differently, MNEs need to "manage" not only their own assets, but the assets of others too. Frequently such assets external to the firm are complements to what the firm has internally. Increasingly, firms must manage assets inside the firm, and, as best they can, assets that lie external to the firm too. The management

approaches which can be utilized are rarely hierarchical—although sometimes acquisitions can be used to secure control of critical complementary assets. Frequently, however, this isn't possible; and the challenges to MNE management are considerable.

Implications for MNE Theory

How have globalization, outsourcing, and offshoring factors impacted the nature of MNE, and the requirements for a theory of MNE? With the growth in intermediate markets, with coordination and communication costs lowering, and with the distribution of production capabilities dispersing globally, it appears that the forces favoring internalization are weakening,[27] at least in some industries. As intermediate markets have expanded, outsourcing (and in-sourcing) opportunities have expanded. Moreover, increased uncertainty has enhanced the pay-off to the ability of firms to be flexible and entrepreneurial. This in turn has changed the way in which the multinational firm has manifested its presence. General Motors may today source its Pontiac engines in Mexico, its wheels in Taiwan, and its brakes from Germany; but tomorrow the sourcing pattern may need to be different. Supply-chain management has emerged as an important factor in the competitive success of MNEs.

With globalization, the extent of vertical integration appears to be diminishing—not because internalization is inherently flawed—but because of the shifting geographic locus of production capabilities. The (American) system of twentieth century production and innovation, which relied heavily on in-house R&D and vertically integrated production, is yielding in many industries to a system which is less integrated. Chesbrough (2003) has referred to this as "open innovation", inasmuch as it is based on sourcing innovation from suppliers external to the firm as well as from in-house R&D programs. Of course, there is still a critical role that the enterprise plays in combining technologies in order to create customer solutions.

The semiconductor industry is a case in point. Fabless semiconductor companies are now common. These are firms that design and sell chips globally, but they depend on (offshore) fabs to manufacture their products. The auto industry has likewise engaged in considerable outsourcing, aided by the modularization of design. Modularization is facilitated by standards and standardization. Industry-level standardization allows for specialization and the emergence of intermediate markets. Internal designs can proceed without deep knowledge of all aspects of a system. For example, the highly standardized nature of the PC allows for manufacturers to specialize in subsystems such as CPUs, keyboards, screens, and software.

Indeed, it was a key insight from Williamson that the firm's boundaries are determined by the interaction between "production" costs and "governance" costs.[28] As noted earlier (Teece, 1986a: 395), "differences amongst countries in comparative costs will cause the international specialization of production and concomitant trade". This framework (by referencing production costs) would imply that country-level capabilities and costs would be a factor in the location decisions of MNE. For example, if the USA is no longer competitive in textiles, then the locus of production will migrate offshore. With hindsight, I would emphasize firm-level as well as country-level costs, as wide differentials in costs can open up amongst firms in the same industry and in the same country.

6. *Injecting the Resources/Capabilities Perspective into the Theory of MNE*

General

The above analysis suggests that while the MNE theory has done quite well in an era of rapid globalization, there is nevertheless the need for a more robust theory of the MNE. As Peter Buckley put it, "the theory of the multinational firm therefore requires

development in several directions—the general area of the economics of business strategy is in need of greater attention" (Buckley, 1985: 18).[29] His admonition has merit, irrespective of the globalization that has taken place.

Largely missing from the theory of the MNE—either the Hymer version or the naked internalization versions—has been consideration of the importance of the firm's organizational capabilities. This has been a significant omission. Inasmuch as notions of organizational capability have been around for decades, and have received much attention recently, efforts to embed capabilities into the theory of the MNE would appear to be overdue.

Developments in the field of strategic management have highlighted the importance of resources and (dynamic) capabilities to enterprise success. In this and following sections it is suggested that: (1) the capabilities perspective on the business enterprise has much to offer to the theory of MNE; (2) the capabilities perspective is consistent with, and arguably implicit in, the Dunning and Teece treatments of the MNE. However, while prior work hinted at a capabilities approach, the MNE theory which referenced it was not developed sufficiently to illuminate the character of the MNE beyond what was provided by the internalization school; (3) Cantwell's (1989) emphasis on technological accumulation can be seen as a useful jumping-off point for a more full-blown analysis of MNE capabilities.

Cantwell correctly recognizes that MNEs are frequently active generators of firm-specific competitive advantages. He sees the firm in evolutionary terms accumulating technology (and capabilities) over time. Moreover, technology transfer activities by MNEs create spillover benefits. These external economies enhance the competitive capabilities of regions, thereby possibly stimulating more inward DFI.[30] Hence, neither firm-specific (ownership) advantages or locational advantages are truly exogenous.

In short, Cantwell's contributions add critical dynamic dimensions to Dunning's framework as well as to internalization considerations. In my view, these are important extensions. The capabilities approach outlined below is yet a further extension,

emphasizing the organizational as well as the technological capabilities of MNEs.

Resources/Capabilities Compared to the Internalization School

The internalization school saw the essence of MNE activity as being driven by market "failure", that is, imperfection in markets which caused managers to want to bring activities under common ownership, subject to internal rather than market coordination. Buckley and Casson (2002: 39) noted early on that "the strongest case of all concerns the markets for various types of knowledge", Teece (1986a) put know-how at the core of the theory of the MNE. However, the elements of knowledge transfer that were emphasized in these early treatments did not necessarily draw out well the elements I now wish to emphasize.

In an early paper (Teece, 1977), capabilities were explicitly flagged as being at the core of a firm's technology. A distinction was made between embodied (embracing physical items such as tooling, equipment, and blueprints) and unembodied knowledge.

> The second form of technology is the information that must be acquired if the physical equipment or "hardware" is to be utilized effectively. This information relates to methods of organization and operation, quality control, and various other manufacturing procedures. The effective conveyance of such "peripheral" support constitutes the crux of the process of technology transfer. (Teece, 1977: 245)

This early statement was a crude attempt to recognize the importance of organization, procedures and tacit knowledge to business performance and technology transfer.[31] These attributes of an organization are what today we think of as elements of capability. If a firm possesses capabilities, it can create additional value by scaling them globally. In what follows I will identify the foundations of capabilities and discuss the manner in which such abilities are generated, and then replicated/transferred globally. I will first

outline the approach and identify some of the different sources of an MNE's capabilities.

The capabilities approach represents the business enterprises as bundles or portfolios of difficult-to-trade assets and (production) competencies ("resources").[32] Within this framework, competitive advantage can flow at least for a period from the ownership of scarce and difficult to imitate assets.[33] However, sustainable competitive advantage can only flow from whatever unique ability business enterprises have to continuously shape, reshape, configure and reconfigure, and align those assets to create new technology, to respond to competition, gain critical mass, and serve changing customer needs.[34] The particular (nonimitable) "orchestration"[35] capacity business enterprises have to shape, reshape, configure and reconfigure those assets so as to create and respond to changing technologies, competition, and market developments is what has come to be known as the firm's (dynamic) capabilities.

The dynamic capabilities framework is especially relevant to markets exposed to rapid technological change and strong international competition. The framework suggests success factors for MNEs. With the continuous expansion of world trade and investment, with factors of production being highly mobile, and with the sources of innovation becoming increasingly global, an increasingly larger share of the global economy is reasonably accurately characterized as "open", that is, as being exposed to the forces of global competition, and to the international flows of capital, technology, and skilled labor. The pay-off to flexibility,[36] entrepreneurship, learning, and astute investment choices and other factors that are central to the dynamic capabilities framework has increased since the 1960s when the global liberalization of trade and investment began gaining momentum (Teece, 2000). Moreover, intangible assets and intellectual capital are playing a greater role in economic activity. Subsequent sections of this chapter are an effort to analyze how MNEs—the global engines of the capitalist system—can be successful in this new environment where the "output" of the business enterprise is often "conceptual" products/intellectual capital.

Types of (Dynamic) Capabilities

In competitive global environments MNEs must proactively adjust their portfolio of assets and competencies in order to build and sustain competitive advantage. Many factors can trigger the need to refine and sometimes reconfigure an MNE's business model, and its assets and competences. Exogenous events (e.g. recession, enhanced competition, exchange rate movements, regulation) will require responses. So will technological innovations, and the emergence of new competitors using different business models. However, not all enterprise-level responses to innovation and change are manifestations of dynamic capabilities. As Sidney Winter (2003) notes, "ad hoc problem solving" isn't necessarily a capability.

The microfoundations of the MNE's dynamic capabilities include difficult to imitate organizational-level innovation, change, global sourcing and global marketing routines; the business intuition and insight needed to create new business models and revenue architectures that scale globally; the investment insights, protocols, and procedures which enable the business enterprise to identify and address new markets and technologies. Finally, dynamic capabilities include the capacity to calibrate uncertainty, and continuously effectuate the coalignment and efficient governance of cospecialized assets domestically and internationally. Do note that dynamic capabilities are rooted in large part in the capabilities of management and in the design of the enterprise.

The typical MNE has assets at work in numerous jurisdictions. Orchestration skills are especially important when there is such a diversity of assets inside and outside the enterprise. Put differently, as a practical matter orchestration needs and opportunities expand as the firm globalizes, since the panoply of assets an MNE can access is, as a practical matter, likely to expand. Consider just the MNE's own internal R&D resources. MNEs increasingly recognize that each of its R&D laboratories can be the source of new innovation, and it must organize itself appropriately to capture these potential benefits (Almeida and Anupama, 2004).

Inasmuch as change requires continuous adjustments to business models and realignment of assets and competences to sustain value creation, an MNE's dynamic capabilities require the continuous sensing of changing opportunities and needs on a global basis, and prompt execution. This ability to orchestrate assets globally and not just analyze changing needs is referred to here as managerial orchestration, and it is an essential element of dynamic capabilities whether an enterprise is domestic or multinational.

Various classes or sources of dynamic capabilities are now explored in more detail. A high performance MNE is likely to possess several if not all of these difficult-to-imitate attributes. While for analytical purposes several classes of dynamic capabilities are identified separately, they usually need to operate in unison (and be difficult to imitate) for high performance to be achieved.

Dynamic Capabilities through the Selection and Implementation of Routinized Processes

In Teece and Pisano (1994) and Teece, Pisano, and Shuen (1997) certain routines[37] (or "processes") were an essential element of a firm's (dynamic) capabilities. One can separate production routines to sustain current operations (not the basis of dynamic capabilities) from learning routines designed to achieve improvement (one basis of dynamic capabilities). Examples include new product development routines, quality control routines, and technology transfer and/or knowledge transfer routines.

Not all dynamic capabilities can undergird differential performance. Cross-function R&D teams are now widely adopted and recognized as essential for superior product development performance. However, the existence of common elements already ubiquitously adopted by competitors does not imply that a particular routine has not been the source of competitive advantage, at least for a considerable period of time. Studies of the diffusion of organizational innovations (e.g. Armour and Teece, 1978; Teece, 1980b) indicate that diffusion of organizational innovations is by no means instantaneous, particularly at the global level.

Accordingly, significant economic profits can be earned before diffusion competes away superior returns. Decade-long adoption cycles are not uncommon. Uncertain imitability (Lippman and Rumelt, 1982) is also likely to slow the diffusion process, domestically and internationally. Indeed, Helfat and Peteroff (2003) suggest that capabilities evolve in a life-cycle fashion, which includes several stages: founding, development, and maturity. Once maturity is attained, the capability can branch into additional stages, including renewal, replication, redeployment, and recombination. The expansion of international operations is a case in point.

Dynamic Capabilities through the Selection and Implementation of Improved Business "Models"

A business model defines the manner in which a business enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit. It is the hypothesis about what customers want and how an enterprise can go about getting paid and making a profit for the value it delivers. It explains: (1) how the revenue and cost structure of business is to be "designed" to meet customer needs; (2) the way in which the resources are to be assembled; the identity of market segments to be targeted; and (3) the mechanisms and manner by which value is to be captured. The function of a business model is to "articulate" the value proposition, identify targeted market segments, define the structure of the value chain, and estimate the cost structure and profit potential (Chesbrough and Rosenbloom, 2002: 533–4). In short, a business model is a plan for the financial "architecture" of a business which makes valid assumptions about costs, scale, and customer and competitor behavior. It outlines the contours of the solution required to win in the marketplace.[38] Once adopted it defines the way the firm "goes to market". A good business model will scale globally.

Getting the business model right is critical to the success of a new business; adjusting and/or improving the model is likely to be critical for continued success. The capacity an enterprise has to create,

adjust, and hone globally scalable business models is a critical dynamic capability. There are some firms whose global expansion is built entirely on a business model. McDonald's introduced fast-food franchising, and Dell introduced direct-to-consumer sales of personal computers and related computer equipment. Neither of these firms has spent substantial sums on R&D. Both have developed systems and methods to figure out what products customers want; and both have developed new and different and cheaper ways of getting products to the consumer in a predictable fashion. The essence of their success depends importantly on the business models that they have employed.

Dynamic Capabilities through Investment Choices: The Special Role of Complementary and Cospecialized Assets[39]

In most analyses of competition and competitive advantage, it is common to stress that various innovations are substitutes, rather than complements that may be cospecialized to each other. Indeed, Schumpeter (1934) stressed that successful innovations/firms are threatened by swarms of imitators, all striving to produce "me-too" substitutes.[40] Of equal if not greater significance, particularly in industries in which innovation might be characterized as cumulative, is complementary innovation. For instance, in the enterprise software industry business applications can be especially valuable to users if they can somehow be integrated into a single program, or into a tightly integrated suite. The development of gyroscopic stabilizers made imaging devices such as video cameras and binoculars easier to use, and enhanced the product, especially when the new features are able to be introduced at low cost. Likewise, better batteries enable personal computers and cell phones to run longer between charging. Situations of complementarities between technologies, and between technologies and other parts of the value chain, are extraordinarily common, yet infrequently featured in economic analysis and in strategy formulation. With the sources of technology being widely distributed internationally,

there is a requirement to integrate globally distributed assets using the multinational enterprise as the fulcrum.

Complementary assets where the value of an asset is a function of its use in conjunction with other assets can be referred to as cospecialized assets.[41] With cospecialization, joint use is value enhancing.[42] Situations of cospecialization can emerge from R&D investments or from "thin" markets, that is, the assets in question are idiosyncratic and not readily bought and sold in a market. Capturing cospecialization benefits frequently requires integrated operations. Cospecialization allows differentiated product offerings or unique cost savings. When markets are thin, competitors aren't able to rapidly assemble the same assets by acquisition, and hence cannot offer the same products/services at competing price points. An enterprise's ability to identify, develop, and utilize specialized[43] and cospecialized assets built or bought is a core dynamic capability.

With cospecialization, special value can be created (and potentially appropriated by another party) when an asset owner is not cognizant of the value of its assets to another party with assets whose value will be enhanced through combination.[44] This arises because the markets for cospecialized assets are necessarily thin, and are frequently global in nature. Because the cospecialized assets in question are unique, competitors cannot necessarily obtain these assets, and even if they could, the cospecialized asset is likely to have a different value in use if the competitor has a different portfolio of complementary assets.

In short, the dynamic capabilities framework suggests that cospecialized assets may need to be combined globally in order to enable (systemic) innovation[45] to proceed. If they cannot be procured externally, they will need to be built internally. MNEs can create value by combining cospecialized assets. This may require the use of innovation routines to create the necessary cospecialized technologies. Inasmuch as complementary technologies are frequently dispersed globally, such technologies will need to be pulled together on a global basis.

The computer, software, and electronics industries are riddled with cospecialization requirements and opportunities domestically

and globally. A case in point was the development of NAND flash memory for digital film. Besides the capability to develop and manufacture flash memory, one also needs NAND controller technology to access flash memory quickly to enable the use of flash memory for digital photography. (Photographers didn't want to wait more than a few seconds at most between photo shoots.) Without NAND controller technology, NAND flash couldn't advance commercially. With it, an entire new application domain would open up. Since NAND flash controller technology wasn't ubiquitously available, the semiconductor flash memory manufacturers had to (1) invest in R&D to develop their own (several tried and failed) or (2) try and acquire the technology externally—naturally difficult as the technology was in only one set of hands, and wasn't for sale via a naked license arrangement. Toshiba, for example, had the requisite NAND flash memory chip technology, but lacked controllers. It turned to Lexar, and later to SanDisk to provide the controller technology. The global integration of these technologies by Toshiba (its dynamic capabilities) was important to its success in flash memory devices.

Another example is the iPod pioneered by Apple. Steve Jobs and his colleagues at Apple combined known technology (digital music players had already been invented) with the iTunes music store (a cospecialized "asset" pioneered by Apple—CEO Steve Jobs himself persuaded key artists to provide content) and digital rights management (DRM) software developed by Apple to give the artists confidence that their music would not be pirated. These key elements were combined in a superbly well-designed package (the iPod player itself) which has obliterated Sony's lead in the personal stereo market (the Sony "Walkman"). Nevertheless, the components that make up the iPod are almost all completely outsourced. As one observer noted: "take an iPod apart and 83% of the components are made by Japanese companies".[46] In short, it was Apple's dynamic capabilities—the ability to sense a market need, and then to uniquely bring together all the necessary cospecialized assets—that undergirds Apple's success with this product, which has been sold through Apple stores around the world.

Indeed, the example illustrates an increasingly common form of MNE, with the global sourcing of components and the bringing together by management of disparate assets from unexpected quarters.

Dynamic Capabilities through Asset Orchestration, Knowledge Sharing, and Coordination[47]

One of management's core functions is to develop and implement a company's unique strategy, and to forge a "fit" globally amongst (and within) assets, structures, and processes. The firm's management team must also decide which technological opportunities and customer needs the company will respond to, and then line up the resources/assets needed to effectuate the strategy. The ability to proactively adapt, redeploy, and reconfigure in an entrepreneurial fashion gives meaning to "orchestration", and thus to dynamic capabilities.

Redeployment and reconfiguration are business model redesign and asset-reshuffling processes that need to be ongoing in an organization confronting change. Redeployment could involve transfer of nontradable assets to another organizational or geographic location (Teece, 1977). It may or may not involve mergers and acquisitions.[48]

Examples abound. Several major airlines are trying to create separate low cost "carriers within carriers", partly in response to the success of Southwest airlines in the USA. United Airlines has created Ted, KLM the Dutch airline has created Buzz, British Airways has created Go, and Delta Airways first Delta Express and more recently Song. Song has a lean management team, targets women customers, has new boarding procedures, packs in more seats, and targets higher aircraft utilization (Daniel, 2003: 8). Existing Delta aircraft and employees were redeployed into the new company to get it started. These restructurings involve both a modification of the business model, and a redeployment of assets—two elements of dynamic capabilities working together, hopefully in unison.

Dynamic Capabilities through Efficient Learning, Technology Development, and Protection of Intellectual Property

It is well recognized that individuals develop knowledge inside the business enterprise.[49] Failure to share such knowledge across divisions and geographies as needed may well lead to greater opportunity loss/untapped potential than any loss through the exercise of managerial discretion, for example, the consumption of managerial/worker perquisites. It is rather difficult to monitor such behavior, however, as it is hard to calibrate what employees know, and what they are holding back. Good incentive design and the creation of a learning, knowledge-sharing, and knowledge-creating environment on a global basis is likely to be critical to business performance, and foundational to the dynamic capabilities of MNEs (Nonaka and Takeuchi, 1995).

Of equal importance is monitoring and controlling the transfer and "leakage" of trade secrets and intellectual property. Innovating business enterprises with limited experience have been known to inadvertently compromise or lose their intellectual property rights.[50] Failure to proactively monitor and protect know-how and intellectual property is a common governance failure. The appropriation of shareholder capital for personal gain can occur with "spinouts" and the departure of key employees. Spinouts may be led by management, or by key employees.[51] Monitoring know-how leakage and guarding against opportunistic exits is both a board and management-level responsibility.

The outsourcing of production and the proliferation of joint development activities likewise create requirements that firms develop governance procedures to monitor the transfer of technology and intellectual property. Technology transfer activities which hitherto took place inside the firms increasingly take place across organizational boundaries. The development of governance mechanisms to assist the flow of technology domestically and globally while protecting intellectual property rights from misappropriation is key to dynamic capabilities in many sectors today.

7. *Dynamic Capabilities, Resources, and Competitive Advantage*

The general framework advanced in this book sees difficulty-to-imitate and globally scalable dynamic capabilities (and resources) as foundational to the competitive advantage of multinational enterprises. The greater the diversity and rate of change in business environments, the more critical are dynamic capabilities for the financial performance of the MNE.

Some observers have identified a modality of competition which they refer to as hypercompetition. It is a modality "characterized by intense and rapid competitive moves, in which competitors must move quickly to build [new] advantages and erode the advantages of their rivals" (D'Aveni and Gunther, 1994: 217–18). Hypercompetition appears to be the result of rapid innovation, globalization, and deregulation. Dynamic capabilities are likely to be essential to the survival of MNE in industries and environments which can be characterized as hypercompetitive.

As noted above, it is of course necessary that the MNE build capabilities that are "sustainable", that is, nonimitable. Nonimitability is more confidently assured in the presence of "isolating mechanism" and "tight appropriability regimes"[52] (Rumelt, 1987; Teece, 1986a). When the appropriability regime is "tight", differential performance can be more readily sustained, at least for a time.[53] In short, dynamic capabilities alone are unlikely to suffice to create a durable or sustainable competitive advantage for the MNE.

The dynamic capabilities perspective on the MNE is about more than rapid innovation, adaptation, and flexibility. It is also about the proactive entrepreneurial shaping of the multinational enterprise and its global environment. Achieving dynamic capabilities can be seen as both a process design task and an organizational design/structure task (Volberda, 2003: 467), and possibly a "market design" task. Neither flexibility nor orchestration can be achieved with rigid bureaucratic structures or with deep hierarchies. Indeed, a considerable amount of decentralization coupled

with coordination with groups and entities inside and outside the firm both at home and abroad is likely to be necessary for an MNE's dynamic capabilities to be continuously manifested.

Dynamic capabilities are resident in a firm's processes and routines and also within the firm's top management team. The continuous manifestation of dynamic capabilities within the MNE requires continuous entrepreneurial activity. The entrepreneurial activity is different but related to the managerial activity. Entrepreneurship is about understanding opportunities, getting things started, and finding new and better ways of putting things together. It is about coordinating on a global basis the assembly of disparate and usually cospecialized elements, getting "approvals" for nonroutine activities, sensing business opportunities, and finding ways to scale capabilities globally. We have come to associate the entrepreneur with the individual who starts a new business providing a new or improved product or service. Such action is clearly entrepreneurial; but the entrepreneurial function required in the MNE context should not be thought of as confined to startup activities.

As noted earlier (Teece, 1977), the effective conveyance of (dynamic) capabilities constitutes the crux of the processes of technology transfer, and in turn ought to be seen as the crux of the MNE. To be competitive globally, it is not enough that an enterprise have dynamic capabilities; it must be able to utilize/transfer them across national boundaries, and orchestrate them as part of a global network.

The special challenges associated with replicating capabilities globally should not be underestimated. Differences in the labor force, in financial markets (despite their global features) regulations and cultures are critical factors that must be taken into account in shaping strategy. 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 in the home market is poorly appreciated, so unless the MNE has already replicated its systems of productive knowledge in other markets, 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.[54] Even understanding what all the relevant routines are that support a particular competence may not be transparent. Indeed, Lippman and Rumelt (1982) have argued that some sources of competitive advantage are so complex that the firm itself, let alone its competitors, does not understand them.[55] 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 that 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 e.g. 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 expansion and has been emphasized here. The other is the ability to support product-line expansion. To the extent that the capabilities in question are relevant to customer needs elsewhere, replication can confer value.[56] 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.

Factors that make replication difficult also make imitation difficult. Thus, the more tacit the MNE's productive knowledge, the harder it is to replicate by the MNE 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.

In conclusion, the concept of dynamic capabilities, when applied to the MNE, highlights organizational and (strategic) managerial competences which can enable an MNE to achieve superior performance. Key ingredients are difficult to replicate routinized processes, the basic manner in which a business is designed, as well as the decision frames, heuristics, and protocols which enable MNEs to avoid poor investment choices and embrace astute ones. Once assets are within managements' orbit, their effective utilization and continuous orchestration becomes essential. Indeed, orchestration directed at achieving new combinations and asset coalignment is central to the dynamic capabilities framework. Preventing imitation and internal rent dissipation are key elements too.

Lying at the heart of dynamic capabilities are five fundamental management/organizational skills: (1) learning and innovation processes; (2) business "design" competence (what business model to employ); (3) investment allocation decision heuristics; (4) asset orchestration, bargaining, and transactional competence; and (5) efficient governance and incentive alignment. Buttressing these is an understanding of the processes of imitation

and the strategies and processes that can be used to protect intellectual property. Widely diffused managerial and organizational competence cannot be core elements of an MNE's dynamic capabilities.

Note that dynamic capabilities flow from more than just learning and technological accumulation. In this sense, the framework offered here goes further than that which has been advanced by Cantwell. This is not meant to downplay the importance of technological accumulation. Technological innovation and learning remain as an important mechanism by which firms build from specific (technological) capabilities. But in a world where the global outsourcing of R&D is common (Teece *et al.*, 1988; Chesbrough, 2003) it will be problematic to rely too much on in-house R&D as undergirding competitive advantage. Furthermore, as several companies have demonstrated, distinct business models alone can be the source of competitive advantage.

The dynamic capabilities framework relegates an MNE's administrative competence to secondary importance, unless such competence is embedded in distinct and difficult-to-replicate business processes. Stable administrative functions can typically be outsourced to multiple vendors. Of course, there may well be circumstances where administration is complex, novel, and difficult to imitate in which case it can be the source of competitive advantage.

The distinct skills which constitute an MNE's dynamic capabilities cannot generally be bought or "outsourced"; they must be built, or at least assembled. Once cospecialized assets are assembled, they must be skillfully orchestrated on a global basis. Such orchestration skills require astute decision-making on a global basis and an entrepreneurial capacity built into the management team. These skills and processes will undergird long-run enterprise performance and cannot be outsourced without loss of competitive advantage. They lie at the core of the MNE's capabilities. MNEs possessing dynamic capabilities are able to quickly respond to, and shape, evolving technologies and marketplaces. Accordingly, they ought to demonstrate superior enterprise performance over multiple product life cycles.

8. Imperfect Competition and Bargaining Theory

Introduction

In Sections 6 and 7, efforts were made to explain how notions of enterprise capability can enhance our understanding of MNE. In this section, I wish to ask whether the theory of MNE would suffer if all references to market power and oligopoly theory were purged.[57] I conclude that not much would be lost, and something would be gained. In doing so, the desire is to shed additional light on the Hymer theory of the MNE which wobbled schizophrenically between monopoly power and efficiency (internalization) interpretations.

The Theory of Imperfect Competition

The theory of imperfect competition endeavors to analyze how product and factor market competition evolves when price and output decisions are interdependent. Even in this domain, oligopoly theory is notorious for establishing results that are indeterminate. Game-theoretic formulations make clear that different assumptions lead to different conclusions. Game-theoretic analysis, by proving that almost any outcome is possible, ends up proving nothing. Few economists claim that oligopoly theory is robust, and most recognize the unsatisfactory state of the theory of imperfect competition.

Since the work of Hymer, there have been numerous, but usually quite perfunctory references to the theory of imperfect competition and oligopoly in the course of developing the theory of multinational enterprise. Frederick Knickerbocker (1973) did in fact develop a theory of DFI based on an argument that firms will invest abroad to defend markets abroad. In essence, he has a "copycat" model of DFI where if one firm invests abroad, others will follow. The basic idea is that foreign investment is triggered not by the desire to seize opportunity, but by the desire to protect market power. DFI is insurance against unexpected competitive

moves of one's rivals. Knickerbocker's reasoning lacks rigor or good logic.

Students of international business have "tipped their hat" in an almost perfunctory way to oligopoly theory and the theory of imperfect competition; in the next section, I suggest that a useful approach, at least until oligopoly theory finds its way is to (i) abandon it and (ii) focus on bargaining theory in the context of thin markets as a conceptual lens to help explain the multinational scope of the enterprise, and the division of profits between international firms and the (indigenous) owners of cospecialized assets.

Bargaining Theory, Cospecialization, and the MNE

As discussed earlier, the rationale for DFI and MNE activity frequently stems from the possession, by the enterprise, of difficult-to-replicate tangible and intangible assets, innovation routines, quality protocols, and the like. The exploitation of such capabilities frequently involves bringing together what the firm has at home with what other firms own abroad. Complementary technologies which are globally distributed but which must be aggregated for a new market opportunity to be addressed are a case in point. The particular geographic location in which complementary capabilities exist is of little moment. The issue is usually the same. No matter where they are located, there isn't a well-developed market for the existence of such complementary (and possibly cospecialized) assets. Nevertheless, MNEs frequently need to make contractual arrangements for access to such assets.

Bargaining theory (not oligopoly theory) has something to say about the terms upon which access can be arranged. It suggests that the terms of trade are likely to be affected by whether either party has credible contractual alternatives. In this regard, game-theoretic models of small numbers bargaining arrangements which explore the implications of information asymmetry may well be relevant. However, the general framework isn't one for which oligopoly

theory yields deep insights. The situation is better characterized as one of bilateral "monopoly" in factor markets.

Of course, the monopoly power at issue isn't the monopoly of market control which is the subject of antitrust (competition) policy. Rather, the situation to be modeled is one in which it is desirable to assemble complementary assets when input/factor markets are thin. Accordingly, traditional notions of oligopoly and imperfect competition are at best secondary to the issues which ought animate the theory of MNE.

In this regard, Hymer took the field of international business and international economies down the wrong path for three decades. It's now time for these deficiencies to be addressed. The emerging literature on the resources/capabilities theory of the firm is endeavoring to do so.

Public Policy

The notion that oligopoly/monopoly theory (focused on product market behavior) has utility with respect to understanding the essence of MNE strategy has already been challenged (Teece, 1981c, 1983, 1984) with respect to the theory of the MNE. For whatever reason, this challenge has largely gone unnoticed in the theoretical literature, although the actions of most policy makers today is consistent with them being unconcerned with Hymer's worries about monopoly.[58] My earlier critique was hostile to both Hymer's interpretation of the MNE, as well as to the utility (in the context of MNE behavior) of oligopoly theory more generally.

The conundrum which the literature has been slow to sort out relates to both the positive and the normative theory of MNE. If one adapts a comparative institutional approach (as recommended by Williamson) then one would see the MNE not as an instrument of monopoly, but as an instrument of global efficiency, transferring technology to and enhancing capabilities in offshore subsidiaries. This is of course precisely what has happened over the past half-century of active DFI. Yet Hymer and his followers embraced the

MNE with great ambivalence, enveloped as they were by market control theories of the MNE. One can take comfort that policy makers did not pay much attention; for to restrict DFI would have denied many countries access to the capability-enhancing capacities of MNEs. Indeed, whatever problems MNEs may have created, monopolizing markets at home or abroad has not been one of them. The presence of direct foreign investment by MNEs in a host economy usually results in higher wages, skill augmentation, and higher quality products. Indeed, if anything, MNEs have tended to break up cozy relationships amongst incumbent domestic competitors. The growth of American DFI in the UK is a case in point.[59]

More vigorous competition (not diminished competition) seems to have followed the expansion of the MNE in practically all jurisdictions. Indeed, in the debate surrounding globalization, to the extent that MNEs are vilified, it is because they bring competition (not monopoly) and the erosion of market position to otherwise protected and inefficient domestic firms in the advanced industrial countries. Put differently, the policy concerns today are quite the opposite of Hymer's.

9. Conclusion

The last half-century has seen the emergence of an important body of scholarly work on the multinational enterprise and direct foreign investment. Stephen Hymer is a critical figure in this evolution in that, in a true Kuhnian sense, he challenged existing paradigms (easy, as they were weak and barely existent) and steered scholarship in the direction of firm- and industry-specific inquiry. With hindsight, this was not a huge leap as notions of firm-level competitive advantage were embedded in the business literature at this time. However, the field of strategic management (where such ideas could be found) was itself bereft of a theory-building activity. As a result, Hymer could write on an almost clean sheet of paper. He did so, and he did so well. The fact that his efforts are still discussed 50 years later speaks to his contribution. That

said, he simultaneously toyed with capabilities notions, market power notions, and internationalization notions. The seeds of an acceptable theory of the MNE were sown by Hymer, but not reaped during his lifetime. He failed to fully explore where an MNE's special advantages came from, in part, perhaps, because he was handicapped by the weaknesses of neoclassical economics itself, which provided no definitions, propositions, or theorems connecting the underlying asset structure of the firm to its performance.

Since Hymer's untimely death, at least two generations of scholars in international business, strategic management, organizational behavior, and strategic management have presented and tested new ideas which now make it possible to view the MNE differently, and more realistically. In particular, the capabilities framework specifies the nature of various classes of difficult-to-replicate assets that MNEs may possess. These capabilities are ones that can generally be scaled successfully, that is, MNEs can establish the various processes, procedures, business models, and governance procedures in jurisdictions other than the home country. In describing capabilities that MNEs have, the framework implicitly assumes that the capabilities in question are well honed, that is, that they are best practice or near best practice, at least compared to what's already operating amongst competition enterprises in the foreign jurisdiction.

Some might ask whether the capabilities framework adds anything to the existing frameworks since these already recognize the importance of specific assets, technological accumulation, and technology transfer. This can be answered in the affirmative. To simply refer in general to the importance of "intangibles" and know-how is hardly adequate. The treatment advanced here recognizes a broad range of nonimitable organizational and managerial assets which, once transferred abroad, can provide the basis for the MNE's competitive advantage.

The presence of nonimitable firm-specific assets (possessed by MNEs) is important to the theory of the MNE as it suggests, *inter alia*, (1) DFI can occur in industries other than research-intensive ones. MNEs may possess firm-special organizational assets, that is,

as noted, Dell Computers business model can suffice to undergird its global DFI strategy. (2) The assets that are at the core of the MNE's competitive advantage are ones for which the market for know-how is likely to function rather poorly. Organizational routines, governance systems, and business models cannot generally be protected by the instruments of intellectual property law—and the absence of secure property rights is likely to handicap the operation of the market for know-how—indicating that DFI is likely an important vehicle by which firms capture value from innovation. (3) The firm with the high performance systems is likely to be able to generate sufficient profits and the cash flow to support scaling the business, domestically and internationally. (4) MNE expansion is likely to be associated with entrepreneurial management, that is, firms active in seeking and effectuating "new combinations" domestically are also likely to seek and effectuate them globally. (5) MNE expansion is likely to be as much a function of business creativity as it is technological prowess. Indeed, since technologies and intellectual property can generally be licensed more readily than business intangibles, the framework would suggest high levels of DFI from countries with high levels of business creativity, all else equal.

The framework outlined here may be considered a mere refinement by some. However, a case can be made that the capabilities approach provides significant augmentation to our understanding of the MNE. The framework recognizes the importance of technological know-how, but also a whole raft of organizational and managerial factors which have hitherto not received much attention. In particular, the role of asset orchestration capabilities, the development and transfer of business and operating routines, the role of shrewd investment choices and asset alignment skills, and the role and importance of developing scalable business models are rather new to the literature in international business and the theory of the MNE. It is hoped that these ideas will stimulate further research and help us better understand the nature, behavior, and effects of MNE activity in the global economy.

Notes

1. For earlier assessments of Hymer's work by this author, see Teece (1981c).
2. The internalization school began with Coase but was applied most enthusiastically and completely to the MNE by Buckley and Casson (1976), Rugman (1980), and others (see below).
3. Hymer took considerable inspiration from his advisor and champion, Charles Kindleberger; hence I sometimes refer to the Hymer/Kindleberger approach to recognize the close association between the two.
4. New information and communication technologies and in particular the Internet have lowered the costs of international interactions for small firms and large firms alike.
5. A company that engages in international business by exports and imports, or by non-equity-based strategic alliances, ought not be thought of as an MNE, despite the fact that their operations might have an international flavor.
6. For a review of the state of theory pre-Hymer, see Letto-Gillies (2005, chapters 3 and 4).
7. A secondary detriment of DFI advanced by Hymer was that DFI and MNE activity would remove conflict (competition) in foreign markets. Direct control of production abroad would somehow, in Hymer's view, reduce competition and augment market power, thereby enhancing market imperfections. While this is undoubtedly a theme of Hymer, it is a flawed approach and is not given primary emphasis here. However, the issue of imperfect competition is raised in Section 8 below.
8. Such industries were in turn frequently research intensive.
9. See Ronald Coase (1960: 15).
10. This was very much a US tradition, as at the time the study of antitrust economics and competition policy was primarily an American intellectual and policy enterprise.
11. Put differently, if the MNE has special advantages as Hymer posits, perfect competition is inconsistent with the existence of multinational enterprise.
12. In this regard, Hymer was engaging in what Harold Demsetz calls "Nirvana Economics" (1969).
13. See Pleatsikas and Teece (2001a, 2001b).
14. Hymer assumes that local firms had informational advantages relative to the foreign firm in the local market.

15. Ed Mason was a Harvard economics professor. Joe Bain was a University of California at Berkeley economics professor. The essence of their paradigm is captured in Bain (1958).
16. See Ronald Coase (1937).
17. But see below that he did appreciate that technology transfer does raise contractual issues. As noted later, it was not until Dunning (1980) and Teece (1986b) that these two factors (special advantages and internalization) were brought together.
18. I refer to developments with respect to the resource-based view of the firm, and dynamic capabilities.
19. None of the early writers developed a comprehensive framework around the development of (dynamic) capabilities. Nevertheless, the various classes of assets that could give rise to competitive advantage were at least identified and discussed.
20. See the quote above from Teece (1985).
21. Dunning refers to this as the OLI paradigm (for ownership, location, and internalization).
22. This is discussed later in Teece *et al.* (1997).
23. Figure 10, p. 295 from Teece (1986a) illustrates how both asset/capability factors can be examined along with internalization (contracting).
24. John Cantwell (1989, 1995) has recognized this and done much to explain how a firm can generate new knowledge and competitive advantage. This is very much in the spirit of Alfred Chandler and is consistent with the ideas advanced in the latter sections of this chapter.
25. See also Chesbrough and Teece (1996).
26. This analysis assumes an environment where market institutions are well developed, and contracts will be honored by the courts.
27. Because the thickening of intermediate markets is likely to make intermediate product transactions easier.
28. Unfortunately, Williamson's (1975, 1985) framework was not dynamic but he did recognize, as Dunning did, that integration decisions depended on more than just internalization advantages.
29. In Buckley and Casson (1985).
30. See also Feinberg and Gupta (2004).
31. However, as discussed below, the quote omits the importance of strategic capabilities. Note also that capabilities may be at the foundation of Hymer's "special advantages".

32. The reference here is to the resource-based theory of the firm advanced by Rumelt (1984), Wernerfelt (1984), Amit and Schoemaker (1993), and others. My earlier work (Teece, 1980a, 1982) was also in this vein.
33. It is critical to analytically treat the firm's assets as not necessarily being permanently bound ("integrated") to the firm.
34. This view is consistent with Cantwell's view that MNEs generate their technological capabilities—but it suggests that more is needed to sustain competitive advantage.
35. Orchestration is the process by which managers make, build, acquire, deploy, and redeploy decisions with respect to assets/capabilities. This concept is developed later in Sections 2 and in 4.
36. Makadok (2004) distinguishes between flexibility and commitment-based theories. As explained in Teece *et al.* (1997) the dynamic capabilities approach is definitely Schumpeterian in its lineage and can be thought of as endorsing the value of flexibility. However it ought to be recognized that the dynamic capabilities framework may not be relevant to all environments, e.g. highly regulated industries shielded from competition such as water reticulation. One observer has coined the term "hypercompetition" to describe environments in which there are intense and rapid competitive moves requiring quick responses by incumbents and new entrants alike (D'Aveni, 1994). The framework advanced here recognizes both resource "fit" and cospecialization, along with flexibility. In short, it does not see a stark distinction between flexibility and fit, although it recognizes that the latter will need to be continuously adjusted (orchestrated).
37. For a review of the literature on routines, see Becker (2004).
38. Marketing strategy and procurement strategy are key elements of this solution.
39. This term, complementary and cospecialized assets, was introduced into the strategic management literature in Teece (1986a), and the definition used here is the same.
40. Schumpeter wrote (1934: 223) that innovations/new combinations carried out by entrepreneurs "are not, as one would expect according to general principles of probability, evenly distributed through time . . . but appear, if at all, discontinuously in groups or swarms". This swarm appearance of innovations and innovative activity occurs essentially "exclusively because the appearance of one or a few entrepreneurs facilitates the appearance of others, and these the appearance

of more, in ever-increasing numbers" (1934: 228). Recent studies which analyze patent races have also reinforced the view that innovations are substitutes, not complements.

41. Lippman and Rumelt's (2003a, 2003b) recent work on developing the microfoundations for resource-based theory is very complementary to my development of the microfoundations of dynamic capabilities. I acknowledge their efforts in modeling co-specialized and complementary assets. In particular, they use the concept of supermodularity to bring in the tools of cooperative game theory. The idea of supermodularity was introduced by Donald Topkins as a way to formalize complementarity, and is also used by economists such as Milgrom and Roberts (see in particular Milgrom and Roberts, 1990) and evolutionary game theorists to model (strategic) complementarities (for instance in models of R&D spillovers).
42. Complete cospecialization is a special case of economies of scope where not only are complementary assets more valuable in joint use than in separate use, but they may in fact have zero value in separate use and high value in joint use. Cospecialization may stem from economies of scope, but they could also stem from the revenue enhancement associated with producing a bundled or integrated solution for the customer.
43. A specialized asset is one where the asset cannot be put to alternative use without loss in value. In the classic mine-mouth coal-fired electric-power facility (Joskow, 1985), once the electricity-generating facility is built at the mine mouth, there is a contractual hazard associated with obtaining coal from the mine. Long-term contracts entered into may or may not suffice to provide adequate protection against the mine owners jacking up the price of coal to the generating facility. If the mine owners can sell coal in (thick) global markets, they might conceivably not be dependent on the generating facility. If the power facility cannot get the same or similar coal from another mine at the same price, and if the coal mine cannot dispose of its coal elsewhere except at a lower price, then the condition of cospecialization exists.
44. Even if they are cognizant, they do not have the bargaining power to take advantage of the situation.
45. For a discussion of systemic innovation, see Teece (1988, 2000).
46. Jesper Kroll. Quoted in the *Financial Times*, May 5, 2005, p. 11.
47. As suggested by McKelvey *et al.* (2004) these elements of dynamic capabilities are also discussed by some scholars under the topic of the

knowledge-based theory of the firm. In Teece *et al.* (1997) as well as in earlier drafts, the development of dynamic capabilities stressed the importance of innovation, learning, and the "coordinative capabilities of firms".

48. As Capron *et al.* (1998) explain, failures in the market for resources sometimes cause firms to buy and sell business. What they refer to as market failure appears to relate to the "thin market" problem discussed in Section 4.
49. Active R&D and other knowledge-generating activities are one way to develop such knowledge.
50. For example, Xerox lost control of much of its personal computer technology when it allowed Steve Jobs, without restriction, to see a demonstration of the Xerox Star Personal Computer System.
51. The design of contractual constraints, incentives, and corporate cultures to minimize such activity is a critical element of dynamic capabilities.
52. In the cited treatment, intellectual property protection, the tacit nature of know-how, and the inherent difficulty of technology, another factor developed in this chapter is the unique coalignment of specific assets. Specific assets may not simply be ubiquitously available.
53. Competitive advantages are continuously eroded by actions of other players, which lead again to higher levels of competition and the need to react faster. In the end, these dynamic interactions between firm learning and adaptation, on the one hand, and higher levels of competition and selection, on the other hand, can cancel each other out. This is often dubbed an "arms race" or "the Red Queen effect" (Kaufman, 1995) after the comment to Alice, "it takes all the running you can do to keep in the same place" (Carroll, 1946). Companies adapt faster and faster, but as a consequence of the resulting increase in competition they do not make any progress. When isolating mechanisms are operative, and appropriability regimes are tight, Red Queen effects can be overcome, possibly over several life cycles of the product or process.
54. 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.

55. If so, it is our belief that the firm's advantage is likely to fade, as luck does run out.
56. 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.
57. I do not mean to imply that MNEs never have market power and never exercise it. I do, however, suggest that in markets open to international trade and investment it is relatively rare. More importantly, when wielded as an explanation of MNE behavior, it has often shielded the observer from considering more fundamental factors which drive international expansion, including the global scaling of technological and organizational capabilities.
58. Most of the Asian NICs, including Singapore, Taiwan, Korea, and now China, have embraced direct foreign investment in their economies. Policy makers in these countries appear to recognize the benefits that the MNE provides through technological capabilities and market access.
59. To be fair to Hymer, his greater concern may have been that the MNE would undermine the nation state. It is the case that direct foreign investment and outsourcing in particular has had ramifications for various domestic constituencies such as labor.

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Part II

The Business Enterprise in Economic Development

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Chapter 6

The Role of Management, Enterprise, and Technology in the Wealth of Nations

Scholarship in economic development focuses on macro economic factors (e.g., investment level), infrastructure, technology and skills, and the institutional environment, to name just a few topics. Attention to the business enterprise is often seriously missing. This chapter tries to insert a capabilities theory of the business enterprise into the broader study of economic development.

1. Introduction

It is increasingly recognized by scholars who study economic development that plentiful land, labor, and capital are insufficient to support sustainable wealth creation.[1] It helps to have a good climate and plenty of land, but no nation has become wealthy just from good land and warm weather. Fiji and the Congo are well endowed in this regard, but are poor and likely to remain so.

The organization of society—especially the institutional, political, and legal systems—are key ingredients of success. Absent the appropriate legal systems, clear and enforceable property rights, competitive markets, and mechanisms for good governance, the benefits of a market economy cannot be fully realized. Wealthy countries rely on private enterprise and market organization, have stable political systems, property rights that are recorded and respected, and some level of protection against governmental takings. It is also critical to have a stable monetary policy, an educated labor force, a properly functioning judicial system, and some means for the smooth transfer of power. These foundations encourage investment and foster innovation.

However, once one gets beyond such fundamentals, it is not so easy to figure out the details of the economic system most likely to support sustained productivity growth and wealth generation. While productivity growth has been a topic of scholarly inquiry amongst economists for decades, the productivity slowdown that occurred in the USA in the 1970s challenged the ability of (neoclassical) growth theory to explain what was going on. Up through this time period, the Hicks–Kaldor view that investment levels and capital stock were the chief determinants of growth was commonly accepted. However, mainstream growth theorists have been unable to explain the ascendancy of China, Japan, and other Asian "tigers", and productivity slowdowns and increases in the USA.

It is now recognized that the technical apparatus of growth theory does not adequately feature the role of technology, institutions, and the legal system in the process of economic growth and development in market-based economies. Ironically, classical

economists including Adam Smith, Karl Marx, and Joseph Schumpeter at least understood the role of technological innovation quite well, but the postwar growth theorists smothered these insights, and it took some time for intellectual blinders to be removed. Now that they have, we are able to focus more clearly on the role technology, business enterprise, and supporting institutions play in economic growth and development.[2] In this chapter I focus mainly on the role of business organization and technology, since both (and especially the former) have been seriously neglected.

2. The Business Enterprise

We are accustomed to thinking of competitive advantage as residing with nation states. Ricardo argued that it was differences in soil and climate that anchored differences in endowments as between England and Portugal. It was understandable that Ricardo might take this view since firms as we know them today simply did not exist; and even when economists started focusing on firms and not farms, firms were viewed in a rather undifferentiated fashion. Moreover, (perfect) market competition left little room for discretionary behavior by managers.

However, we all know better now, thanks in part to the encyclopedic work of business historian Alfred Chandler from Harvard University. As I note elsewhere, there is a large body of scholarship supporting the notion that the competitiveness of nations depends in an important way upon the organizational and financial capabilities of firms and their supporting institutions.[3] Professor Chandler recounts the history of how managers in the USA, Britain, and Germany built the organizations and took the risks of investment necessary to capture the economies of scale and scope opened up by the technological innovations of the second Industrial Revolution. His thesis is not that markets shape business organization, as is commonly supposed in economic theorizing; rather, it is that business organizations shape markets.[4] More recently, the same themes have been restated.

Most essential to the successful maintenance of the long term health and growth of the enterprise are the learned capabilities of top management. These managers make the critical decisions in allocating personnel and financial resources that determine the fate of the enterprise and often of the entire industry of the country on which it operates.

And

The competitive strength of national industries depends on the abilities of the core firms to function effectively and to maintain and enhance their integrated learning bases.[5]

The scholarly work of business historians suggests that what firms are able to accomplish depends on what they do themselves as much as what the broader institutional environment permits and encourages. Moreover, the success of business enterprises located at home and abroad helps drive the fortunes of nations; yet the business enterprise does not feature in textbook theories about economic growth. This is clearly a deficiency, and it is only now being remedied.

One cannot overemphasize the importance of top management. If top management makes strategic errors, companies suffer and the nation states where the firm is located are likely to suffer too, at least to the extent resources are not quickly and efficiently redeployed. Commenting on RCA's (Radio Corporation of America) demise in the 1960s, 1970s, and 1980s, Alfred Chandler writes: "If RCA had resisted the computer and avoided the curse of the conglomerate, if it had continued to concentrate, as did its Japanese competitors, on the consumer electronics market, the one it knew best, then it might have remained the industry path definer."[6]

Conversely, if top management is able to assemble resources and orchestrate them wisely, significant wealth creation opportunities are possible, so long as the economic fundamentals are in place. This is what Alfred Chandler teaches in *Scale and Scope*.[7] Tom Watson's leadership in getting IBM into the computer industry with the IBM 360 is now legendary. So are Bill Hewlett and David Packard, first in scientific and industrial instruments, later in computers and computer peripherals. Bob Noyce and Gordon

Moore guided Intel into a pioneering role with the microprocessor. Michael Dell pioneered a new way of organizing the personal computer business. Steve Jobs at Apple launched the iPod and the iTunes music store, playing a catalytic role in the emergence of a legal market for digital downloads of music. Of course, these successes were aided by business friendly environments, flexible labor markets, and global access to skills, capital, and markets.

Many studies have emphasized that it is not only firms but networks amongst them that are important. Alliances, joint ventures, and other interorganizational arrangements enable firms to access and align critical complementary assets, intellectual property, and scarce talent.[8] In rapidly changing environments, the presence of networks turns out to be very important. Strategic alliances, joint ventures, cross-licensing deals, and other arrangements which enable firms to access complementary assets, vertically, laterally, and horizontally help firms prosper. The full vertical integration model is generally no longer viable in markets where there is rapid change; alliances and joint ventures support the ability of firms to assemble, disassemble, and, as necessary, reassemble elements of the value chain as dictated by economic circumstance, or as encouraged by opportunity.

3. Technology and Know-How

It has long been recognized that economic prosperity rests in some measure upon knowledge and its useful application. Many economic historians have emphasized the role of technology and organization in economic development. Nonetheless, until recently many economic theories have surprisingly underplayed the role of invention, knowledge accumulation, and knowledge transfer in economic development. The study of innovation and knowledge transfer has been regrettably relegated to a backwater in mainstream economics as well as in the other social sciences.

In recent years, several structural changes have occurred in global economies that have modified the nature of what is strategic and have served to highlight the importance (to the business

enterprise and to nation states) of knowledge and its management. This is what I now address.

Liberalization of Markets

Since the Kennedy rounds of trade negotiations in the 1960s, markets for goods and services have become increasingly global. Tariff and non-tariff barriers have been lowered. While the world is far from being properly characterized as having adopted free trade, significant progress has been made. Final goods, intermediate goods, and factors of production flow globally with far more freedom than in earlier times. Restrictions on knowledge transfers by both importers and exporters have also been relaxed.

Accordingly, firms cannot so rapidly earn supra-competitive returns by locating behind trade barriers. Transportation costs have also fallen, and information about market opportunities often diffuses instantaneously. Together, these developments have reduced the shelter previously afforded to privileged positions in domestic markets. Competition has been sharpened.

Expansion of What's Tradable

Markets have not only liberalized, but also have been created for many types of "intermediate" products where markets hitherto didn't exist. This has been most amplified in securities markets where swaps and swaptions, index futures, program trading, butterfly spreads, puttable bonds, eurobonds, collateralized mortgage bonds, zero-coupon bonds, portfolio insurance, and synthetic cash are now commonplace. This sudden burst of financial innovation began but 20 years ago, propelled by the move to floating exchange rates, the need to manage risk better, and the opportunity to tap into global pools of capital. It has been aided by developments in computer and information technology, which have enabled the design of new financial products and the execution and monitoring of myriads of complex transactions. Also contributing has been the desire to minimize taxation.

In addition, firms have shown greater affection for outsourcing as suppliers take advantage of the growth in the number of potential suppliers at home and abroad. In the petroleum industry, for instance, markets exist not only for many grades of crude oil and refined products, but also for a range of intermediate products (such as oxygenates) which were hitherto rarely traded. Moreover, certain forms of intellectual property are "exchanged" (cross-licensed) or sold with far greater frequency than was hitherto experienced.[9]

Strengthening of Intellectual Property Regimes

Intellectual property is an aspect of property rights which augments the importance of know-how assets. Knowledge assets are often inherently difficult to copy; moreover, like physical assets, some knowledge assets enjoy protection against theft under the intellectual property laws of individual nation states. In advanced nations, these laws typically embrace patents, trademarks, trade secrets, and copyright.

Intellectual property systems have been strengthened since the 1980s, both in the USA and abroad. Moreover, intellectual property is not just important in the new industries—such as microelectronics and biotechnology—it remains important in pharmaceuticals and chemicals and is receiving renewed interest in more mature industries such as petroleum and steel.

The growth of information technology has also amplified the importance of intellectual property and has injected intellectual property into new contexts. For example, it is not uncommon to discover the foundations of corporate success for wholesalers and retailers buried in copyrighted software and in information technology supporting order entry and logistics.

The Growing Importance of Increasing Returns

Contemporary textbook understandings of how markets operate and how firms compete has been derived from the work of

economists such as Marshall and Chamberlain. These views assume diminishing returns and assign industry participants identical production functions (implying the use of identical technologies by all competitors) where marginal costs increase. Industry equilibrium with numerous participants arise because marginal-cost curves slope upwards, thereby exhausting scale and advantages at the level of the firm, making room for multiple industry participants. This conceptual apparatus was useful for understanding eighteenth-century English farms and nineteenth-century Scottish factories and even twentieth-century American manufacturing. However, major deficiencies in this view of the world have been apparent for some time—it is a caricature of the firm. Moreover, knowledge is certainly not shared ubiquitously and passed around amongst firms at zero cost.[10]

In this century, developed economies have undergone a transformation from largely raw material processing and manufacturing activities to the processing of information and the development, application, and transfer of new knowledge. As a consequence, diminishing returns activities have been replaced by activities characterized by increasing returns. The phenomenon of increasing returns is usually paramount in knowledge-based industries. With increasing returns, that which is ahead tends to stay ahead. Mechanisms of positive feedback reinforce the winners and challenge the losers. Whatever the reason one gets ahead—acumen, chance, clever strategy—increasing returns amplify the advantage. With increasing returns, the market at least for a while tilts in favor of the provider that gets out in front. Such a firm need not be the pioneer and need not have the best product.

The Impact of New Information Technology

New information technology is dramatically assisting in the sharing of information. Learning and experience can be much more readily captured and shared. Knowledge learned in the organization can be catalogued and transferred to other applications within and across organizations and geographies. Rich exchange can take place inside

the organization, obviating some of the need for formal structures. Distribution costs can sometimes be lowered, as with digital music which can be downloaded from the Internet.

Furthermore, network computing, supported by an advanced communications infrastructure, can facilitate collaborative entrepreneurialism by stripping out barriers to communications. It challenges existing organization boundaries, divisions, and hierarchies and permits formal organization to be more specialized and responsive. Interorganizationally, networked organizations have blurred and shifting boundaries, and they function in conjunction with other organizations. The networked organization may be highly "virtual", integrating a temporary network of suppliers and customers that emerge around specific opportunities in fast-changing markets. Recurrent reorganization becomes the norm, not the exception.

Implications

These developments suggest a different dynamic to competition and competitive advantage. The expansion of markets illustrates the point. Since markets are a great leveler, competitive advantage at the level of the firm now flows mainly from the ownership and successful deployment of non-tradable assets. Competitive advantage cannot be built by producing undifferentiated products using undifferentiated components, undifferentiated labor, and globally sourced financial capital. This is because if all inputs can be accessed by all, competition will eliminate economic profits. The paradox is that the domains in which competitive advantage can be built narrows as markets expand. Not even human resources can provide the basis for competitive advantage for a country if the skills at issue can be accessed by all in an open labor market. Of course, this is generally not the case.

The class of assets that is especially difficult, although not impossible, to trade involves knowledge assets and, more generally, competences. The market for know-how is riddled with imperfections and markets are seriously faulted as institutional devices

for facilitating trading in many areas of technological and managerial know-how. Hence, the development of many types of new markets has made know-how increasingly salient as a differentiator, and therefore as a source of the competitive advantage of firms. This can be expected to remain so until know-how becomes more commodity-like. This may happen for some components of intellectual property, but it is unlikely to be a common phenomenon.

The strengthening of intellectual property rights is an important counterforce to the growing ease of imitation. As the diffusion of knowledge and information accelerates, intellectual property becomes more salient. While intellectual property can be traded, and can sometimes be invented around, in many jurisdictions it cannot be infringed with impunity and without penalty.

4. Capturing Value from Knowledge and Competence

The thesis advanced here is that the competitive advantage of firms in today's global economy stems not from market position, but from the ownership and/or employment of difficult-to-replicate knowledge assets, and the manner in which they are deployed. It is always useful to distinguish between the creation of new knowledge and its commercialization. The creation of new knowledge through autonomous (specialized) innovation is a critical function. In theory it can be the domain of the individual, or of the research laboratory, or of autonomous business units. In reality, the commercialization of new technology is increasingly the domain of complex organization.

New challenges require new organizational forms and the development and the astute exercise of dynamic capabilities. Dynamic capabilities reflect the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments.[11] They require an understanding of the nature of knowledge and competence as strategic assets. The nature of knowledge and its replicability (or lack thereof) is thus critical to business strategy and proper management in today's global

economy. Understanding the processes of imitation and/or replication are very important to enterprise success.

Replication involves transferring or redeploying competences from one concrete economic setting to another. Since productive knowledge is typically 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. 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, knowledge assets are not always easy to replicate. Even understanding what all the relevant routines are that support a particular competence may not be transparent. Indeed, some sources of competitive advantage are so complex that the firm itself, let alone its competitors, does not understand them. Furthermore, many organizational routines are quite tacit in nature, making both replication and imitation difficult. Imitation can also be hindered by the fact that few routines are stand-alone. Imitating a part of what a competitor does may not enhance performance at all. Understanding the overall logic of organization and superior performance is often critical to successful imitation.

Owning assets (physical or intangible) can be the source of competitive advantage only if such assets are supported by a regime of strong appropriability or are nontradable or what might be termed "sticky". As discussed earlier, once an asset is readily tradable in a competitive market it can no longer be a source of firm-level competitive advantage. The main classes of assets that are not tradable today are locational assets, knowledge assets, and competences.

Were a perfect market for know-how to some day emerge, knowledge would no longer be the source of competitive advantage. This is unlikely to happen any time soon, but understanding

the limits on the market for know-how is important to understanding how firms can capture value from knowledge assets. Were it to happen, privileged access to government largess and protection would possibly emerge as the main differentiator. Such a world would not be appealing.

5. Conclusion

Knowledge, competence, and related intangibles have emerged as the key drivers of competitive advantage in developed and developing nations. This is not just because of the importance of knowledge itself, but because of the rapid expansion of goods and component markets, leaving intangible assets as the main basis of competitive differentiation in many sectors of the global economy. There is implicit recognition of this in the management literature with the growing emphasis being placed on the importance of intangible assets, reputation, customer loyalty, and technological know-how. While there is some recognition of these changes, there is perhaps a failure to recognize just how deep they are, and how important the business enterprise is to the development and deployment of these assets. As a result of the growing importance of knowledge and competence, the value-enhancing challenges facing management are gravitating away from the administrative and toward the entrepreneurial. This is not to denigrate the importance of administration, but merely to indicate that better administration is unlikely to be the source of competitive advantage, as good administration is ubiquitously available.

Indeed, if one looks at the sources of wealth creation today, they are markedly different from what they were barely two decades ago. In advanced economies, the key sources of wealth creation lie with new enterprise formation and the exploitation of technological know-how and other intangible assets by business enterprises. In some countries privileged access to government largess is still a major factor; but it should not blind us to the critical importance of well-managed businesses, proper governance, and entrepreneurial activity.

To summarize, economic prosperity depends upon good governance, well-organized and managed business enterprises, and the ownership and control of difficult-to-imitate intangible assets, including intellectual property. When the basic foundations of good governance are in place, countries will prosper, and the level of their prosperity depends on their ability to create, utilize, and protect intangible assets. Control of physical capital is fading in its significance; ownership and control of intangibles by business enterprises are in the ascendancy. The understanding of these new developments requires more focus and study on the business enterprise and its management.

Notes

1. See de Soto (2000).
2. These issues have been the focus of my own work. See e.g. Teece (2000, 1998b, and 1998c).
3. See Teece (1986a and 2006b).
4. Teece (1993). See also Chapter 2.
5. Chandler (2001).
6. Ibid. 49.
7. Chandler (1990a).
8. Teece (1996).
9. Grindley and Teece (1997).
10. Teece (1977, 1981b).
11. See Chapters 1 and 2 as well as Teece *et al.* (1997).

Chapter 7

Managers, Entrepreneurs, and the Literati in Economic Development

Economic growth theory has underplayed the importance of the management of the business enterprise in economic growth and development. In today's global economy, business enterprises must be able to sense opportunities, seize or execute on such opportunities, and reconfigure and transform as circumstances dictate. In order to accomplish this, management must be intensely entrepreneurial. Moreover, success in high-technology sectors requires the employment and effective use of many skilled individuals (the literati). This has its own peculiar challenges for management and organization, including the need to design collegial organization structures with low authority, good incentives, and a culture of commitment. Industrial models of organization with deep hierarchies need to be abandoned in favor of distributed leadership models where the employment relation is understood in non-traditional terms.

1. Introduction

Today's global economy has raised the stakes for the business enterprise. Opportunities are amplified, but so are the business risks. A company that is excellent at making the wrong things will fail. Yet it can be mediocre in providing innovative things that people want and it may succeed, at least for a while.

Survival for the business enterprise is not just about executing well; it's about figuring out where to put your resources, realizing those opportunities, and then defending and/or moving on when competition inevitably arises.

Many are familiar with the Old Testament story of David and Goliath. David slew Goliath not because he was bigger and stronger, but because he understood Goliath's vulnerabilities. David had the insight to launch a stone with a sling so that it could hit Goliath where he had no armor—on the forehead.[1]

Everyday, firms compete in the marketplace. Battles for customers and for talent are commonplace, although such battles run by a different set of rules in the commercial world than in the military sphere. There are more and more participants every year, and the competition seems to get tougher. As intermediate (supply) markets expand, and as governments succeed in creating "level playing fields", the number of competitors increases, and privileged access to opportunities declines. The liberalization of trade and investment regimes worldwide has served to sharpen competition in those regions exposed to global competition.

The new world we are in requires a different breed of manager, and more highly skilled employees. In particular managers must think strategically, act entrepreneurially, and execute flawlessly (or very nearly so) if they are to lead their organizations successfully. They must also figure out how to harness the skills of the literati, who play a much more significant role in creative success than was perhaps true in the past. This chapter attempts to identify the role that entrepreneurs, managers, and the literati play in enterprise performance and economic growth.

As discussed in Chapters 1, 2, and 6, strategic, organizational, and human resource decisions made by management lie at the

heart of enterprise performance. Indeed, in today's economy, success requires that managers behave in an intensely entrepreneurial manner and build into their organization the capacity to sense and seize opportunities, and then transform and reconfigure as competitive forces dictate. Such capabilities, if built, constitute the dynamic capabilities of the enterprise. Not many CEOs have these skills, and fewer still succeed in building them into their businesses. In addition to describing these capabilities, I look in this chapter at the special role that talented individuals play in the global economy today. I describe how building organizations around individual expert talent involves special challenges.

2. The Lucana in Economic Growth Theory

Economic growth theory, be it neoclassical or the so-called "new" growth theory, is limited in its ability to explain differences in growth rates amongst nations. Perhaps the primary reason for this is the low appreciation and understanding amongst economists with respect to the role of institutions, management, and governance. Few would dispute that the engine of capitalist development is the business enterprise; yet, the role of the business enterprise in growth and development is greatly underemphasized in economic growth theory. Accordingly, if we want to understand economic growth and economic development better, we need a more complete understanding of the role of management and entrepreneurship in enterprise performance, and of enterprise performance in economic development and growth.

Fortunately, economic growth theorists and development scholars alike are beginning to recognize that the application of technology and the development of institutions to protect property, control corruption, and advance the rule of law are critical to development and growth. For instance, a leading mainstream scholar, Jeffrey Sachs, recently wrote:

> I believe that the single most important reason why prosperity spreads, and why it continues to spread, is the transmission of technologies and

ideas underlying them. Even more important than having resources in the ground, such as coal, was the ability to use modern, science-based ideas to organize production. (Sachs, 2005: 41)

In the modern world, the multinational corporation is frequently the instrument by which technology gets transferred, at least in commercial contexts. It is necessary, therefore, to develop a better understanding, in both developing and developed country contexts, of the role of the enterprise in developing and using new technologies and new forms of business organization. Indeed, recognized business historians such as Chandler (1990a) and Lazonick (1990) attribute a large part of the reason why the USA overtook Britain in economic performance to differences in management and enterprise structure. Many other writers see the organization of Japanese firms post-1950 as a major factor enabling Japanese postwar growth. Mowery and Nelson (1999: 371) ascribe descriptive power to dynamic capabilities in helping to illuminate the importance of enterprise performance to industrial leadership. Notwithstanding the work of economic and business historians and others, mainstream economic theory has not properly recognized the role of entrepreneurship, institutions, management, and organization in economic development and growth.

Outside mainstream economics, there is at least a considerable literature stressing the role of the entrepreneur in economic growth and development. However, in the context of today's open economies, the distinction between the functions of entrepreneurs and managers is fading. Indeed, the thesis of this chapter is that once the process of new business formation is achieved—with an enterprise achieving say $100 m. of revenues and/or employing 100 plus personnel—the role of the entrepreneur and the role of managers in enterprise success morph considerably. Put differently, once an enterprise is established, continued success in an open competitive economy requires entrepreneurial management and the building, maintenance, and employment within the enterprise of what I call "dynamic capabilities". Put differently, distinctions between entrepreneurial capitalism and managerial capitalism are blurring, and marketplace success requires management to be

entrepreneurial in important ways defined by the dynamic capabilities framework.

The notion that entrepreneurship, organization, and management are important to economic growth can be traced to the classical economists. Even Adam Smith was aware of the importance of learning and knowledge to economic growth. His discussion of the pin factory demonstrated how individual and organizational learning—repeated exposure to individual tasks flowing from specialization—enabled workers to increase productivity.

> The great increase in the quantity of work which, in consequence of the division of labor, the same number of people are capable of performing, is owing to three different circumstances; first, to the increase of individual dexterity in every particular workman; secondly, to the savings of time which is commonly lost in passing from one species of work to another; and lastly, to the invention of a great number of machines which facilitate and abridge labour. (Smith, 1776: 112)

Marshall (1925) also recognized the importance of organizational considerations, particularly external economies arising from the interaction between industrial districts. He saw positive externalities available to all firms in a given industry. He anticipated many of the later insights on spillovers, and some of the insights on appropriability.

It is well recognized that Schumpeter was somewhat schizophrenic about the role of the entrepreneur and the role of management of large organizations. In *The Theory of Economic Development* (1911), he stressed the role of the individual entrepreneur in economic development. In *Capitalism, Socialism, and Democracy* (1942), he emphasized the role of the large corporation in innovation and economic growth. Schumpeter described in *Capitalism, Socialism, and Democracy* a world of "managerial capitalism" where the entrepreneurial function and the entrepreneurial class were destined to disappear. As Acs et al. (2006) note, "the large corporation, by taking over the entrepreneurial function, not only makes the entrepreneur obsolete, but also undermines the sociological and ideological functions of capitalist society". Schumpeter (1942)

saw the large corporation as autonomatizing progress, with the giant industrial enterprise ousting small and medium-sized firms.

Of course, enterprises large and small have great trouble sustaining long-term superior performance. Even with large R&D budgets, success at innovation is not automatic. To sustain superior performance, the business enterprise must do a lot more than simply allocate large expenditures to R&D. The innovation process requires active orchestration of both intangible and tangible assets by entrepreneurs and managers. This is true whether the context is the small or the large enterprise.

Indeed, it is clear that both large and small firms face similar challenges. The maturity of the venture capital and private equity providers means that the differential with respect to access to financial resources, as between large and small companies, has been reduced in most developed economies. Hence, the Schumpeterian dichotomy between large (well-capitalized) firms and small, poorly funded ones has substantially eroded, at least in North America and Europe where venture capital and private equity are well established.

3. The Role of Management in Economic Growth

Invention does not necessarily lead to innovation. In the first century AD, Heron of Alexandria invented the aelopile, which was arguably a steam engine, since it converted steam into rotary motion; but it was basically a curiosity, and never put to practical use. The Chinese were the world's technological leaders from about 500 AD to 1500 AD; but they also failed to put many of their inventions to commercial use.

Knowledge is always highly specialized. By itself, it yields nothing. Humphry Davy invented the carbon filament lamp in 1800, but it was not until 1879 that Thomas Edison, after experimenting with thousands of filaments, came up with a carbon filament in an oxygen-free bulb which had long life and commercial applicability.

As Schumpeter said, innovation is about new combinations. Who puts this knowledge together and brings useful products and

services to market? It's entrepreneurs and managers, harnessing the skills of exceptionally talented individuals. Without management, there may be invention, but there is unlikely to be innovation. It is the entrepreneurs and managers who together perform the orchestration functions necessary to create new services and products that buyers want. In short, it is management and the organizations that they build that make knowledge useful and that make skilled workers productive. Frequently, the entrepreneurial and the managerial functions morph into each other, with managers playing a fundamental role in transforming inventions into innovation.

Early management systems and organizational structures were based on the Prussian Army, and sometimes the Church. Such emulation was not out of awestruck admiration. It was simply because that was all there was around to use as a model. Not surprisingly, fairly rigid hierarchies and command-and-control structures came to characterize the first large business organizations. These early organizations, nevertheless, sufficed to build the railroads, steel mills, banks, automobile manufacturers, big department stores, and telephone companies in the early twentieth century. The command model remained dominant for almost another century. Industrial enterprises were shaped along functional lines, with separate departments for finance, manufacturing, and marketing. In the intervening years, some amount of decentralization came to be employed and divisions with independent profit centers emerged at DuPont, General Motors, and several other large US enterprises; but these organizations, nevertheless, maintained deep hierarchies.

Reflections on the past remind us that management and organization lie at the heart of the performance of both individual enterprises and national economies. The purpose of organization is to facilitate collective effort, and to orchestrate cospecialized assets. We have been taught the virtues of the price system in achieving some level of coordination and response to changing technologies and market circumstances (Hayek, 1945). But it is not just traders and arbitrageurs who respond to market signals. It is also business enterprises. The business enterprise and its management

are fundamental to economic response. They effectuate the deployment and redeployment of resources in response to price signals. This is often overlooked. An economy with a competitive market structure will not spawn the creation of viable enterprises unless there are exceptionally capable entrepreneurs and managers orchestrating necessary responses.

In this chapter, I identify enterprise capabilities that are needed (in both the small and large company context) to succeed in an open and competitive economy. This genre, called "dynamic capabilities", is advanced not only as a descriptor of the managerial skills and organization structures which must exist for superior enterprise performance, but also as the outline for a possible new theory of the business enterprise, or at least a theory of the economic function of the manager in a market-based economy.

4. Dynamic Capabilities

Is there any way to distill the basic factors that lie behind business success? The answer, I believe, is in part context driven. Consider therefore competitive economies open to international trade, investment, and technology flows with legal structures that allow credible commitments. In such contexts, what are the foundations of business success? Does strategy and entrepreneurship matter? Do investment implementation processes and protocols matter? Does organizational structure matter? Does the choice of business model matter? The answer, of course, is that all of the above matter and that decisions on each involve managerial choices and action. Because so much matters, we need a framework that can integrate disparate but interdependent concepts.

The thesis advanced in this chapter is that a new kind of management and organization is needed to compete in open economies generating and exposed to rapid innovation. The management required must be intensely entrepreneurial, while simultaneously being good at execution and the management of talented individuals. Failure to sense new opportunities, to seize upon them, and then restructure and reconfigure as new competition emerges will

leave the enterprise extremely vulnerable. Employees' jobs will be at risk if the management team does not have or is unable to develop requisite capabilities, which I label dynamic capabilities.

Early statements of the dynamic capabilities framework can be found in Teece, Pisano, and Shuen (1990a, 1990b), Teece and Pisano (1994), Teece (1996), and Teece, Pisano, and Shuen (1997). The definition of dynamic capabilities found in Teece, Pisano, and Shuen (1997) is slightly modified to read as follows:

> The ability to sense and then seize new opportunities, and to reconfigure and protect knowledge assets, competencies and complementary assets so as to achieve sustained competitive advantage.

As shown in Chapter 1, it is possible to disaggregate dynamic capabilities into three classes: the capability to sense opportunities, the capacity to seize opportunities, and the capacity to manage threats through the combination, recombination, and reconfiguring of assets inside and outside of the firm's boundaries. To avoid being too repetitive, each is described here in only a cursory manner. The microfoundations of these capabilities are outlined in Chapter 1.

Sensing

In fast-paced environments, consumer needs, technological opportunities, and competitor activity are constantly in a state of flux. The profit streams earned by incumbent enterprises are almost always at risk. Opportunities constantly open up for both newcomers and incumbents. As discussed in Teece, Pisano, and Shuen (1997), some trajectories are easily recognized (e.g. miniaturization, compression, and digitization in information and communication technology), most are not. Opportunities come from differential access to existing information (Kirzner, 1973) or from new information and new knowledge (Schumpeter, 1911, 1934). The R&D process, of course, is one way to create such new knowledge and concomitant opportunity.

Kirzner stresses the alertness of the entrepreneur to recognize any disequilibrium by taking advantage of it; his entrepreneur

provides the pressure to move the economy back towards equilibrium. As Baumol (2006: 4) notes, "the job of Schumpeter's entrepreneur is to destroy all equilibria, while Kirzner works to restore them. This is the mechanism underlying continuous industrial evolution and revolution." Shane (2003) likewise notes that "Schumpeterian opportunities result from disequilibrating forces, making Schumpeterian entrepreneurship a disequilibrating activity. In contrast, Kirznerian opportunities are the result of equilibrating forces" (p. 20).

When opportunities are first glimpsed, one must, of course, also figure out how and when competitors, suppliers, and customers will respond. Competitors may or may not see the opportunity or they may calibrate it differently. Their actions, along with those of customers, suppliers, the government, and standard-setting bodies can also change the nature of the opportunity and the rules of the game. There are no mandatory structures for the rules of the game, other than those imposed by regulators, public not-for-profit standard-setting bodies, intellectual property and antitrust laws, and social mores. The shape that the rules of the game take is thus the result of complex interactions between ecosystem participants. All managers can do is make informed conjectures about the way ahead. These conjectures become working hypotheses that need to be updated as evidence emerges. There are few "rules" upon which an early consensus will emerge; but once such rules emerge, quick action is likely to be needed.

In order to identify opportunities, enterprises must constantly engage in scanning, searching, and exploration across technologies and markets, both "local" and "distant". This activity not only involves investment in R&D and the probing and reprobing of customer needs and technological possibilities; it also involves understanding latent demand, the structural evolution of industries and markets, and likely supplier and competitive responses. To the extent that business enterprises can open up technological opportunities through their own R&D and through tapping into the research output of others while simultaneously understanding customer needs, they have a richer menu of investment opportunities.

Analysis of the search for information, knowledge, and opportunity has a long history in management research and in practice (March and Simon, 1958; Nelson and Winter, 1982). The searching behavior of enterprises involves exploring on both market and technological fronts. It involves search inside the enterprise (e.g. for technological solutions) and search outside the boundaries of the enterprise too. Without exploration and search, an enterprise has limited opportunities. In essence, this capability is about investment in R&D, scanning for new inventors and needs, and understanding market evolution and transformation. Figuring out how to generate, select, filter, and comprehend relevant information is not a capability naturally resident in an enterprise or its management team.

Seizing

The skills that result in the identification and/or development of an opportunity are not the same as those required to profit from or "exploit" the opportunity. In theory, one could imagine a transaction between entities that scout out and/or develop opportunities, and those that endeavor to execute upon them. In reality, some of both need to take place inside the enterprise and heavily involve the top management team. New insights about markets—particularly those that challenge the conventional wisdom—will always encounter negative responses; the promoters/visionaries must somehow defeat the naysayers and transform internal views. Some level of managerial consensus will be necessary to allow decisions to be made and implemented.

Investment decisions involve purchase of inputs and redeployment of internal assets. To achieve returns in excess of the cost of capital, the ex post value of resources organized in new combinations must be greater than the ex ante cost of securing their employment. The enterprise can earn returns in excess of its cost of capital if either:

(1) the enterprise has superior foresight with respect to the future market value of purchased inputs or

(2) the enterprise can purchase the inputs and use them *ex post* in unique combinations (such as in conjunction with its other complementary assets) in a manner which increases the cash flows attributable to the input.

Put differently, if the enterprise can redeploy purchased assets to a higher valued use or achieve scope and scale economics not available to the previous owner of the asset, then it can create value not available to others.

Sensing a business opportunity but failing to act is not uncommon[2] because seizing opportunities involves both entrepreneurial and managerial activity. At the most basic level, seizing is about making good decisions under uncertainty, and executing well on those decisions. It is not about optimizing on known prices and costs. Indecision, bias, and inaction are antithetical to this capability. In short, disciplined decision making and execution are both critical, although the latter has received more attention than the former in the management literature. Good decision making requires disciplined investment routines; information and data collection (both external and internal) and analyses, objective reasoning, attention to history, and good governance. Indeed, decision-making routines provide part of the linkage between changes in the organizational environment and appropriate action inside the organization (Becker, 2004). Such routines may be incompletely specified and decisions will require further input and specification by management. Interpretation and judgment will be required to know what routines to employ in particular contexts. Routines will need to be modified as the environment itself changes.

The proficiency with which an opportunity is embraced is likely to depend importantly on the quality of the enterprise's routines, decision rules, and strategies around investment in tangible and intangible assets. Business historians (e.g. Chandler, 1990a, 1990b; Lazonick, 2005 and others) have reminded us that over the long run, the ability of enterprises to arrange financing and invest astutely around new technologies is critical to enterprise performance over the long run. Consider the development of civilian jet transport aircraft in the USA in the 1950s. As Phillips (1971) noted:

> Any one of Boeing, Douglas, Lockheed, or Corvair might have been first . . . The technology was there to adapt to—not risklessly or costlessly to be sure, but it was there. Perhaps the biggest risk in 1953 was not technological in character. Instead, it was risk with respect to what sort of jet to build and when to build it. (p. 126)

In an environment of rapid technological change with increasing returns, there is considerable additional risk related to timing, product specification, and the selection of the particular technologies that need to be accessed and combined to produce an offering to the market that will be appealing to customers. Boeing and Douglas succeeded with the 707 and DC-8, respectively. Both aircraft drew in part on certain technologies known at the time and pioneered by others, including de Havilland with its Comet series of civilian jet transports.

IBM likewise gained leadership in the computer industry not necessarily because of its technological prowess, but because it was willing and able to make the necessary investments in developing and commercializing the 360 family of mainframe computers.[3] Technological pioneers who failed to make the decisions and gather the resources to invest behind their technological accomplishments (e.g. Ampex with the VCR, Xerox with the personal computer) let others profit from the innovation which they pioneered (Teece, 1986a). Consider also Intel's decision in the 1980s to abandon DRAMs, and focus on the microprocessor; or consider Rolls-Royce's decision to persevere with the RB211 jet engine for four decades, eventually achieving success; or consider Motorola's decision to develop Iridium—a (failed) multibillion bet that involved deploying scores of low orbiting satellites to provide ubiquitous global mobile communications.[4] History has been kind to some of these decisions, but not others.

Investment disciplines in a knowledge-based "new economy" enterprise are likely to involve special challenges. For instance, the ubiquity of interdependent systems and complementarities amongst technologies can lead to an n-sided market effect.[5] Addressing opportunities may involve investing simultaneously in complementary technologies and complementary assets. Relatedly,

the presence of increasing returns means that if one network gets ahead, it tends to stay ahead. Getting ahead is likely to require significant up-front investments. Customers will not want your products if there are strong network effects and your installed base is relatively small. Accordingly, one also needs to strategize around investment decisions, getting the timing right, building on increasing return advantages, and leveraging products and services from one application to another.

The organizational skill needed to make high quality unbiased, but interrelated, investment decisions under uncertainty is rare.[6] Enterprises, like markets, do not behave in a frictionless fashion. Decisions languish, internal procedures get violated, projects get undermined, and goals get thwarted (Gibbons, 2003). Decision-making errors and biases are not uncommon. It is necessary to recognize that the investment decision context inside the enterprise often involves irreversibilities, cannibalization, and/or asset coalignment issues. These issues are usually absent from capital allocation decisions made by pure financial investors. Because of concerns about cannibalization of existing product lines, innovations may get shelved. Because of significant irreversibilities, management's asset selection and reinvestment decisions inside the enterprise[7] often have long-lived implications for the business enterprise, transcending those made by a financial investor investing in liquid assets.

The nature and priorities with respect to investment decision making have clearly changed. In the last century, financial capital was the scarce resource and internally generated cash was critical to an enterprise's financial flexibility and capability. Capital budgeting techniques were developed and applied to support project finance decisions. Top-down planning and control systems ensured that capital was properly allocated and malfeasance managed.

Today, financial capital is less of a constraint. The difficult resource to accumulate is knowledge. Knowledge is harder to monitor and manage than is financial capital. In an open economy with rapid technological change, the challenge is less about managing financial resources and more about managing, learning, knowledge

accumulation and protection, and cospecialization. The environment requires unique investment skills and different organizational structures and management systems. Conceptual approaches need to be modified and toolkits updated.

While project-financing criteria (e.g. discounted cash flow, payback periods, and the like) and techniques for decision making under uncertainty are well known, there is little recognition of how to value intangibles and take into account features such as cospecialization, irreversibilities, and opportunity costs.[8] The latter are critical dimensions of strategic investment decisions. Indeed, the concept of a "strategic investment" is not recognized in the finance literature. Moreover, the field of finance provides almost no guidance with respect to how to estimate future cash flows. Making such estimates is as much, if not more, the foundation of good decision making as are the methodologies and procedures for analyzing cash flow.

As noted, the major investment choices made by executives (and the boards of directors) require special skills, not ubiquitously or evenly distributed amongst enterprises. Nor are they generally possessed by portfolio managers in the financial world.[9] Resource/asset alignment and coalignment issues are important in many technology-based industries; they are quite different from portfolio balance issues. Investments inside the knowledge-based enterprise are often cospecialized[10] to each other, and are frequently illiquid. Also, the nature of portfolio "balance" needed inside the knowledge-based enterprise is different from the portfolio balance sought by pure financial investors. The economics of cospecialization are not the economics of covariance with which investors are familiar. Indeed, the task of making astute project and enterprise-level investment decisions is quite daunting because of cospecialization and irreversibilities.

The project finance and related literatures provide tools and clear decision rules for project selection once cash flows are specified, and uncertainty and/or risk are calibrated. However, the essence of the investment decision for the (strategic) manager in the knowledge-based enterprise is that it involves estimating future revenue streams and cost trajectories, as well as a panoply of

continuous and interrelated cospecialized investment issues.[11] The returns to particular cospecialized assets cannot generally be neatly apportioned or partitioned. As a result, the utility of traditional investment criteria outlined in finance textbooks is impaired.

In short, managers need to make judgments around not just future demand and competitive responses associated with multiple growth trajectories, but also around the payoffs from making interrelated investments in intangible assets. In the world of tangible assets, this can sometimes be precisely modeled. For instance, if one builds a new chemical plant or petroleum refinery, investment in various processing units can be modeled using linear programming tools. But in many circumstances, business investments are not in the form of clearly defined "projects" *per se* and future returns are uncertain.

Managerial judgment takes on great significance in such contexts. This was also true during prior centuries as Alfred Chandler's (1990a, 1990b) analysis of successful enterprises from the 1870s through the 1960s makes apparent. Tacit investment skills are of great importance, no matter how much analytical work is done to aid the decision. Chandler further argues that success in the late nineteenth and much of the twentieth century came to those enterprises that pursued his "three-pronged" strategy:

(1) early and large-scale investments behind new technologies;
(2) investment in product-specific marketing, distribution, and purchasing networks;
(3) recruiting and organizing the managers needed to supervise and coordinate functional activities.

The first and the second elements require commitment to investments where irreversibilities and cospecialization are identified.[12] While the nature of required investments may have changed, investment decision skills remain important.

Central to quality decisions in many industries today is the ability to gauge (or to shape) industry evolution and competitive responses, including the possible emergence of standards and dominant designs. Work in strategic management (Mitchell, 1991; Teece, 1986a) provides crude insights into decision factors and

frameworks that recognize how the appropriability regime, standards, market evolution, complementary assets, and the capabilities of competitors should be taken into account. These frameworks outline decision rules which can undergrid dynamic capabilities.

Reconfiguring

The establishment and subsequent growth of a successful enterprise will lead to the augmentation of its resource and asset base. Success will lead to the accumulation of more resources and specific assets, as well as internal rules and procedures, and the enterprise will begin evolving in a path-dependent way. The key to sustained profitable growth is the ability to recombine and to reconfigure assets and organizational structures as markets and technologies change. Reconfiguration is needed to maintain ecological fitness and, if necessary, to try and escape from unfavorable path dependencies.

As the enterprise grows, it also has more assets to manage and to protect against malfeasance and mismanagement. Shirking, free riding, the strategic manipulation of information, and internal complacency are all issues that established enterprises will confront continuously. In many cases, this leads to the establishment of rules and procedures (routines) that constrain interactions and behaviors. Except in very stable environments, such rules and procedures are likely to require modification from time to time, if superior performance is to be sustained. It is not uncommon to find that a routine subsequently becomes dysfunctional, providing inertia and other rigidities that stand in the way of improved performance (Leonard-Barton, 1995; Rumelt, 1995). As a result, less-well-resourced firms (sometimes rejuvenated established firms, sometimes new entrants) end up winning in the marketplace.

Sustained superior profitability involves a constant struggle to build, maintain, and adjust the complementarity of product offerings, systems, routines, and structures. Inside the enterprise, the old and the new must be complementary. If they are not, business

units must be disposed of or placed in some type of separate structure. Otherwise, work will not proceed efficiently, and conflicts of one kind or another will arise inside the enterprise.

Asset alignment and coalignment are necessary to minimize internal conflict and to maximize complementarities and productive exchange inside the enterprise. Teece *et al.* (1994) show across a large sample of establishments that surviving enterprises have a high degree of (product market) coherence. The persistence of this pattern across product categories suggests that coherence relates less to the particular technologies than to the processes and sequencing of expansion. The study suggested that diversification which eschews product relatedness is more likely to fail. Put differently, the markets addressed and the manner by which enterprises grow do appear to matter when it comes to long-term performance.

Also, as business enterprises grow, they face increasing complexity. This will require periodic internal restructuring and decomposition. Miles and Snow (1994) also highlight ecological fitness, although their focus is on the relationship between strategy, structure, and processes. To them, "tight fit" organizations are those which have not become laden with bureaucratic processes and where "everyone can see clearly how and why things work as they do" (p. 20). With "tight fit", there is an "appearance and feeling of simplicity, as well as the broad understanding of purpose and mechanisms in organizations" (pp. 20–1). Miles and Snow go on to note that in the absence of "tight fit", managers have trouble articulating the strategy–structure–process package. Roles and responsibilities are not clear and the second-guessing of decisions is commonplace. Crises are frequent. They further note that "fit is both a state and a process—[it] is best conceptualized as a journey rather than a destination" (p. 11).

Redeployment and reconfiguration are important elements of what was referred to earlier as asset orchestration (see also Capron *et al.*, 1998). Redeployment and reconfiguration may involve business model redesign and asset-realignment processes. Redeployment could involve transfer of non-tradable assets to another organizational or geographic location. It may or may not involve

mergers and acquisitions.[13] Helfat and Peterof (2003) suggest that capability redeployment takes one of two forms:

> The first involves the sharing of a capability between the old and the new market. Many instances of related diversifications fall into the category. A second form of redeployment involves inter-temporal transfers of capability from one market to another. When demand for sperm (whale) oil plummeted after the first drilling of petroleum in Pennsylvania in 1859, the whaling teams shifted their activism. They adapted—from hunting sperm whales in tropical waters to hunting baleen whales in the Arctic. This involved a product market switch from whale oil to whale teeth used in products such as corsets, buggy coaches, and umbrellas. (pp. 20–1)

Other examples abound. Several major airlines have tried to create separate low cost "carriers within carriers", partly in response to the success of Southwest Airlines in the USA. United Airlines has created Ted, KLM the Dutch airline created Buzz, British Airways created Go, and Delta Airways created Delta Express and then Song. Song had a lean management team, targeted women customers, had new boarding procedures, packed in more seats, and targeted higher aircraft utilization (Daniel, 2003: 8). Existing Delta aircraft and employees were redeployed into the new company to get it started. These restructurings involve both a modification of the business model, new or modified labor contracts, and a redeployment of assets. It is by no means clear that new business models that do not address fundamental labor cost and employee commitment issues in the airline industry will succeed—indeed some have already failed—but the necessity of adopting new business models has been recognized.

5. *The Dynamically Competitive Enterprise and Talented Individuals*

General

The dynamic capabilities framework outlined above and elaborated in Chapter 1 recognizes certain levels of dependence between the organization and the individual. In particular, if the CEO and the

management team fail to perform well with respect to sensing, seizing, and then transforming, performance failure at the enterprise level is likely. All stakeholders associated with the company are in varying degrees harmed by such failures. If labor markets are efficient, individuals can be redeployed. However, given that value is likely to be at least partially enterprise specific, the value that a worker has in one organizational setting will be different from another. There is no guarantee, therefore, that value will be preserved when employees are displaced by lack luster enterprise financial performance, and possibly, even failure. Of course, if labor markets are inefficient, the ease with which labor can be redeployed is likely to be reduced.

The modern corporation with dynamic capabilities is both exposed to change and is an instrument of change. As discussed, the managerial task is substantially entrepreneurial: to sense opportunities; then put knowledge and capital to work by seizing upon opportunities; and then responding to the competition that will inevitably follow success. The enterprise will need to develop a distinct culture (of innovation) to succeed.

Economic performance is the first responsibility of business. A business that does not earn its cost of capital is problematic—it wastes society's resources, and it puts constituencies—including employees, suppliers, and customers—at risk. It is irresponsible for an enterprise to accept discretionary social responsibilities that impede its capability to earn its cost of capital.

In today's world with knowledge-based enterprises competing vigorously, the role of the individual in the enterprise is also different from what was once the norm. The nineteenth-century employer believed, with some justification, that the employee needed the business enterprise more than the business enterprise needed the employee. Not so with respect to skilled employees today. It is the enterprise's job to excel at recruiting and retaining top talent. Economic power is now weighted towards the individual if the individual has exceptional skills. Moreover, highly talented individuals do not want to be employees in the traditional sense. Such individuals seek and receive greater workplace autonomy, and typically accept greater accountability. Machine operators

in a factory could be told what to do. Exceptional talent will not hesitate to tell management where to go if they perceive that management is "out of line". Exceptional talent generally does not need to be supervised, and does not accept traditional supervision. Such talent can dictate, in some circumstances, what they will contribute to the organization and the surplus, if any, that will be left for other stakeholders. The traditional employment relationship, with the worker receiving directions in a command-and-control hierarchical structure, simply does not work for such highly skilled individuals.

Accordingly, when the modern organization employs many highly skilled individuals, it has to create an organization of near equals, of colleagues, and associates. The modern knowledge-based organization cannot organize with traditional boss/subordinate dichotomies. It must be a relatively flat structure, with distributed leadership, and self-organizing teams. Of course, every member must act as a responsible decision-maker within their professional domain.

The Importance of Interdependence

In dynamically competitive talent-based firms, it is universally accepted that people are important. This perspective actually has its roots in the industrial world. Robert Owen, the successful textile manufacturer in Scotland, published a tract in 1813 advising his fellow manufacturers to care for their people "at least as well as their industrial equipment".

There is also a common adage in talent-based firms that your assets go down the elevator every day. This is true; but why do they generally come back the next day? The answer is not just because there is work to do, but because each needs the other in the organization. Individuals are often specialists, being very good at certain things. Society has learned that we can have more of everything by specializing; but the price of specialization is dependence on others. At least in professional service organizations, but also in hospitals and research centers, there is the split in function

between literati and managers. The former produce knowledge, the latter help organize the talent and apply the results. Both need each other. Exceptional talent is likely to own the "means of production" which is specialist knowledge. However, exceptional talent can benefit from being a member of an organization, and capturing the benefits from interacting with colleagues.

Indeed, both research and development, professional services, as well as many other kinds of business services are quintessentially businesses of specialists. In either type of organization, individuals can leverage each other more than in organizations populated by generalists. For instance, those in professional services firms who are good at finding work need others to help execute on projects. Likewise, those who are good at doing the work need others to help find it. Those who are good with data need others to help them access data. Those who have the skills to access and organize data need others to analyze it. Projects can be made bigger and more challenging if other colleagues with complementary skill sets can be trained or recruited. Clients are generally happier if the organizations can integrate the work of disparate specialists, relieving the clients themselves of the burden of doing so.

Reputations, Brands, and Individual Names

Brands and names help bring awareness of the service provider, and also become a proxy for reputation. Good brands have great value as they reduce sales costs and help sustain premium pricing. Indeed, brands serve as trustworthy consumer advisors. In some sectors of the economy, customers do not rely just on brands and reputation; they also care about individual "names". Accordingly, the reputational capital of individuals can be an important asset. Repeat customers usually want to know who is going to be the service provider. Sophisticated clients know that even in organizations with reliable procedures and a strong culture for the provision of quality, performance at least to some extent depends on the identity of the team leader, and possibly the key staff as well. In essence, this means that in the specialized services sector branding

is really a kind of quasi cobranding—the "name" of the team leader and the firm's brand together help sell services. This means that traditional conceptions of the employment relationship must be modified.

In Ronald Coase's (1937) and many other relatively traditional conceptions of the employment relation, employees "agree to obey the directions of the entrepreneur within certain limits". The employee lets the entrepreneur/manager direct his activities within that zone because the entrepreneur is assumed to be better at providing direction than the worker. If the entrepreneur does this better than the price system, then this provides the rationale for internal organization. The entrepreneur/manager is placed at the apex of a hierarchy so as to properly exercise control over resource allocation and skills. Inside the zone of indifference, the worker does not care about the tasks to which he or she is assigned.

Unfortunately, the Coasian conception, while interesting, is not able to handle with ease the exceptionally talented or "expert" employee. In the Coasian firm, the boss must know as much as the talented individual if the boss is to provide direction inside the employee's zone of discretion. This is clearly difficult if not impossible. Moreover, the exceptionally talented individual's "zone of discretion" is likely to be quite narrow. Accordingly, Coase's view of the employment relation does not appear to fit a firm endeavoring to provide expert services.

Alchian and Demsetz's (1972) analysis of the employment relation was different from that of Ronald Coase's and it is in some ways more relevant to high-end specialized services firms. Their claim is that the *raison d'etre* of the firm is team production. According to them, managers do not have any power of fiat or authority that the marketplace does not have. It is no different for the employer to deal with employees each day than for the consumer to deal each day with the neighborhood baker. There is no need in their model for the employee to surrender control, as is necessary in the Coasian firm. Rather, the firm is a place where productivity-enhancing team behavior takes place. The existence of the firm flows from its ability to provide for cooperative activity superior to that available in a market setting. Managers

monitoring team behavior (as in Alchian and Demsetz's (1972) manual freight-loading example), detect shirking, and align rewards so that they reflect performance.

However, Alchian and Demsetz (1972) are skeptical that high-end specialized services can be organized under traditional employment structures because of imperfect monitoring of individual performance. As they put it:

> while it is relatively easy to manage or direct the loading of trucks by a team of dock workers when input activity is so highly related in an obvious way to output, it is more difficult to manage and direct a lawyer in the preparation and presentation of a case. (p. 786)

Because of these problems, they predict that professionals will be less likely organized as capitalist firms. Others have suggested the partnership form is the response to this problem, as partners can monitor each other.

The Alchian and Demsetz (1972) model has been criticized because it equates the employment relation to a commodity transaction. Their approach does not apply perfectly to the management of exceptional talent, but elements are recognizable. First, to the extent that there are hierarchical elements amongst high-end professionals, it is the professionals who hire "bosses" rather than the other way around. The Hollywood agency model for creative talent was an early manifestation. As explained by Albert and Bradley (1997), the stars themselves beginning with Newman, Streisand, and Portier broke away from the studios to create their own production company, First Artists. A key element of First Artists' strategy was to create a climate in which leading actors could control their professional environment and lives. As Albert and Bradley point out, Steve McQueen, who joined First Artists shortly after it was founded, was able to choose the director and producer for his first film produced by First Artists. The artists did not manage themselves. They put a professional manager in place; but the manager mandate was clearly to effectuate the artist's view of how a film should be produced. There have been many independent production companies founded since, with varying

degrees of success. As a result, the balance of power in Hollywood has shifted from the studios to the talent.

University faculties have some similar attributes. The faculty arguably hire their Dean since the Dean generally serves at the sufferance of the faculty, at least in the major research universities in the USA. The basic point in both the Hollywood studio and university faculty situations is that as compared to an industrial setting, the "power" relationship between "bosses" and "workers" is arguably inverted, turning the traditional model (bosses direct workers) on its head.

In short, experts and other types of creative and highly skilled knowledge workers, be they medical doctors, professors, engineers, or economists, desire high autonomy and can be self-motivated and self-directed because of their deep expertise. The university environment caters for this with the tenure system—requiring the discharge of teaching, research, and service obligations by faculty, but allowing the individual faculty member considerable discretion as to whether and when (other than meeting class) tasks are performed. Authority is usually perceived as anathema, in part because it has two indirect and largely hidden costs:

(1) it can readily be found overbearing by the skilled individual, who if incentivized correctly, may not need and does not want supervision and close monitoring;
(2) the perceived subjective nature of performance measurement allows managers to exercise wide discretion on compensation, particularly bonuses, allowing and encouraging lobbying and other influence costs which is debilitating to all, except perhaps those who wield the authority.

There is, of course, a connection between the amount of autonomy provided (job design) and the nature and type of incentives and rewards. In traditional organizations, prohibitions, rules, and directives and their monitoring generally must increase as compensation is uncoupled from clear objective performance metrics. As it becomes easier to measure the employee's (agent's) performance, the employee's (agent's) autonomy can be increased, without loss of efficiency.

Both industrial and service firms face challenges associated with the exercise of authority, but the demand for autonomy by individuals is likely to be greater in the services context, thereby amplifying the problem. The challenge is to find ways to effectuate cooperation and avoid conflict. If service firms can indeed provide satisfactory ways of objectively measuring performance, they then can provide greater autonomy by using incentives. With better incentive alignment, firms can begin a virtuous circle of work freedom and high reward.

Weaknesses in Traditional Managerial Models

In many business enterprises, it is often assumed that authority is the indisputable means of managerial control. Often the implicit assumption in high authority commercial structures is that employees are lackadaisical, not particularly trustworthy, perhaps not too smart, and therefore need to be closely monitored and supervised and threatened with punishment to get them to behave properly and put forth adequate effort toward the achievement of project and company goals. A case can be made that the hierarchical and authoritative nature of some organizations is more suited to the characteristics of adolescents, not adults, and certainly not the literati.

Moreover, financial rewards are allocated in the traditional model in ways that are usually highly subjective. Competition takes place to establish oneself at a senior position in the organizational hierarchy, as this affords the ability to control others while simultaneously affording protection against being subject to control by others. Seniority in the hierarchy allows more personal freedom, control over discretionary resources, and is the confident path to higher compensation. Because pay is not metrics-based, the politics of pay become part of everyday life. People jostle to claim credit, even at the expense of colleagues. A good deal of time and effort is spent posturing in order to appear valuable to the organization, through the eyes of the boss. Eventually the need to do excellent work usually gets lost sight of, and the company suffers performance difficulties.

The effective co-option and productive employment of exceptional talent cannot always be achieved by traditionally organized and managed firms. New arrangements are needed and are being developed to guide, integrate, and make more productive the autonomous but interconnected work of highly skilled people. The organizational structures that result may indicate how to reorganize industrial firms too. As Tom Peters has noted, "The professional service firm is the best model for tomorrow's organization in any industry."[14] In order to understand the implications for the way firms need to be organized and the employment contracts that need to be struck, it is necessary to review some fundamentals of the marketplace for top talent.

The Literati in the Dynamically Competitive Enterprise

The contemporary workforce has always contained individuals with high education and/or exceptional talent. The economic significance of the literati has become more important as markets expand and intangible assets grow in importance. The growing importance of knowledge as a source of competitive advantage means that specialized talent is becoming more important (Albert and Bradley, 1997: 4). Robert Reich (2002: 107) has also noted that talented and ambitious people can earn more, relative to the median wage, than could talented and ambitious people in the industrial era.

Larger and more open or "contestable" markets are the reasons why dispersion in earnings has increased. The higher rewards top talent can command stem from the value which now seems to flow from the creative, analytical, and "rainmaking" abilities of leading professionals. In particular, the skill to help solve complex problems, to help make critical decisions, or solve complex disputes, commands high value. It is not just research scientists, engineers, designers, athletes, movie stars, musicians, and film producers who can earn these rewards. It is also other types of professionals and consultants like lawyers, financial analysts, turnaround specialists, and even former government officials and economists.

Managing exceptional talent requires a unique approach to human resource management. Certain behavioral assumptions need to be employed, including the following:

(1) The literati like their work and need minimal direction. They desire to work hard, achieve the highest possible professional standards, and are willing to accept responsibility for their own actions.
(2) The literati respond to financial incentives. If one gets the financial incentives right, then many aspects of organizational life will be relatively easy. Get them wrong, and it will be difficult to coax actions out of employees, literati, or otherwise, that run counter to their incentives.
(3) The literati are worthy of trust and are not instinctively opportunistic.

While economic theory may sometimes assume that individuals are opportunistic—and there are undoubtedly many opportunistic people in society—in an organizational context, it is unlikely to be productive for management to act as if the literati are deceitful or burdened with guile. Making positive, but realistic assumptions about individual behavior is likely to turn out to be self-fulfilling.

The literati also have important non-pecuniary goals. Besides advancement, they want to belong to an organization they trust and respect. They also seek the approval of their colleagues. Accordingly, achieving "identification" and "commitment" with their employer has very positive motivational implications. The literati also want and deserve the freedom to excel. If they have such freedom, they will commit much more of themselves to solving problems, doing the best they can in their daily work, being great colleagues, and building understanding relationships with both colleagues and clients, all the while maintaining the highest standards of professionalism.

With the literati, the role of management is to influence, encourage, and mentor where necessary. The literati need to be given freedom, responsibility, and support. Management must not be authoritarian or bureaucratic. That is not to say that the organization should be without rules. Permissive management is not an antidote to the weaknesses of excessively hierarchical structures.

To function productively, even the literati must learn to work cooperatively in teams. However, teams can be non-traditional. Teams can change with each project. It is desirable to keep project teams small, but intense and intimate. Teams need not emphasize consensus and compromise; rather, the aim should be to achieve excellence while giving some degree of rein to individualism. Certain especially creative and exceptionally talented individuals can be given special recognition. Hence, team building with the literati is somewhat different from certain aspects of everyday team building based on their skills. Such teams have been called "virtuoso teams".[15] Table 7.1 summarizes some of the differences between traditional teams and virtuoso teams.

In dynamically competitive knowledge-based organizations, leadership should be exercised by people at all levels. Leadership skills include initiating action, planning, problem solving, initiating necessary communication with colleagues and management. A critical element of leadership is accepting responsibility.

Table 7.1. Key differences between traditional teams and virtuoso teams

Team Characteristics	Traditional Teams	Virtuoso Teams
Membership	Members chosen based on who has available time	Members chosen based on expertise
Culture	Collective	Collective and individual
Focus	Tight project management On time and on budget performance more important than content	Ideas, understanding and breakthrough thinking Content is king
Clients	Mundane	Sophisticated
Intensity	High/medium	High
Stakes	Low/medium	High

Source: Drawn from Fischer and Boynton (2005).

In short, the lines between managerial and non-managerial work are becoming blurred. Indeed, as project work requires collaboration amongst people with different skills, requirements for horizontal relationships among diverse groups, sometimes including professionals outside the enterprise, demands on leadership expand.

The distributed leadership approach is not an abdication of managerial responsibility. It is just the opposite. The executive leadership team should be responsible to the Board and to shareholders, as well as to employees and other constituents. Any "power" that individual leaders have should stem from professional and personal respect gained through professional success and through creating and maintaining an open, honest, and transparent culture.

To summarize, exceptional talent is unlikely to be productive and satisfied in a traditional hierarchical organization, being compensated in traditional ways, and having compensation put at risk for events beyond their control. Dynamically competitive enterprises must develop new ways of compensating exceptional talent, and a (new) way of organizing the daily business so as to enable the highest quality of service to be provided. Table 7.2 tabulates some

Table 7.2. Contrasting views of the business enterprise

Organizational Characteristics	Industrial Era	Dynamically Competitive Era
Hierarchy	Deep	Shallow
Leadership	Centralized	Distributed
Work	Segmented	Collaborative
People	Cost	Asset
Basis of control	Authority	Influence and example
Assumptions about individuals	Opportunistic	Honorable
Financial incentives	Base + discretionary bonus salary	Metrics-based, limited discretion components

of the ways in which traditional firms are likely to be different from dynamically competitive ones, at least in the services sector.

6. Conclusion

One of the most significant oversights in economic growth theory is the failure to recognize the importance of management and organization to enterprise performance and to economic development. In environments exposed to global competition, management must be exceptionally entrepreneurial to succeed. Moreover, with the literati becoming increasingly important, managers must design new business models, incentive schemes, and commitment strategies to garner the full energies of the literati. Management teams that succeed in doing so can enjoy robust enterprise performance.

Notes

1. I owe this example to Dick Rumelt, along with many other insights about strategy.
2. One classic case of sensing the future but failing to act on it is Xerox's investment in the 1960s and 1970s in digital electronics and computing. It understood the potential, set up Xerox PARC, created many of the key technologies of the PC industry, but failed to invest what was necessary to take advantage of the opportunity (see Smith and Alexander, 2003).
3. What is elaborated upon below was not strongly featured in Teece *et al.* (1990a, 1990b, 1997), although it was more central in Teece (1998a).
4. This decision resulted in a very expensive failure for Motorola.
5. The most elementary n-sided market occurs when n = 2. Two-sided markets occur when activity in one "market" has a positive feedback effect on another market. The classic case is traveler's checks, or credit cards. In both circumstances, consumers won't carry traveler's checks or credit cards unless merchants are willing to accept them; but merchants won't accept them unless a sufficient number of consumers are willing to carry them. One "side" of the market simply cannot develop

without the other. Once momentum is established on one side, it helps stimulate activity on the other (Evans, 2003).

6. One company with a reputation for investment discipline is Exxon Mobil. Only the projects the company is confident will grow shareholder value make the grade, and every investment at Exxon greater than $50 million goes before the management committee. And as one observer notes, "Exxon is a machine. It has been operating well for over 100 years" ("Strategies: Exxon Mobil, The Cautious King of the Oil Patch". *Business Week*, April 4, 2005, p. 73). Exxon clearly has rigorous investment protocols in place that cause it to be very prudent with shareholder funds, and its protocols have served it well. Over many years it has avoided big blunders; when it broke from its disciplines, it ran into problems, for example, the acquisition of Reliance Electric, and the formation of Exxon Enterprises.
7. In Teece *et al.* (1997), particular classes of assets were recognized, including technological assets, complementary assets, financial assets, operational assets, and structural assets.
8. Ghemawat (1991) and many others have examined uncertainty and irreversibilities. However, cospecialization has received very little attention.
9. The decision skills required of management have limited commonality with those of an investor. One difference is the illiquidity and irreversibility of most managerial investment decisions. Another is the need to achieve continuous alignment amongst the assets at work in the firm. Both public and private equity investors typically lack this kind of orchestration and integration capability or capacity. Moreover, their skills are most applicable when investments are liquid.
10. Cospecialization is defined and discussed by the author in Teece (1986a).
11. Monteverde and Teece's study of the automobile industry (1982) showed that "systems integration" considerations impacted make–buy decisions. This evidence hints at the value to be created from figuring out heuristics and protocols likely to aid decisions involving interrelated investments.
12. Anecdotal evidence supports the view that early commitment to an emerging market can lead to sustained competitive advantage, particularly when there are scale and scope economics and network externalities. As already mentioned, IBM's commitment in the 1960s to the 360 and follow-along mainframe computing programs which gave it

several decades of leadership in new processors is also indicative of the importance of bold investment decisions. The manner in which Boeing bet on the 747 jumbo jet without a clear quantification of future profits is also legendary (Serling, 1992). Indeed, one observer notes that Boeing is losing market share to Airbus and will continue to do so because its management is "increasingly skeptical of large investments in new aircraft, dropping plans for a sonic cruiser and a stretched jumbo jet" (Kay, 2003). Only time will tell whether these judgment calls were good ones. See Baden-Fuller and Stopford (1994) for an excellent analysis of how certain firms have rejuvenated themselves.

13. As Capron *et al.* (1998) explain, failures in the market for resources sometimes cause firms to buy and sell business. What they refer to as market failure appears to relate to the "thin market" problem discussed in this chapter.
14. Tom Peters (1993) during his endorsement of Maister.
15. See Fischer and Boynton (2005).

Part III

Competition Policy

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Chapter 8

The Nature of Competition in Regimes of Rapid Technological Change

This chapter asks how competition policy should be shaped if it were to favor Schumpeterian competition over neoclassical static competition. Schumpeterian competition is the kind of competition that is engendered by product and process innovation. Such competition not only brings price competition—it tends to overturn the existing order. A framework that favors dynamic over static competition would put less weight on market share and concentration, and more weight on assessing potential competition and enterprise-level capabilities. Developments in evolutionary economics, the behavioral theory of the firm, and dynamic capabilities in recent decades indicate how the machinery of a new framework can be engineered and applied to antitrust.

1. Introduction

Society remains bereft of evidence that antitrust intervention has benefited the consumer. Indeed, Crandall and Winston (2005) conclude that "we find little empirical evidence that past interventions have provided much direct benefit to consumers" (p. 4). Amongst the causes of this unfortunate state of affairs they cite "substantial and growing challenges of formulating and implementing effective antitrust policies in a new economy characterized by dynamic competition, rapid technological change, and important intellectual property" (p. 23).

The lack of compelling evidence indicating that antitrust isn't aiding consumers is a matter of concern, and motivates inquiry in this chapter. The working hypothesis here is that the employment of static analysis to address antitrust issues in a dynamic economy is unlikely to improve consumer welfare, and that the chances of helping more than hurting go up if antitrust analysis can create and apply a more dynamic framework.

The problem appears to be that (a) much of economic theory is still permeated with static analysis; (b) the antitrust and competition policy practitioner community seems unaware of what is now a substantial literature, much of it quite robust, on evolutionary theory and the economic, organizational, and behavioral foundations of innovation; (c) while this new literature has generated meaningful general descriptions of market and organizational behavior, these have only recently caught the attention of antitrust scholars. Because of this, (d) the enforcement agencies aren't confident about discarding "conventional wisdom", despite the fact that many of them are aware that much of it is deeply discredited.

This chapter endeavors to help explain why static analysis appears to dominate, even though thoughtful policy makers are aware of dynamic competition. Unfortunately, policy makers are left wielding static analysis in part because of a wrong perception that scholars haven't yet filled the intellectual void. Indeed, until this perception changes, not much is likely to happen. As Richard Posner has observed, "antitrust doctrine has changed more or less in tandem with changes in economic theory, albeit with a lag"

(2001: 942). If scholars don't embrace the now robust behavioral/evolutionary approaches, economists are unlikely to analyze dynamic considerations properly.

2. Market Structure and Innovation

Unfortunately, many economists seem to be stuck in a well-traveled and largely irrelevant debate, now half a century old, as to what form of market structure favors innovation, labeling this as the "Schumpeterian" debate. Regrettably, this is all that many have absorbed from the rich work of Schumpeter, the Austrian School, and extensive development in behavioral and evolutionary economics. This so-called "Schumpeterian debate" casts Schumpeter too narrowly and is not of much interest any more. However, it can still bog down discussions about competition policy and innovation.

A more careful reading of Schumpeter will reveal at least three Schumpeterian propositions relevant to antitrust policy. (The first two are discussed in this section, the third in the next.) The first proposition relates to the impact of market structure on innovation. On this topic, Schumpeter himself articulated conflicting and inconsistent perspectives. In *The Theory of Economic Development* (1911) he spoke of the virtues of competition fueled by entrepreneurs and small enterprises. By the time he wrote *Capitalism, Socialism, and Democracy* (1942), Schumpeter's revised (second) proposition was that large firms with monopoly power are necessary to support innovation. This transformation was no doubt in part a reflection of the transformation that had occurred with respect to the principal sources of innovation in the American economy.

So with respect to the impact of market structure on innovation, Schumpeter seems to have maintained two almost diametrically opposite positions. One can call his first position Schumpeter I, and the second position Schumpeter II.

Schumpeter I is perhaps more appealing today than Schumpeter II. Indeed, I believe that the debate over whether to favor

competition over monopoly (as the market structure most likely to advance innovation) was won long ago in favor of some form of rivalry/competition.

However, the line of causation which is most commonly discussed runs only from competition to innovation. Indeed, as noted by the FTC: "competition can stimulate innovation. Competition amongst firms can spur the invention of new or better products or more efficient processes . . . ".[1] While this is undoubtedly correct, it does not recognize that innovation may impact competition and market structure. Nor does it suggest what type of market structure is desirable—only that competition can drive innovation.

Unfortunately, we don't appear to have found a great deal of evidence that market concentration has a statistically significant impact on innovation, despite 50 years of research. The main take away is probably that this is not a useful framing of the problem, in that market concentration alone doesn't stack up even theoretically (let alone empirically) as a major determinant of innovation.

In short, framing competition issues in terms of monopoly versus competition appears to have been unhelpful, at minimum inconclusive. Rivalry matters, but market concentration doesn't necessarily determine rivalry.

In briefly reviewing the theory, one can note that some industrial organization theories suggest that innovation is bound to decline with increasing competition, since the monopoly rents for new entrants will decline with increasing competition (Dasgupta and Stiglitz, 1980; Kamien and Schwartz, 1982).

Other studies, following Arrow (1962), hypothesize a positive relationship between competition and innovation. But Arrow sets aide the appropriability problem (i.e. how to capture value from innovation) and posited a perfect property right in the information underlying a specific production technique.

One can perhaps interpret Arrow's property right as a clearly specified and costlessly enforceable patent of infinite duration. The principal focus of Arrow is on how the (pre-invention) structure of the output market affects the gain from invention. Competition wins out because competitive output is larger than with monopoly. Hence, a given amount of unit costs reduction is more valuable if

the market is initially competitive. Protected by a perfect patent, the inventor simply licenses the invention at a whisker below the cost saving that the invention makes possible. Put differently, competition will win out and advance innovation when the business environment is characterized by what I call elsewhere a strong appropriability regime (Teece, 1986a).

Absent strong appropriability, the presumption that (perfect) competition is superior to alternative arrangements cannot be built on Arrow (1962). In fact, it is important to note that despite how Arrow's paper is usually interpreted (to claim that competition spurs innovation), Arrow's general position in his writings is, much like Schumpeter, that competitive markets provided inadequate incentives to innovate.

As Sidney Winter points out, Arrow's analysis also sidesteps business model choices (Winter, 2006). The producer and the inventor are one in the same.

Of course, one must also recognize that business (model) innovation is important to economic welfare, along with technological innovation. But the economics literature (theoretical or empirical) does not seem to address whether market structure is important to this type of innovation.

Empirical evidence is equally murky. Cohen and Levin (1989) review the literature and conclude that there isn't a strong linkage between market concentration and innovation. The endogeneity of market structure is perhaps one reason why a robust statistical relationship between concentration and innovation is yet to be found. Nor is there any significant relationship between market concentration and profitability. As Joskow (1975) notes, "we have spent too much time calculating too many kinds of concentration ratios and running too many regressions of these against profit figures of questionable validity" (p. 278).

3. Static and Dynamic Competition

As discussed earlier, there is a third (usually overlooked) but very important proposition embedded in Schumpeter: dynamic

competition should be favored over its poorer cousin, static competition. I will describe both static and dynamic competition in turn. In doing so, I recognize that these styles of competition sometimes do not have bright lines separating them. Certainly, Schumpeter didn't provide crisp delineation.

In this chapter I try to give some substance to Schumpeter's intuition. Unfortunately, static competition is frequently favored unwittingly by antitrust economists. Dynamic competition is a style of competition which relies on innovation to bring forth new products and processes and concomitant price reductions. It improves both productivity and consumer welfare. Promoting it may well mean recognizing that competitive conduct may involve holding short-run price competition in abeyance.[2]

Dynamic competition is not embraced as widely as it needs to be in part because the overwhelming focus in economic research is (implicitly) inside the paradigm of static competition. Indeed, a major contribution can come from simply revealing to judges, juries, the enforcement agencies, and legislators that most economic analysis is static, when it should be dynamic, and as a consequence innovation may well get harmed by superficial answers derived from implicitly held static notions about desirable forms of competition. This bias stems merely from the analytical tools used, as most every economist recognizes the importance of innovation, then usually proceeds to apply analytical approaches that ignore it. Recognizing this state of affairs should deflate the hubris with which many antitrust scholars approach issues. To the extent they wield analytical tools of static competitive analysis, antitrust analysts are quite likely to make prescriptions which harm both innovation and competition, and sap productivity.

In order to come up with prescriptions that do more good than harm, it is necessary to inquire about the determinants of innovation, and the impact of antitrust activity on innovation. Dynamic competition is advanced by rapid technological change. And this is where the problem starts. The analytical framework most commonly used by economists stubbornly adheres to the view that market structure and little else determines the rate of technological change. This framework is grossly inadequate.

For instance, in merger analysis, as in many other forms of antitrust analysis, one is required to define a market and look at market shares. If a merger augments concentration above an accepted threshold, it may be blocked. Merger analysis usually proceeds this way, even though there are a growing number of economists who are beginning to think otherwise, particularly in differentiated product contexts.[3]

More often than not, however, avid antitrust economists (perhaps inadvertently), adopt the mantle of static competition. Because of its familiarity, they (unwittingly and inappropriately) use the apparatus of static microeconomics to analyze contexts where innovation is important. Innovation is at best an afterthought in static microtheory. The presence of innovation complicates the analysis, destroys equilibrium, and debases the value and utilities of the tool bags that most economists carry. This is unsettling, and tends to be resisted by the profession. Thus, dynamic analysis is shunned either because it isn't known, or if known it is feared that recognizing it will be too hostile to well-accepted and well-practiced analytical frameworks. Competition policy advocates should not accept this state of affairs any longer.

To preview what is to follow, this chapter recognizes that dynamic competition is associated with the change in external circumstances and/or the generation of new products, new processes, and new business models. As Schumpeter said, competition fueled by the introduction of new products and processes is the more powerful form of competition: "competition from the new commodity, the new technology, the new source of supply, the new type of organization—competition which commands a decisive cost or quality advantage and which strikes not at the margins of the profits and the output of existing firms, but at their foundations and their very lives" (Schumpeter, 1942: 8).

In today's vernacular, dynamic competition is heavyweight competition; static competition is the "lite" version. Advocates of strong competition policy must surely favor the former. Static competition is anemic compared to dynamic competition. More on this below.

Static Competition

Static competition reflects an intellectual framework, generally not a state of the world. Absent innovation, (static) competition manifests itself in the form of existing products offered at low prices. No new products are introduced, and rapid price reductions driven by innovation simply don't exist. There's no hurly-burly competition. Without innovation, all firms have the same technology and the same business models. Markets are in a comfortable equilibrium. Nobody makes any money of course, but nor do they innovate. Price gets squeezed down to marginal cost.

Agents are nevertheless rational and well informed. Prices are drawn down to the floor of long-run marginal cost; but that floor becomes their resting place. Firms just make their cost of capital and cover long-run marginal costs, and consumers are bereft of new products and true bargains. They never get overcharged, but there's nothing to charge them up.

While the framework has a simple theoretical simplicity and elegance, the industrial dynamics behind it are uninteresting. Absent innovation, there is unlikely to be much or any new entry—if incumbents can satisfy demand, new entrants aren't needed. Absent scale economies, no firm is likely to become dominant, and the ecology of firms is unchanging.

The static economics paradigm is what infuses, at least, the undergraduate economics textbooks. It is not a recognizable state of the world, except perhaps in a few local markets somehow insulated from competition. Unfortunately, it is what tends to spill over into antitrust economics as a normative paradigm. However, it is not and has never been a good abstraction of the economy. Nor has it ever been a state to which we should aspire.

Dynamic Competition

Dynamic competition is driven by innovation, but not exclusively. The term dynamic is a shorthand for a variety of rigorously competitive activities such as significant product differentiation and rapid response to change, whether from innovation or simply new

market opportunities ensuing from changes in "taste" or other forces of disequilibrium. Dynamic competition is in fact more intuitive and much closer to today's everyday language view of competition than is the (textbook) notion of static competition.

Dynamic competition is of course embedded in the Austrian economics framework of Carl Menger and his fellows (e.g. Kirzner). The Austrian treatment is quite different from neoclassical economics. The focus of the latter is on a static equilibrium in which there is a minimum number of known exogenous variables. Austrian economics does not purport to compute any equilibrium, because the essence of competition is taken to be the dynamic pattern by which it comes about, not the equilibrium itself. The truth is, Hayek argued, that "competition is by its nature a dynamic process whose essential characteristics are assumed away by the assumptions underlying static analysis" (Hayek, 1948: 94). The wishes and desires of consumers cannot be regarded as given information to producers but ought to be regarded as problems to be solved by the process of competition.

With dynamic competition, new entrants and incumbents alike engage in new product and process development and other adjustments to change. Frequent new product introductions followed by rapid price declines are commonplace. New innovations stem from investment in R&D, and/or the improvement and combination of older technologies. There are continuous introductions of product innovations, and from time to time dominant designs emerge. With innovation, there are explosions in the number of new entrants; but once dominant designs emerge, implosions are likely and markets become more concentrated. As with dynamic competition, innovation and competition are tightly linked.

The model of dynamic competition recognizes that competition is a process, and that entrepreneurs and entrepreneurial managers are essential to it. Stagnation is defeated by perennial gales of competition. Maintaining innovation depends upon the existence of entrepreneurs and institutional structures that support innovation.

Technological innovation comes in waves, based on different technologies. These waves cause what Schumpeter called "creative

destruction" (Schumpeter, 1942: 83). A large fraction of new (radical) technologies are introduced by enterprises new to an industry; however, incumbents do sometimes pioneer, and if not are often able to imitate or improve on the new entrant's products. The benefits of creative destruction may not come immediately; changes take time. Innovation drives competition, and competition is in turn driven by innovation.

This paradigm of industrial change has been refined by Abernathy and Utterback (1978) and given some theoretical motivation by Burton Klein (1977). There is now considerable evidence supporting it over a wide range of technologies (Klepper and Graddy, 1990; Utterback and Suarez, 1993; Malerba and Orsenigo, 1996). It implicitly recognizes inflexion points in technological and market evolution. The advent of new technological ensembles or paradigms is usually marked by a wave of new competitors entering an industry to sustain success. Incumbents must master discontinuities as well as incremental change and improvement.

There are many other complementary "models" of innovation. At their core, most can be related to an evolutionary theory of economic change and a behavioral theory of the firm. As Sydney Winter once said, the methodological imperative of evolutionary theories is "dynamics first"; the methodological imperative of behavioral theory is that internal firm structure (not market structure) and internal processes such as learning, diffusion, sensing, seizing, reconfiguring impact firm behavior.

Evolutionary theory in economics is sometimes understood to be economic Darwinism; but the logical structure of an evolutionary theory is much broader than its biological versions. Evolutionary theory draws attention to what went before. As a general principle, novelty comes about by changing and combining existing artifacts and structure. "Descent with modification" crystallizes this key point.[4] Selection leaves behind variants that are unfit according to the selection criterion at work.

Selection processes include not only birth and deaths of individual firms (Hannan and Freeman, 1989), but also the ability to adapt to the changing environment by changing strategies and structures.

Scholars disagree on the amount of adaptation that is possible. Some evolutionary economists see firms as strongly constrained; strategic management scholars claim much greater capacity for change effectuated by managers. All recognize that the advance of change in the context of changing markets and technologies will lead to diminished prospects for the enterprise.

Another common thread to behavioral/evolutionary mechanisms is that they are probabilistic rather than determinative (Aldrich, 1999: 33–50). Rigorous evolutionary theories will make probabilistic statements like "there is a Z probability that individual Y will not replicate (die when the entity has a limited life span) under the selection environment X" (Murmann, 2003: 15).

Because business enterprises are guided by routines that interact in highly complex ways, managers more often than not find it difficult to figure out what makes the enterprise successful. This ambiguity around causation becomes a problem when the environment changes, as causal ambiguity makes it difficult to figure out what the enterprise should do differently. When Japanese auto manufacturers started to take a large share away from the US manufacturers in the 1980s, a string of explanations were put up by the US auto industry to explain the phenomenon, including a view that the cost of capital was lower in Japan, that unfair trade barriers in Japan prevented exports from the USA, to concerns that the US firms were falling behind in the use of robotics, etc. It took nearly two decades for the US auto industry to figure out for itself that labor–management issues, and management itself, were key causal factors associated with decline.

Once causation was more accurately diagnosed, management and organizational changes were made that began to make a difference. Often it is necessary to create a breakout structure to unshackle the new from the old.

There are a number of assumptions and propositions that characterize dynamic competition. Many of them are rooted in an evolutionary theory of economic change. As Schumpeter said, "in dealing with capitalism, you are dealing with an evolutionary process". Features of evolutionary theory are outlined in the next section.

4. Relevant Aspects of Evolutionary/Behavioral Economics

Evolutionary economics and the behavioral theory of the firm are separate but related frameworks. Both have been in existence for half a century or more. Both embrace firms and markets as we see them. Both recognize a capability to discover new technologies and business models in the economic system. Entrepreneurial activity by individuals and enterprises is critical to this capability.

Some endogenous generation of innovative opportunities is likely. Evolutionary theories recognize some process of imperfect (mistake-ridden) learning and discovery on the one hand, and selection on the other. Whereas neoclassical theory can recognize bad outcomes due to bad luck and uncertainty, evolutionary theory accepts the systematic mistakes associated with ignorance or wrong-headed understanding. Clearly, the canons of rational choice theory and equilibrium economics provide only a very limited basis for the study of innovation.

Neoclassical theory almost completely neglects the specificities of competencies and skills that each firm possesses. The relatively tacit and organizational capabilities which cannot be imputed to individuals are especially neglected. This neglect impedes any satisfactory analysis of the innovative capabilities of firms.

Bounded rationality is assumed as agents have an imperfect understanding of the environment they live in, and what the future will deliver. Because of limits to rationality, enterprise behavior is often rule guided/based. There are relatively invariant routines shaped by the learning history of the enterprise.

Adaptation and learning generate variety. Managerial action inside firms (at headquarters)[5] and market and factor market competition between firms act as selection mechanisms, leading to the disappearance of some firms and the rapid growth of others.

Knowledge of specific technologies determines how technology is going to advance. Technological paradigms shape the direction of future change. There is no innovation possibility frontier.

Technologies develop along relatively ordered paths (or trajectories) shaped by specific technical properties, search rules, technical "imperatives", and cumulative expertise. As a consequence,

diversity between firms is a fundamental and permanent characteristic of environments undergoing technical change.

Firms differ because of different technological capabilities with respect to innovation, differing degrees of success in adapting technologies developed externally, and different cost structures. They may also differ because of differing search/sensory procedures and capabilities, and differing strategies (behaviors).

One should expect path dependencies when there are increasing returns of some kind. This will be especially true for (a) information goods and (b) cumulative technological advances. How strong path dependencies are is mainly an empirical question.

Market concentration is a function of two opposing forces: (a) selection mechanisms which tend to increase the standing of innovating firms, while (b) learning and imitation mechanisms spread innovations/new knowledge throughout the potential adapters, thereby reinforcing existing disparities via cumulative mechanisms internal to the firm.

Abilities to innovate and imitate are firm specific and depend on a firm's past innovative record—learning is cumulative. Chance matters, but chance favors those firms which are prepared.

Although some of the economic benefits from innovation and the adaptation of new products and processes can be appropriated by the innovators themselves, there are learning externalities. The ease of imitation depends on the intellectual property regime (strong or weak) with the nature of the relevant knowledge (codified or tacit). Skills and know-how almost always leak out from individual generators/first adapters to the whole industry.

Innovation in products and processes is nevertheless to a fair degree endogenous via-in-house R&D, technological acquisition (e.g. in licensing), as well as by learning mechanisms.

There is considerable dispersion in costs and profitability and growth rates inside an industry. Asymmetries in capabilities are a direct consequence of the cumulative, idiosyncratic, and appropriable nature of technological advances. The more cumulative are technological advances at the firm level, the higher the likelihood of success breeding success.

Moreover, the higher the opportunity for technological progress, the higher the possibility of differentials between innovators and laggards. High technological opportunity associated with a high degree of appropriability provides incentives to innovate for a firm on or near the frontier; but possibly low incentives for firms with relatively lower technological capability.

"Normal" technical progress proceeds along trajectories defined by an established paradigm and extraordinary technical advance associated with the emergence of new paradigms. As shown by others (Dosi, 1984), market processes are generally weak in directing the emergence and selection of radical technological discontinuities. Put differently, when the process of innovation is highly exploratory, its direct response to economic signals is weaker and its linkage with scientific knowledge is greater. Institutional and scientific contexts are more important than the market.

Institutions and markets coevolve. Industrial, technological, and institutional factors interact. In particular, research and training bodies and the intellectual property system help shape industrial outcomes. The competitive strengths of individual enterprises as well as the industry depend on such factors. For instance, according to Murmann, German firms achieved global superiority in dyestuffs by 1914 not because they had superior strategies and organization, but because there were a large number of new entrants, and a large number of exits, giving the German dye industry more room to experiment with different firm strategies and structures. By 1900 the leading dye firms had all developed in-house R&D capabilities and could match new product introductions by competitors in the UK and the USA, as well as in Germany. The German firms also patented heavily in the UK, and their innovative efforts at home were built upon an extremely strong university system in chemistry. "Germany had it easier than Britain in bringing forth competitive firms" (Murmann, 2003: 51). The British government also imposed higher tariffs on industrial alcohol, an important input in dye making. Strong organizational capabilities in R&D, manufacturing, marketing, management, and strong patent portfolios, allowed the German dye industry to capture 70–90 percent of world market share (Murmann, 2003: 92).

Strength in both the supplier industry and in supporting institutions aids innovation. The German firms actively shaped their selection environment—particularly education and training, tariffs, and patents. German firms not only benefited from governmentally supported education and training; they helped upgrade them.

Indicators of dynamic competition include heterogeneous firms engaging in experimentation and innovation. New products and processes are developed and introduced, and internal processes are reworked and adjusted. Firms constantly battle unanticipated events. Rivalrous behavior is the norm.

An evolutionary approach underscores the importance of maintaining variety in the economic system. Competition policy authorities as well as other agencies must be concerned with protecting economic diversity and meaningful variety in organizational forms. The focus need not be a particular market—it should be broader as what's outside the market tends to be amongst the best candidates for Schumpeterian entry and radical innovation.

These propositions, derived mainly from behavioral and evolutionary theories of firms and markets, promise to expand our understanding of firm behavior particularly in domains of rapid innovation. Following Joskow (1975: 278), I would like to believe that the field of industrial organization to which antitrust economics owes so much can "play an important leadership role in the extension and revision of the conventional theory of the firm rather than be its prisoner".

5. Implications

General

Static and dynamic competition have elements in common. Current law embraces both,[6] although in my view when it relies on economic theory to inform it, the law gets a larger injection of static analysis than dynamic analysis. But dynamic analysis has always been embraced to some degree by the law.

Traditional static analysis focuses on detecting market power in product markets. Dynamic analysis views competition through a broader lens and focuses less on outcomes and more on process. It favors maintaining rivalry but it also protects property. The working assumption is that intellectual property rights are desirable institutional/legal arrangements providing necessary appropriability mechanisms to promote and reward innovation.

The framework also recognizes that the benefits of dynamic competition do not arrive immediately; some short-run static inefficiencies may have to be tolerated to support innovation. Wooden policies blind to innovation and fixated on short-run efficiencies are likely to hurt innovation, and thereby hurt competition.

If policy is to favor dynamic over static competition, a role for vigorous antitrust enforcement still remains, but it proceeds less self-confidently. Uncertainty and complexity are hallmarks of dynamic market environments. In particular, the tools of static analysis should be used sparingly, if at all. Simple rules based on static analysis may well stand in the way of competition. In particular, concentration analysis should be deemphasized, as Ordover indicates (perhaps for different reasons). To prohibit mergers merely to manage concentration is unlikely to help consumers.

More generally, the presumption that more competitors are always better is overturned—once the goal is not just lowering price but also protecting innovation.

Barriers to entry may need to be examined over a longer time period and must be examined at the firm level.[7] The role of supporting structures and government funding for research also affect entry conditions. They may purely reflect capabilities that incumbents have developed that newcomers shouldn't expect to possess. Capabilities are likely to reflect the search for unique advantages. Their possession drives competition.

In stark contrast to the basic assumption of the structure–conduct–performance (S-C-P) paradigm, in dynamic contexts conduct in this framework is not a function of market structure. Market conduct is driven more by internal organizational factors: standard operating procedures, investment routines, and improvement routines. Performance depends on the (relative)

organizational capabilities and behavioral traits of the enterprise. Enhanced industrial performance also stems from the improvement in individual technologies, and the expansion in the use of more productive technologies.

As discussed above, some typical evolutionary patterns to industry dynamics can be observed—perhaps one can call it an industry life cycle. In the early stages of the evolution of an industry, firms tend to be small, and entry relatively easy, because of the diversity of technologies being employed. However, as the dominant design emerges, costs of entry rise as an established scale for competition activity becomes apparent.

Learning becomes cumulative, and established firms are somewhat advantaged over the new entrants. After an industry shakeout, established firms settle into a more stable industry structure. This may sooner or later be overturned by a new technology that has the promise of being superior. Under normal circumstances, with entry and exit, the life of firms tends to be short (Geroski and Schwalbach, 1991; Geroski, 1995).

New technologies can be competency enhancing or competency destroying. The essence of the dynamic competition approach is that technological change itself shapes industry structure. Also path dependencies and dynamic increasing returns are likely to be present in many circumstances.

Put differently, the rate and direction of innovation at the level of the firm does not depend on market structure but on the competences of the firm, the internal and external knowledge the firm can draw on, the IP regime, and its complementary assets. Entry conditions are a function of appropriability and cumulativeness. Learning and innovation will also shape the boundaries of the firm.

Market concentration is likely to be an outcome of market selection, which in turn depends on the uneven exploitation of learning opportunities; that is, concentration has little to do with market power.

Moreover, if the degrees of selection are interpreted as a proxy for how well markets work—in the sense that they quickly reward winners and

weed out losers—then more efficient markets tend to yield, in evolutionary environments, more concentrated market structures, rather than more "perfect" ones in the standard sense.[8]

The possibility of innovation rests on the permanent existence of unexploited technological opportunities. A growing body of evidence from the microeconomics of innovation (Rosenberg, 1976, 1982; Freeman, 1982; Dosi, 1988) supports the notion that unexploited opportunities permanently exist and that what firms actually explore is a small subset of what's available. Accordingly, firms aren't constrained by nature, but by their own capabilities—there are therefore almost always opportunities to be sensed and seized.

Market Definition

Market definition issues typically play a central role in antitrust analysis, especially as it relates to Sherman Section II and Clayton Act issues. Defining the boundaries of one or more markets is the first step under the Merger Guidelines.

Economists recognize that market definition is merely an analytical tool. As Janusz Ordover put it "Arguments for and against a merger that turn upon distinctions between broad and narrow markets definitions are, to an economic purist, an inadequate substitute for, and a diversion from, sound direct assessment of a merger's effect".

While Ordover is undoubtedly correct, in practice the courts and agencies seem to require market definition.

An evolutionary/dynamic competition perspective would appear to support Ordover's position, as market share/concentration is unlikely to have much power in explaining conduct decisions, including those surrounding pricing. There is no general theorem establishing that higher concentration leads to higher prices or less output. There may be some theoretical support in static models to show that equilibrium output falls and equilibrium prices rise as the number of firms declines.

There is a modicum of empirical work in some markets like telecom and airlines to support the S-C-P paradigm. But the evidence

supporting it is weak, and when innovation is significant, theoretical connections and empirical correlations become even weaker.

Fortunately, the Merger Guidelines are clear that, at least in the merger context, market share is only a starting point—market definition is merely a tool. But it may not be even a good starting point or a good tool when the industry is characterized by rapid technological change. As discussed earlier, high market share may simply indicate that selection/competition processes are working well.

Also, as Katz and Shelanski note, in practice the hypothetical monopolist test is hard to apply in the context of innovation. Hartman *et al*. (1993) note that when innovation is present, products are likely differentiated in quality, and price isn't the main or only competitive weapon. Furthermore, we note that innovation can make it difficult to define relevant product markets because business executives and government officials alike may not yet know what the future products will be.

The hypothetical monopolist test to establish relevant markets may be better suited for quasi-commodity products than for high-tech companies. With innovation, value disparities are likely to exist amongst substitute products. In the context of the earlier discussion, before the emergence of the dominant design, competition takes place on features, not price. Hence, the hypothetical monopolist test might not be applicable before the emergence of a dominant design. In the case of autos, an application of the test circa 1910 might have put steam cars, electric cars, internal combustion engine cars in separate markets, despite the fact that competition amongst these technologies was already fierce, and over the next few years led to the obliteration of producers who were not able to transition to the design and production of internal combustion engine autos.

More importantly, if one is to adopt a future-looking posture, then neither the agencies nor the courts are likely to know which products are likely to be good substitutes in the future. Since innovation produces new products and lowers the cost of existing products, it is necessary to include in the market such future products; but this is quite difficult to do in many instances.

Market Share and Actual versus Potential Competitors

In traditional analysis, a market is first defined, and then actual competitors within it are identified and allocated a market share. In conventional analysis, actual but not potential competitors are included in the market. Potential competitors are recognized only when certain conditions of probability and immediacy of entry are met.

In dynamic contexts, potential competitors can be of very considerable importance. As discussed, what today may be thought of as a potential competitor can obliterate incumbents tomorrow in acts of Schumpeterian creative destruction. To exclude such competitors from the boundaries of the market would clearly be a mistake.

As discussed earlier, what is required is an assessment of capabilities. These are difficult to quantify; but a very large literature on capabilities now exists in the field of strategic management. This provides many clues with respect to how to assess the capabilities of both actual and potential competitors.

Furthermore, snapshots on market shares, whether present or forward looking, won't tell you much if markets are in turmoil, as they frequently are in dynamic contexts. Moreover, high market share by no means suggests market power. Not only are today's market shares a poor indicator of the future, but as already noted, a high market share may indicate not just superior performance, but strong selection (competition) at work in the industry.[9]

Accordingly, in both merger analysis and in Section II cases, when dynamic competition is at work, one must look beyond market share data. Serious consideration of potential competitors is required. After all, studies show that new entrants almost always drive innovation in established industries.

A focus on potential competition will help ensure that market analysis is forward thinking. Market share is likely to be irrelevant in regimes of rapid change; competition for the market is likely to be as significant as competition within it (Teece and Coleman, 1998; Pleatsikas and Teece, 2001b).

Katz and Shelanski likewise note that market share may be altogether irrelevant in some cases because there may be markets

in which innovation is so characteristic and sustained that firms compete not just for market share, but for markets as a whole. A firm's monopoly today may say little about the firm's prospects one, two, and five years down the road (Katz and Shelanski, 2007).

One should note that there have already been efforts to come up with new analytic approaches to market definition in recognition of the fact that defining the market at the level of the product is difficult when successful future products cannot be predicted with any degree of certainty. I refer to Gilbert and Sunshine's proposal for innovation markets (Gilbert and Sunshine, 1995). They put potential competition to one side, and focused instead on what they call "innovation markets", by which they seem to mean R&D markets. Although this concept was used in *US v. GM*, the concept seems to have been forgotten.

Despite its shortcomings, the innovation market approach did shift the attention away from product markets to activity upstream. This required antitrust authorities to determine what skills and assets are needed to innovate, and determine who possesses those skills. This can be a fundamentally different inquiry from examining demand side substitution, which is now quite familiar to economists and many courts. The innovation market approach might have been pushed to its logical conclusion—the analysis of capabilities, which we now discuss.

Analyzing Capabilities to Assess Competitor Positions and Economic Power

As was noted by Edith Penrose ([1959] 1995), an enterprise should be defined not by its current products, but by its (upstream) "resources", or what some prefer to call capabilities.

Penrose defined the internal resources of the firm as "the productive services available to a firm from its own resources", particularly those from management experience. "A firm is more than an administrative unit; it is a collection of productive

resources" (pp. 149–50). She saw that "many of the productive services created through an increase in knowledge that occurs as a result of experience gained in the operation of the firm as time passes will remain unused if the firm fails to expand" (p. 54). Penrose saw the capabilities of management—not exhaustion of technologically based economies of scale—as determining whether a firm could expand to take advantage of opportunities. In reality of course, the resources/capabilities of the firm are defined by other assets too—like innovation capabilities—but it is important to note that Penrose laid out a model which implicitly eschewed market shares as a measure of how a firm is "positioned" to compete.

Subsequent research has established that firms exhibit more stability in their capabilities than in their products. In this sense, capabilities are easier to analyze than products. Capabilities are a proxy for those interrelated and interdependent aspects of the enterprise that govern its competitive significance. They are arguably a better proxy for competitive position than (downstream) market share.

Strategy refers to the broad set of commitments made by the firm that define and rationalize its objectives and how it intends to pursue them. Some of this may be explicit, and some implicit in its culture and values. Strategy is often more a matter of faith and determination, not one of calculation. Structure refers to how a firm is organized and governed and how decisions are made and implemented. Strategy and structure shape capabilities; but what an organization can do well is likely to be partly a function of what it has done in the past. However, its R&D activities and success at acquiring external technologies can mold its going-forward capabilities. Strategy helps determine what capabilities one should own and protect.

The world is too complicated for a firm to have "an optimal strategy", and while its capabilities are always in a state of flux, existing capabilities are a good guide to what a company can do in the future. The capabilities approach would be quite a break from standard analysis. It would calibrate a firm versus competitive standing not by reference to products but by reference to more enduring traits.

In a dynamic context a firm will have a changing kaleidoscope of products—yet its underlying capabilities are likely to be more stable. For instance, rather than analyzing Honda's market share in outboard motors, lawnmowers, and small electric generators, perhaps a more meaningful approach for antitrust analysis would be to look at a capability "market". Here the relevant capability might be around small four-stroke internal combustion engines. A capabilities approach may lead to "markets" being defined more narrowly or broadly than product markets.

The tools for assessing capabilities may not be well developed yet, but they are developed enough to allow tentative application. Clearly, product market analysis can be unhelpful and misleading in dynamic contexts. Using the right concepts imperfectly is better than a precise application of the wrong ones.

The question arises as to whether simply doing a better job at analyzing potential competition would help. Clearly it might. In the end, however, one would be forced to look at the capabilities of potential competitors—so there is probably no escape from developing the analytics of a capabilities approach.

The innovation market approach introduced by Gilbert and Sunshine (1995) implicitly recognizes that focusing on product market analysis is inadequate. But it too narrowly focuses on R&D as the arena for measuring innovation competition. Even if it is defined quite broadly, R&D is usually just one element of the resources and problem solving that goes into innovation. The resources that must be committed—and the skills that must be employed—to succeed at innovation are usually much greater than that needed for just R&D. Furthermore, R&D concentration has little to do with innovation outcomes, except possibly in industries characterized by cumulative technological change—and even here, the linkage can be expected to be weak. The widespread adoption of elements of an open innovation[10] model—whereby elements of the innovation process are outsourced—makes this point even more compelling.

Merger Analysis

Despite the misgivings of an increasing number of economic scholars, in practice merger policy in the USA, the European Union, and most other jurisdictions where there is competition law focuses on how the merging party's combinations will affect concentration in one or more product markets. In effect, an increase in concentration is taken as a proxy for a decrease in competition that if of sufficient size will lead to an increase in the prices faced by consumers.

Focus on dynamic competition is likely to be especially relevant in high-technology industries. The evolutionary/behavioral economics approaches outlined here are not ones that lead to the abandonment of antitrust, or even necessarily to its restriction. But they do lead to a more careful approach that recognizes uncertainty and complexity and relentlessly asks: does this practice support/discourage innovation? Will this merger assist or burden dynamic competition?

The evolutionary/behavioral economics framework which we advance suggests a number of modifications in the way that some analysts may view a particular merger:

1. Market structure is not a meaningful concern, at least not until a dominant design has emerged, and the evolutionary paradigm is established and likely to remain for quite some time.
2. If the analysis is to be deflected away from products in the market, the natural place to look is at capabilities. These transcend products.
3. Only if the merger entities are the only ones with the necessary capabilities to innovate in a broad area should concerns arise. Katz and Shelanski suggest that if new product development efforts are under way to create or improve products and processes, and these products are not yet in the market, then harm arises from a merger because it may cripple future product market competition in a market that does not exist. A capabilities approach would soften such concerns—the question should be framed not in terms of whether product market competition will be impaired—as that is too much of an immediate concern—but whether capabilities will be brought under unitary control, thereby possibly thwarting future variety in new product development.

Intellectual Property Issues

Favoring dynamic (over static) competition does double duty. It also softens the patent–antitrust debate. Static analysis looks upon patents with considerable awkwardness—and fuels tension between the patent system and antitrust.

The DOJ-FTC intellectual property guidelines have endeavored to reconcile the tension between intellectual property and antitrust by declaring intellectual property just another form of property, and by noting that patents only imply market or monopoly power if they enable control of a relevant market, which is rarely the case. Still, justifying the exclusivity provided by the patent system is not easy for many competition policy advocates. In practice, neoclassical economists are often hostile to patents, believing that the appropriability problem is naturally solved by other mechanisms, which is often not the case.

Embracing dynamic competition causes tension between intellectual property and antitrust paradox to soften. The patent system provides some amount of exclusion; and some amount of exclusion is required to foster innovation, particularly in more competitive market environments.

Of course, once antitrust doctrine sees the promotion of innovation as its major goal, innovation and competition snap into greater harmony. But the harmony isn't perfect, as questions remain with respect to the degree of intellectual property protection needed to foster innovation and competition. The cumulative/sequential nature of innovation means that intellectual property protection needs to be calibrated in a careful manner. There will almost always be more users of intellectual property than generators of it; so the danger particularly is that the users will try to crimp the scope of intellectual property rights provided to the generators.

6. Conclusion

Antitrust scholars must confront an inconvenient truth: innovation drives competition as much as competition drives innovation. This

requires that antitrust analysis recognize that advancing dynamic (non-static) competition will benefit consumers most, certainly in the long run if not in the short run. The law has already begun to move in this direction, as have the agencies. The pace is glacial, however, in part because antitrust economics has trouble grappling with dynamic concepts. The Chicago School in large measure inadvertently (by embracing static micro theory) ignored it; the post-Chicago economics have been almost as reluctant because their tools are inadequate too. Fortunately, a large body of research in evolutionary economics, the behavioral theory of the firm, and corporate strategy has emerged which can be exploited to hasten the transition toward an enlightened approach to antitrust which has a better chance of minimizing the unintended negative consequences of (static) antitrust analysis. If nothing else, the recognition of dynamic issues will temper the hubris which the uninformed sometimes bring to antitrust analysis.

Notes

1. "To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy", Report of the FTC, October 2003.
2. The argument against generic drugs may be of this kind.
3. In these contexts, that emerging consensus seems to be that what matters are the particular firms one is dealing with.
4. Durham (1991: 22) sets out five requirements for an economic theory of change: units of transmission (e.g. ideas, values); sources of variation (e.g. invention); mechanisms of transmission; processes of transformation; sources of isolation.
5. Managers act as the proximate agent of selection when they pull resources from underperforming units and reallocate them to growing units.
6. As noted by Katz and Shelanksi, Judge Learned Hand wrote as early as 1916 that "the consumer's interest in the long run is quite different from an immediate fall in prices" and spoke of competition as a proper stimulus to maintain "industrial advance" (Katz and Shelanski, 2007: 48).
7. The firm-level analog is what is referred to in the strategy literature as "isolating mechanisms".

8. Dosi *et al.* (1995).
9. Katz and Shelanski (2007): "Even absent innovation, there are reasons to be cautious about the interpretation of market share data. In order to generate sensible predictions of the effects of a merger, the measurement and analysis of market shares should always be tied to a coherent theory of competitive effects that fits the facts of the industry under consideration. Put another way, the analysis of market shares can most confidently be used to predict adverse competitive effects of a merger when one has an empirically supported theory that market shares are informative of competitive conditions and that an increase in concentration will harm competition and consumers."
10. See Chesbrough *et al.* (2006).

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