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ABSTRACT

This paper presents a model of the relationship between Core Competence and Competitive Advantage. The model frames competence relative to both skill related and cognitive components. These components are presented in dynamic terms as they reflect the influence of changes both in the broad environment and in the learning processes within organizations in maintaining competitive advantage. The model also includes the concept of the core product as an intermediate phase between a skill and a competitive advantage in a market. The model's relationships and dynamics are examined through a 50 year study of competence and competitive advantage in the pharmaceutical industry.

INTRODUCTION

The competitive advantages which seem to endure through both good and bad economic times are the most prized assets of the firms which possess them, and the most frustrating challenges for competitors which do not. Frustration occurs primarily because the keys to competitive success are often difficult to determine and imitate. They lie beneath the product/market interface where firms typically compete. In particular, sustainable competitive advantage arises from the distinctive core competencies developed within the firm. Periods of economic recession and recovery highlight those firms whose strategies are built firmly on inimitable core competencies and those which are not. Businesses with competitive strategies grounded in core skills not only survive troubled times with less pain than their competitors, but they emerge stronger still. Firms wishing to understand or emulate industry leaders and leaders wanting to maintain their competitive position need to clearly understand what the concept of a core competence is and how it relates to competitive advantages in the market place.

Unfortunately, core competence is often perceived as a static concept. In defining a core competence or in describing a competitor's competence at any point in time, a description is often used which implies a stable condition or relationship. Competition and the competitive environment, however, are dynamic. Therefore, firms which maintain their competitive advantages over many business cycles must have dynamic, not static, core competencies. In defining core competencies in this paper we always assume that competition and the competitive environment are fluid. We infer from this that one of the basic challenges of any general manager is the relentless pursuit of alignment between the ever changing core competencies within the firm and the ever changing demands of the external environment. If a manager is to accomplish this, then a clear understanding of the

changing relationship between those core competencies and competitive environment is needed.

In this paper we provide a framework to examine the relationship between core competence and competitive advantage using both conceptual models and real-world examples. The conceptual models draw on both academic and practitioner literature. Our primary intent is to capture the many elements which drive core competencies and which link them to competitive advantages. Our real-world analysis then evaluates competition in the pharmaceutical industry and assesses those factors which have historically led to success in this industry. It examines and analyzes the role which core competencies have played in the performance of both leader and follower firms and charts the effectiveness of nine firms in maintaining market alignment over a 40 year period of change.

THE CONCEPT OF CORE COMPETENCE

We propose a definition of the concept which encompasses each of the critical elements which create and sustain a core competence and which distinguishes core competence from other, related concepts. First a formal definition:

> Core competencies are firm-specific skills directed towards the attainment of the highest possible levels of customer satisfaction vis-a-vis competitors. Core competencies may be leveraged directly to satisfy existing customer needs or indirectly to develop a range of core products or core services. Firms with core competencies are more than just highly adept at executing core skill sets. In addition, they have built appropriate cognitive traits which include:
>
> a) recipes and organizational routines for approaching ill-structured problems,
>
> b) shared value systems which direct action in unique situations, and
>
> c) tacit understandings of the interactions of technology, organizational dynamics and product markets.

Both the activity oriented and the cognitive aspects of a core competence are built up cumulatively through learning and are constantly adapted towards applying a firm's skills so as to achieve competitive advantage.

The model shown in Figure 1 shows more clearly how cognitive traits, action-oriented skill sets and the competitive environment are involved. These relationships are more fully discussed in the succeeding paragraphs.

Figure One Here

Core Competence and Competitive Advantage The first component of our definition is critical. It addresses the relationships at the very top of Figure One. We believe that no skill, no matter how refined, can be a core competence if it does not give a firm an advantage in the marketplace by satisfying a customer need better than a competitor. Although the point seems rather elementary, it is important both for avoiding a mis-allocation of resources to activities which, although done well, do not lead to competitive advantage, and for avoiding under-allocation of resources to those activities which, although not directly linked to the market, could lead to competitive advantage.

It is also important here to underscore the distinction between core competencies and competitive advantage. Core competencies are internal traits of a firm. They are skills and understandings that are accumulated over time. Competitive advantage describes an edge that firm has in external market competition. Core competencies usually underscore competitive advantages, but they are not the same thing.[1] For example, customers may not

[1] Competitive advantages resulting from pure luck are not based on core competencies, they have neither the traits of a skill base nor replicability.

be concerned with, or even aware of, Honda's core skills in refining the internal combustion engine as described by Prahalad and Hamel (1990). They are motivated to purchase a Honda over a competitor's vehicle because of the perceived value which comes from a reputation for overall reliability. The core skill in engine design underlies the ability of Honda to more effectively compete for customers, but actually the outcomes of competition occur on a different plane.

It is also important to note that our definition infers that a core competence must be unique to the firm. Core competencies must lead to unique, distinctive traits such that economic profit can be earned in otherwise open competition. It is based on this point that core competencies are often called "distinctive competencies" (Andrews, 1980). Failure of the competence to be distinctive will result in the equivalent of Porter's (1980) "profitless prosperity".

Core Competencies and Core Products and Services The model indicates that competence may not lead directly to a competitive advantage. Here the idea of a core product or service is introduced (Prahalad and Hamel, 1990). This is located on the right side of the figure and will be referred to only as "core product", although services clearly are major applications of competence. A core product serves as an intermediary between the core competence and a product in market competition. The core product is not the final product consumed in the market, and may not even clearly identify the market in which competitive advantage will be realized.

There is a sequence here, not unlike an activity chain, which ties the core competence to competitive advantage through the core product. Core competencies are first applied in core products and services, then other traits are wrapped around these core

products to create the final product or service which will advantageously compete in the market. Hence, it is through the mechanism of core products that a single set of core competencies can be dispersed to multiple product markets. In this respect core products and services are the basis for successful diversification. In Prahalad and Hamel's example of Honda they show how engine competencies allowed that firm to compete successfully in the distinctive markets for automobiles, motorcycles, lawn mowers and electric generators. Here it was clearly the ability to package the core product with other traits which led to successful diversification into multiple markets wherein the core product could lead to competitive advantage. By contrast, we can infer that Honda's core competencies would not lead to competitive advantage in, say, ladies retail clothing; the core products which the core competencies produce can not be advantageously packaged with other traits for competition in that product market.

Core Competence as both Action and Cognition A firm's core competence exists on two levels. On one level there is the active component of a core competence, the exploitation of a skill which focuses on performing some activity better than the competition. For example, actually designing increasingly more efficient internal combustion engines would be a skill exploitation. Consistent with the internal orientation of core competence developed thus far, we see such core skills are meaningful in competition, but need not be the basis of product/market competition itself. Later we will note how this activity of "doing" (or exploiting) not only leads to core products, but also is a key component of the iterative learning process which improves competence levels over time.

The second level or component is the cognitive portion of the competence. Assuming all actions/skills are driven by some mental model, map or recipe, this level captures these

cognitive factors which lie behind core skills and which can transform the mere doing of an act into a competence. These may be cognitive traits shared by a group or they may be found in the mind of the single individual. One implication is that it is through the effective, ongoing development of these cognitive traits, that core skills rise to a level which is distinct from those of a competitor, leading to core products and competitive advantage. These "soft" traits of core competence are subdivided into three parts, all of which are interrelated with each other, as indicated by the two-headed arrows in Figure 1. Further, the roles of all three are predicated on the basic assumption of a constantly changing competitive environment, where change often occurs in non-linear and unpredictable, ways. Indeed, without the need for firms to cope with such ongoing dynamics, the learning process, would not be necessary and the concept of a core competence would revert only to the development and maintenance of specific stable core skills.

The discussion of cognitive traits in the model begins with the proposition that competition is a dynamic process. Mintzberg (1978) makes the point that competitive strategy "emerges" over time, in contrast to being a rationally executable fixed plan. This inability to fully plan competitive strategy is predicated on the inability to fully understand future events. Firms must, therefore, respond to events which were not fully foreseeable as they emerge and incorporate those events into their competitive strategy. As strategies emerge, "recipes or routines" (Nelson and Winter, 1982) play an important role in competence enhancement. They embody the ways the firm organizes stimuli as they come from the environment. These stimuli carry important information about the future effectiveness of a core competence in providing competitive advantage, but because of the unpredictable nature of emergent events, organizational routines have to be adaptable so as to incorporate this information effectively. Therefore, in the dynamic process of maintaining core

competence, operating routines must exist for (efficiently and effectively) responding to external events and integrating relevant changes into the set of core skills.

The cognitive traits of a core competence also include a shared value system (Ouchi, 1981; Peters & Waterman, 1982) among key decision makers. It is the shared vision of those who hone the core organizational skills which gives the appearance of singular action to a multi-person effort. For example, Intel has been described as a decentralized and ill-structured organization. But its strong shared values system uses this as a strength, enabling a large organization to respond smoothly, and quickly to the fast changing environment for microprocessors (Hof, 1992). The shared understanding of what the core skills are and how they relate to competitive advantage drives team efforts in sales forces, research labs and the like. Such a shared vision allows for the common recognition of the external changes affecting the core competence and the quick integration of change in an organizational recipe and core activities.

The third cognitive aspect of core competence is a unique understanding of the different aspects of competitive dynamics. The competitive advantages to which core competencies lead is a function of several forces from both the supply and the demand side. Environmental events directly and indirectly impact several of these factors simultaneously. Responses to changes in the external environment must be formulated based on the totality of the competitive situation. These actions require deep understandings of how the various components of supply and demand relate to the core competence and the competitive advantage it produces. For example, a change in the regulatory environment may significantly effect a firm's ability to bring new products to market. But it also interacts with the functions of the firm's research team and the application of its marketing skills, among others. It is the combined impact of the change in technology with all of these other factors

which will determine the actual impact of the environmental change on the firm's competitive posture. Therefore, maintaining core competencies requires an understanding of the interaction of a change in one aspect of the environment with other aspects of the organization. Kotter (1982) identifies such rich cognitive understandings as one of the traits of effective top managers. Here the roles of shared values and established recipes and routines facilitate the process.

Continuous Learning There is more to the dynamics of maintaining a core competence than just responding to the environment. Organizations must learn. By learning we refer to the acquisition of new and unique understandings through experimentation. Competencies evolve through an iteration of doing, learning and doing some more. Each sequence expands knowledge and enriches core competence. Clearly this process will occur more often as organizations digest a change in their environment, but organizations which nurture their core competencies tend to continue their internal learning processes even in the absence of external motivation. Indeed, one of the shared values of organizations which have maintained long-term competencies is the continuous refinement of their core skills. Senge (1992) states that this process of experimentation and improvement is the key to competitive success. More specifically, Mintzberg and Waters (1982) identified it as the process by which Steinberg Inc. of Canada shifted from a traditional grocery to a self-service operator. Similarly, the late Sam Walton describes his organization's two decades of experimental learning about discount retailing prior to the explosive growth of the Wal-Mart chain (Walton, 1992). The dynamic environment, and the ability to experiment and improve, are seen here as competitive opportunities for the competence leaders to be entrepreneurial--to stay ahead of competitors, not just keep up. The flow of learning from the experimental doing phase to

the cognitive traits which make a shared sense out of the competitive market is a critical part of our model in the context of a dynamic world.

The Total Model and a Caveat The firm's goal of earning economic profit inexorably ties the demands of the competitive environment to the core competence of the firm. We should re-emphasize the point that all of the activities which take place in the lower part of the diagram (Figure 1) are still performed in the context of the larger product/market relationship and the pursuit of competitive advantage. The concept of critical success factors in an industry (Bullen & Rockart, 1986) indicates that there are key areas which a firm must address in order to compete at all in an industry. Indeed, a firm which wishes to earn sustainable profits from competition must address at least one of these success factors better than the competitors if there is to be a basis for earning an economic profit. In this respect the market determines or limits what core competencies a competitor may have. Similarly, firms which have developed competitive advantages in the market have predetermined for themselves which core competencies must be maintained.

This is not to say that purely entrepreneurial activity does not take place. Indeed, the examples of Steinberg and Wal-Mart mentioned above indicate that what is often considered entrepreneurial behavior actually involves the development of a new set of core skills which became critical to success in the next stage of industry competition.

Just as no one entrepreneur can create demand for non existent needs, so too, no firm, no matter how skilled, can respond to major competence destroying shifts in the environment (Tushman and Anderson, 1987). What we are saying here is that the very processes set up to handle change and manage core competencies assume some underlying basic structure of demand, and of how that demand is satisfied by the supply side.

If that relationship is fundamentally altered, then such a quantum change destroys any competitive advantages that firms once enjoyed. The underlying competencies are often rendered useless. The speed and scope of such environmental change presents a situation which is more than just evolutionary, it is revolutionary. For example, in the 1950s many firms had developed high skill levels in the manufacture and refinement of the vacuum tube. Environmental monitoring kept labs on the edge of new knowledge in vacuum tube technology. As the technology evolved, what was needed to maintain competitive advantage evolved, too, consistent with our model. Experimenting and learning helped leading firms push their underlying competencies outward and kept them ahead of competitors. Still, when the transistor was developed none of these evolutionary systems could save the vacuum tube market. Like buggy whips and butter churns before them, they maintained their skills but lost their competitive advantage. No competitive advantage can exist if no demand exists; all the skills and competencies built up will produce neither sales nor economic profits. We therefore have to limit the scope of the model to exclude the case of a dynamic environment which undergoes competence destroying change.[2]

RESEARCH QUESTIONS DRAWN FROM THE MODEL

The model just described presents some assumptions about the relationships between core competencies and the market. They lead to three more formal research questions discussed below.

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[2] However the learning portion of the model may provide a basis for understanding the evolution of newly emerging markets and develop insights into how new skill sets may lead to the development of firm-level core competencies.

Research Question #1 The model presented here distinguishes between a core competence and a product/market relationship. We have said that core competencies and core products must address the most basic questions of any business if they are to lead to a competitive advantage: the who, what and how of customer needs (Abell, 1980). When the competence enables a product of service to satisfy some fundamental point of customer need better than the competition it will yield economic profits for the firm. The more desirable and profitable core competencies build up a broad base from which numerous businesses or products can emerge. However, if the competence or skill does not yield a product or service which fits with the competitive environment it will be unprofitable. We suggest that how and where core competence translates into a competitive advantage will be determined by how the customers and other environmental factors define the product/market relationship. This leads to the first research question:

Research Question #1 Is the determination of which competencies are "core" and lead to competitive advantage made by the competitive environment or the firm?

If in fact the competitive environment provides the basis on which competencies can be built, then an industry analysis should allow for a clear identification of the core competencies on which industry members will compete. Stated another way, we should not expect to find any firms in an industry competing on a base competence which is not predetermined by the competitive environment.

Research Question #2 In the discussion of how core competencies related to competitive advantage we required that the competence be firm-specific. We are assuming that competencies, no matter how skillfully developed and executed, will not provide competitive advantage if they are held by more than one competitor. Those, core

competencies which will lead to a competitive advantage can not be quickly acquired or purchased in an open market by a competitor. Although they could possibly be acquired through purchase from the sole owner, perhaps through acquisition, this does not eliminate the unique status of competitive advantage to whom ever holds it. Thus, firms should not be able to lose competitive advantage due to quick copying by a competitor of their underlying competence. Instead, competence should have the potential to provide a firm with a long-term source of economic profit. Only significant environmental change, a competitor's development of alternative skills or failure to maintain one's own competence should underlie a loss of competitive advantage. For studying the ability to maintain a core competence the second research question looks at the exceptions for insights about sustainability.

Research Question #2 How do firms with established core competencies lose competitive advantage over time?

In the analysis of an industry over a sufficient period of time changes in industry leadership should be observable. In examining the long-term changes in the competitive positions of firms an industry analysis can research overall trends in the industry environment and in the competitive positions of individual firms. By comparing the environmental shifts to the competencies in individual firms it can be determined whether changes in the critical success factors in the environment led to shifts in organizational performance. If not, an analysis at the firm-level can be made to see if failure to maintain core competence was responsible for the performance shift. It is anticipated that these alternative explanations of the relationship between core competence and the environment may throw light upon a given firm's loss of competitive advantage.

Research Question # 3 A key concept in our model is the role of organizational learning. In the model competencies are based on developing firm-specific knowledge and skills. The firm-specific nature of the knowledge enables the firm to stake out a unique competitive position. The development of firm-specific knowledge, therefore, requires more than just collecting information and commonly known skills from the environment. Firm-specific learning must take place. Failure to learn and grow is critical because of the changing nature of the external environment and the demands of the customer. Thus, one of our key points is that learning is a two pronged process when related to core competencies. First, a firm must constantly be collecting information from experimentation and from the external environment. Second, the firm must refine this information internally--it must develop it to a level beyond that of competitors such that the firm retains its edge even as the competitive demands of the industry change. If is this second type of learning which Senge (1992) sees as critical to maintaining competitive advantage and we agree.

Research Question #3 What role do learning processes play in maintaining core competence in a dynamic environment.

Here the focus in the analysis will again be on those firms which have lost their competitive edge. In identifying how they lost their edge questions can be raised as to the role of learning in this loss. Here the interaction between the scope of the change, discussed in question 2, and the speed with which the firm can learn new skills can be examined.

CORE COMPETENCIES AND THE PHARMACEUTICAL INDUSTRY

Selection of Industry and Firms for Analysis The pharmaceutical industry provides an excellent industry to use in studying the applicability of our model. First of all, this industry has been extensively studied by both academics and regulators. These discussions have

lead to a strong consensus about the core competencies in the industry. Second, a broad base for differentiation among therapeutic classes of drugs provides numerous opportunities for competence building and hence situations in which to observe dominant firms rising and falling over the industry's history. Finally, the industry is made up of corporations which are generally dominated by their pharmaceutical units. This allows the researcher to get a clear view of business-level competition largely unencumbered by other corporate business units.

The modern pharmaceutical industry is generally dated from the end of the Second World War. There were, however, many firms conducting drug research prior to the war and some significant products had been developed (Sneader, 1985). These operations, however, were often greatly over shadowed by the larger chemical and dyestuff operations of many firms, particularly in Europe. In the US almost no new ethical drug research was undertaken in the pre-War era. The war saw the shift of penicillin research from Oxford, England to Peoria, Illinois. There, a consortium of US firms developed the deep-tank fermentation techniques which allowed for the mass production of penicillin. Armed with competencies in soil screening for antibiotic action (and the fact that several European competitors were reduced to ruins) these firms went into pharmaceutical research. The granting of patents by the US patent office for artificial antibiotics in 1948 guaranteed profitable returns from pharmaceutical research. Together these events created firms whose dominant business was the pursuit of ethical drugs, independent of overriding chemical or dyestuff operations.

An overall sample of 41 firms was examined used in this study (see Table 1). These were the largest firms in the US and Western Europe. In a prior study we have looked at how the relative competitive postures of these firms changed in the US market between 1969-1988 (Bogner and Thomas, 1991). The nine firms which make up the primary focus of our discussion are presented in Table 3 together with a brief description of their competitive skills.

We have focused primarily on these firms, although the competencies of other firms are also discussed.

Core Competencies in the Pharmaceutical Industry Core competencies have traditionally been based on the skills involved in R&D, marketing and promotion. Our research shows however that these broad descriptions are much too general. Core R&D skills have to be interpreted relative to the various therapeutic classes of drugs which exist. These classes not only recognize the different pockets of demand for drugs they also recognize different bases of R&D skills. For example, the skills needed to develop antibiotic drugs are different from those which produce psychotropic drugs. More over these therapeutic classes have shifted in their relative importance in the overall drug market over the years. In the 1940s and 1950s antibiotics were the primary new drugs. In the 1960s a wave of psychotropic drugs provided significant advances in dealing with mental and emotional problems. And in the 1980s a new generation of cardiovascular drugs replaced older therapies.

A second observation with respect to R&D skills addresses the changing character of the research methodology required to identify new drug compounds. Prior to the Second World War skills in molecular manipulation and mass-assay testing drawn from the organic chemistry of the dye trades dominated R&D. These skills retained their dominance until quite recently. The soil screening and fermentation skills of the antibiotic firms in the 1950s provided an alternative research base for some firms, primarily from the US. Later a major shift change from large-scale trial-and-error techniques occurred when developments in the life sciences of biology and chemistry advanced to the point where researchers could develop drugs based on knowledge of how the body's systems operated. This "rational drug

design" allowed for more concentrated research. The increased knowledge of biology, however, eventually led to a more radical change in the 1980s with the emergence of biotechnology as an alternative to organic chemistry as the base for drug research. A summary of the changes in R&D and other areas of competence is provided in Table Four.

Similar patterns of competence changes occurred over time in the area of marketing and promotion. Prior to the 1950s direct selling to physicians did not exist. However, the creation of "prescription-only" drugs in the US prior to the Second World War, along with the increased flow of new synthetic antibiotics, brought about the need to develop skills for influencing the physician. The physician occupies a unique position as a gatekeeper who in fact purchases the drug for the patient with little regard to price. Through the decades since that time, firms have built detailing sales forces directed at the physicians which fit into the medical cultures of the various countries in which they sell. However, at least two major shifts have occurred in that dominant selling pattern over the last 15 years as indicated in Table Four. These new competitive postures created new bases for the development of selling competencies. Similarly they rendered older ways of selling ineffective.

Finally, our review indicated a new and growing source of competence: the ability to effectively cope with regulatory agencies. Again this was not always a source of competitive advantage. Only in 1962 did the US establish pre-market approval requirements. During the 1960s most Western countries established similar administrative procedures for new drug approval. The next two decades saw these procedures become more and more onerous. Particularly in the US, large sums of money and, more importantly, over half of the product's patent life, are now sacrificed in order to comply with drug approval processes. It is clear, however, that significant variation exists in the amount of time different firms spend in the approval process. Firms aim to be "first-to-market" so as to establish drug-of-choice status

and build up switching costs with respect to subsequent entrants. Therefore, effectiveness (and speed) in dealing with regulatory agencies may lead to significant long-term competitive advantages within therapeutic classes.

FIRM ANALYSIS

Nine firms which reflect the range of competitive positions in the industry were selected for intensive case study treatment. In particular, the case studies sought evidence on relationships between core competence and competitive advantage. Based on the case-study observations made here, conclusions about the research questions will be drawn. Sales figures for the nine firms are presented in Table Five. These data include only pharmaceutical drugs. Please note that the descriptions given in the following section use the universal chemical names of specific drugs. The brand name used in the US is often given in parentheses and is capitalized.

Merck Merck is the largest seller of pharmaceutical drugs in the world. This a position which Merck has held for the better part of a decade now, but they did not occupy that position during the middle years of this industry's brief history. It was, however, the technological base which Merck brought into the industry at the outset which would be the key to their latter success.

Merck was a "fine chemical" producer prior to World War Two. As such Merck did not sell proprietary remedies, rather they sold chemicals and chemical compounds to "professionals": doctors, researchers and pharmacists. Merck participated in antibiotic research during the war and emerged with streptomycin, an important early drug. Merck, however, gave the patent to Rutgers University and allowed it to be freely licensed (Temin,

1980). As a result Merck seems to have missed being a major player in antibiotics (which dominated the industry for twenty years). Merck did however stick to its skills in organic chemistry. In much the same way as Hoechst formulated new compounds prior to the war, Merck employed tedious trial and error tests on organic compounds and produced a series of non-antibiotic drugs which sustained the firm through the antibiotic era.

When rational drug design created the opportunities for firms with broad chemical backgrounds to exploit their skills more advantageously Merck's management seized the opportunity. Building on established bases in cardiovascular drugs and rebuilding its antibiotic skills, Merck was able to introduce a string a drugs in these and other areas in the 1980s. Merck's labs have always been seen as their strength (Byrne, 1987). As Merck has grown larger, management of a creative laboratory environment has become more difficult. The questions which are raised about the ability of the firm to maintain its leadership now center on how management handles the dynamics in the lab (Meyer, 1990).

Merck has realigned its sales force in the 1980s to reflect the move toward more targeted selling. Merck's sales force is the largest in numbers in the US and carries a reputation as being the best trained as well. Training includes extensive continuing education for established sales personnel. The sales function is championed at Merck, with all potential executives spending some of their early months with the firm promoting drugs to doctors.

Merck is also extremely adapt at dealing with government regulators. While new biotechnology firms have had some well publicized difficulties in gaining new drug approvals, Merck's products move through quickly, retaining more of their patent life.

Glaxo Glaxo is in many ways the antithesis of Merck, although Glaxo is number two in world market-share. Glaxo is essentially a one drug company, namely ranitidine (Zantac).

While the company has other products and a promising pipeline in some areas, their global rank has been achieved primarily through ranitidine and their great competence in marketing it. In the 1970s Glaxo was perceived as a weak firm; Boots even attempted to take them over. They had no unique products and no presence in the two largest markets, the US and Japan. In the late 1970s, however, they had formulated a slightly different version of the emerging super-drug cimetidine (Tagamet) produced by Smith Kline & French, now SmithKline Beecham. Glaxo's version was not considered superior on any important trait for the vast majority of users and other second movers were entering the market too. Further, SK&F had established cimetidine as the most successful drug ever, with sales approaching $1 billion annually in the early 1980s.

However, Glaxo developed a strategy for selling ranitidine in Italy. Using what they learned there about focussed selling they set their sights on the US. Without a large US sales force, Glaxo "rented" the under-utilized sales force of Hoffmann-LaRoche and put all of its resources into promoting a single drug. The results were stunning. Ranitidine, not cimetidine, became the first billion dollar drug and Glaxo has maintained its sales and profit growth ever since. Since the success of Glaxo's launch of ranitidine other large firms have redesigned their sales functions to mimic Glaxo's techniques. Primarily they have sought to reduce the number of products which each salesperson handles and to target their salespeople more narrowly, based on physician characteristics. This results from the belief that the promotion of a few "blockbusters" produces more profit than a large more diverse product line. Consequently much larger sales forces are now being used in the industry.

Whether Glaxo has retained its core competence in blockbuster marketing remains to be seen. Glaxo has not yet tried to launch its second super-drug. Although they clearly are readying new attempts, Glaxo has only focused on developing a few blockbuster drugs. In

1986 Glaxo had only 13 products in development compared to Merck's 89 (Economist, 1986). Glaxo has no non-ethical drug businesses and they have sold their ethical operations which do not produce high margin products, ie. bulk antibiotic manufacturing plants.

Bristol-Myers Squibb These two firms merged in 1989 with the intent of matching the scope in both products and research which is found in firms such as Merck and Ciba-Geigy. Bristol was an antibiotic firm through the 1960s. In 1969 they sought to diversify their research. Their more successful efforts were in cancer drugs and central nervous system drugs. However, by the late 1980s their total breadth of new products did not match that of the largest firms. In 1988 Bristol ranked twelfth in the world with Rx sales of just over $2 billion. A similar story characterizes the recent evolution of Squibb. Squibb also was a major antibiotic firm through the 1960s. In the 1970s they sought to branch out of antibiotics and were primarily successful in the cardiology market. However, they too were unable to keep up with leaders such as Merck and were 14th in the world in 1988 with Rx sales of about $1.7 billion.

In the strategic group study of the competitive positions of Squibb and Bristol Myers through the 1970s and 1980s (Bogner and Thomas, 1992) both of these firms were facing a permanent future in a second-tier position in the US market (see Exhibit Two). They had strong R&D skills, but not in all of the major drug classes. They were also being pressed by the changes in marketing to build the extensive focused sales forces needed to target drugs to specific physician groups. The merger of these two firms allowed them to address both of these weaknesses. The R&D strengths complemented themselves well. Not only did the new firm have competencies within classes, they had skills across classes which could take advantage of technological opportunities whenever they occurred in the market. The

combination of sales forces allowed for more product and physician specialization. Competencies, however, are built over time and the merger requires that organizational competencies and managerial skills develop in parallel. We have noted that what makes a competence distinctive is the inability of firms to quickly build or buy what is needed to match another's strength. In becoming third in the world in sales Bristol-Myers Squibb has merely combined products already out of the research pipeline with established reputations among physicians. The competitive question for the 1990s for Bristol-Myers Squibb is whether they have the ability to come close to Merck in the underlying competencies of developing and promoting wholly new drugs and in fully integrating the core skill-sets across two diverse organizations.

Hoechst Hoechst is a broad based chemical firm with about 18% of its sales in pharmaceuticals. The firm has a very strong base in organic chemistry research which dates back to the 19th century. Hoechst has survived the two wars of this century and continues to provide important products. Until recently a lack of an extensive marketing operation in the US required licensing there of all but a few products. Hoechst has attempted to build up its pharmaceutical business through sales force additions around the world during the 1980s.

Hoechst provides a strong example of the endurance of firmly established competencies. Following the destruction of the Second World War Hoechst was able to return to drug research and develop some key products, including furosemide (Lasix) and tolbutamide (Orinase, licensed to Upjohn). The competence resided in the minds and the methods of Hoechst researchers, not in the bricks and mortar. Allied bombers destroyed assets which were not the basis of Hoechst's competence. Thus, the firm was able to rebound as a leading innovator as soon as capital could rebuild factories. Clearly the capital

and other limitations prevented the firm from taking full advantage of its research competencies, as the license of tolbutamide to Upjohn indicates. However, as long as the research competence is retained, the firm will continue to have a competitive advantage with their new products. Therein lies the challenge for a firm such as Hoechst. As research shifts more toward a biology base and away from organic chemistry, the core skills (and competencies) or Hoechst must change in a relatively dramatic manner as well.

Eli Lilly This firm provides a strong contrast to the Bristol-Myers Squibb strategy described above. Lilly has a very similar history to those other two anti-biotic firms. Indeed, Lilly was even more centrally focused on antibiotics than Bristol or Squibb. They also prospered in the 1950s and 1960s, only to have a performance shortfall in the late 60s and early 1970s. Like the other two, Lilly was engaged in a research diversification program. That began in the late 1970s, but seems to have been more successful. The firm notes that six of its top-ten products were antibiotics in 1980, but by 1990 its top ten products covered 7 different therapeutic classes. Lilly has long had some bifurcation of its sales force to avoid duplication in the heavily covered antibiotic areas. In the 1980s Lilly added a third wing to its sales force to more finely target hospitals. Lilly led the world in hospital setting drugs through the 1980s and it wants to maintain its position even as it grows elsewhere.

The larger number of product areas and the desire to lead hospital sales while expanding retail presence may lead to difficulties in competence maintenance for Lilly. We have presented competencies as dynamic, almost living, parts of the organization which have to be nurtured at a level where the competence remains distinctive. As Lilly expands the number of therapeutic classes in which it seeks competitive advantage it takes an ever increasing flow of resources to keep up with, and exceed, the performance of firms such as

Merck, Bristol-Myers and Hoechst in each class. The size of the cash flow available to sustain a competitive position becomes significant here. With pharmaceutical sales trailing the industry leaders by between $1.5 and $2.5 billion annually, Lilly has significantly less resources to dedicate to achieving a competitive edge across multiple research classes.

Hoffmann-LaRoche Our analysis of Hoffmann-LaRoche (Roche) indicates a firm with good basic competencies in organic chemistry, but with a limited product focus. Many aspects of Roche are quite secretive. The firm is still family controlled and Swiss law requires minimal disclosure. Observation of the firm's sales performance and the scope of their new drug introductions, however, cannot be hidden. In that respect Roche reflects the slippage of a firm whose competence focus could not maintain its competitive advantage over time. Roche's success in the 1960s and early 1970s led to the presumed position of #1 in the industry. Even without financial disclosure it is clear that their psychotropic drugs dominated that therapeutic class of drugs. The development of the benzodiazepine class for Roche, however, was, in part, serendipitous (Sneader, 1985). The resulting drugs, chlordiazepoxide (Librium), diazepam (Valium) and flurazepam (Dalmane) all became large selling drugs. In the 1970s these drugs came under severe price pressure from government purchasers, particularly in the UK. In the 1980s rapid patent expiration brought in a range of generic manufacturers and aggressive price competition, driven by the very product successes that had made Roche so profitable. If Roche had nurtured a core competence in psychotropic drug development, then a new line of patent protected drugs would have replaced the older products as the drugs-of-choice. But, Roche had only a limited product range with which to replace their ageing lines. (The under utilization of their US sales force was a key element in

Glaxo's launch of ranitidine in the US.) The firm has slipped greatly in the global market share tables.

In this case competition was dramatic as patents expired around the globe on Roche's key drugs. Competence is based on the idea of replication. By maintaining competencies firms continue to maintain competitive advantage in the wake of Schumpeterian creative destruction. Roche, however, was unable to replicate the success of the benzodiazepines, in spite of the hugh cash flows and large leads in research insights which the firm possessed. It was not that there was an insurmountable technological barrier. Bristol-Myers, Lilly and Upjohn were all able to bring out new, patent-protected drugs in the 1980s which were very successful in this drug class (known in the US as Buspar, Prozac and Zanax respectively). Unable to match its prior success through internal development, Roche has sought to acquire a base competence in the new biotechnology by acquiring 60% of the leading biotechnology firm in the US, Genentech, in 1990, and then acquiring a key diagnostics technology from another biotechnology firm, Cetus, in 1991. Roche's ability to nurture competence is even more a challenge than that of Lilly. Lilly is seeking increased levels cash flow generation to keep their skill levels competitive with those of the top firms. Roche is attempting the more difficult task of re-framing and re-developing a set of new core skills for their R&D thrusts, at a level better than the existing competition.

Schering-Plough Schering-Plough is one of three smaller firms which this study will highlight. This firm should not be confused with the Germany firm, Schering AG, from whose assets the US based firm was formed after the Second World War. In the 1960s and 1970s the firm was very dependent on one product, gentamicin sulfate (Garamycin), for its profits. Foreseeing its inability to compete against larger antibiotic firms Schering-Plough appears to

have sought out a niche position, focussing its limited research dollars on the once promising substance, interferon. The firm acquired a large stake ($8 million in 1979) in Biogen, consistent with this focus on a leading edge biotechnology. The interferon technology, however, did not pan out with the result that Schering-Plough produced the worst return to investors of any Fortune 500 firm from 1975-1984 (Steyer, 1985). In the late 1980s the interferon market was estimated at about $50 million. In the 1990s Schering-Plough continued this focus, expanding its interferon research and production in Ireland and elsewhere.

Burroughs-Wellcome (Wellcome Foundation) Burroughs Wellcome (BW) has a history of making significant contributions to drug research which dates back to the late 19th century. However, that research legacy has not translated in to competitive advantage until recently. Similar to Schering-Plough, BW was a firm of limited scope and presence in the global pharmaceutical market in the 1970s. They too had decided on a focus strategy. Unlike Schering-Plough's movement to the cutting edge of research, BW returned to a much researched area which had been largely abandoned by other firms, namely, anti-virals. Anti-viral research was considered to be a research "black-hole" by many firms. In 1982 BW introduced acyclovir (Zovirax) to help control the symptoms of herpes, then the scourge of sexually transmitted diseases. Herpes was quickly overshadowed by AIDS and BW had the response for that virus too, bringing out azidothymidine (AZT) in 1986, a modification of an earlier disappointing cancer drug.

While BW has had other new products as well (most notably they fought with Genentech over tPA, the anti-clotting agent), anti-virals and their research has come to be a dominate force. The sales of anti-virals have greatly aided the development of the firm's over-

all size, but they still remain mid-sized. Here a new problem emerges in maintaining a successful competence: too much success brings in aggressive new competition from larger, established firms (Porter 1980). Indeed, the potential market for AIDS drugs has almost all large firms engaging in significant levels of research. Most important, in doing this research these firms are building their own firm-specific skills in the anti-viral area in general. With or without success in the AIDS area, these firms will have a stronger base from which to do more anti-viral research in the future. Where BW used to dominate the niche others avoided, they now face a range of large firms pursuing the same competence-based advantage in a mainstream area.

Marion Marion no longer exists as an independent company. In the 1980s they were regarded as one of the top firms in America by Forbes and Business Week. In 1989 Marion was acquired by Dow Chemical and its performance since has been disappointing at best. The reality is that Marion achieved its accolades by being an innovative first-mover in outside drug acquisition. They had no distinctive competencies which could not be easily copied by larger competitors. In the late 1970s Marion began licensing products to fill out its very limited product line. Two drugs, known in the US as Cardizem and Carafate, were licensed from Japanese firms, which had no skills in testing new drugs for approval in the US. Marion took these products through testing and regulatory approval. They were introduced by Marion in the US in 1982 and 1981 respectively. Both were tremendous successes, accounting for over 70% of the firm's sales by 1987. The firm boasted of being a "search and development" firm based on its searching for foreign firms' promising drugs and bringing them to the US market. Needless to say this does not reflect a pipeline of internally developed drugs.

Marion's competence was not distinctive at all. It could be, and was, easily copied by other firms. Moreover, many of the firms with whom Marion competed for new licenses were larger, with more experience in gaining drug approval and with bigger sales forces for post-approval promotion. This is not to say the firm had other competitive options. Even in its very successful 1988 fiscal year its total pharmaceutical sales were less than $750 million. In a competitive environment of the 1960s a smaller firm such as Marion could survive on its small product line. In the 1990s, with high drug research budgets and the largest firms aggressively competing in all important classes through R&D and promotion, a small firm is in need of a very unique niche to service long-term competitive advantage. Put another way, the resources required to build and sustain a core competence were beyond the reach of a firm of Marion's size and considerably lessened its ability to remain within the industry's mainstream.

ANALYSIS OF RESEARCH QUESTIONS

Research Question # 1 With every one of the nine firms discussed above it is clear that the competencies they possess or they pursue are defined by their environment. Any competitive advantage which a competence gives is determined not so much by the level of skill as by the market's demand for that skill. This can be seen most dramatically by comparing the two niche firms, Burroughs-Wellcome and Schering-Plough. The skills in anti-virals and interferon respectively are both first-rate at these two firms. Yet BW has had tremendous success while Schering-Plough has not, based on the scale of the market demand for the products of these skills.

Breakthrough products should be viewed in much the same way. The skills which the antibiotic firms developed during World War Two proved to be profitable because of the

preexisting demand for a cure for infection. So too, the products which came form the European based organic chemistry firms were based on skills which were pursued because of market place demands for those skills in the first place. The sudden rise of the AIDS epidemic and the subsequent surge in research is evidence of the extent to which competencies are built as a reflection of market demands (ie. demand-pull).

Conversely, the proposition that the core competencies which will lead to competitive advantage can be determined by the firm is rejected by the Marion case. Here a firm was able to achieve some unquestioned successes. However, Marion was not able to make their combination of seeking out foreign licenses and bringing drugs to the US market into a competence. The market for these licenses did not define Marion's skill as distinctive vis-a-vis its competition. As a result, the firm was unable to continually replicate the success they had had with Cardizem and Carafate. This may or may not be the case with Glaxo. When Glaxo developed the blockbuster approach to promotion they gained a short term advantage over their rivals. Whether that advantage is distinctive or not in the long run remains to be seen. Note that Glaxo seeks to outperform its rivals by limiting itself to a few big drugs and heavily marketing them with a distinctive marketing and promotion mix. Whether this combination of skills can lead to competitive advantage will only be determined over the next decade.

The concept of economic profit ties together the ideas of core competence and competitive advantage. Competitive advantage is the sustainable base on which those profits can be earned over long periods of time, and core skills must be built, accumulated and maintained towards that end. The more successful firms studied here did exactly that. In the case of Bristol-Myers Squibb the merger was driven by a desire for a mix of R&D skills across the therapeutic classes deemed critical by the market. In the cases of Lilly and Merck this same market-dictated goal was sought through internal development of core skills. And in all

three cases the future success of their skill bases in maintaining their competitive positions will be determined by the success of new drugs in the market--the extent to which their particular research oriented skills give them products which command a competitive advantage.

Research Question # 2 The analysis now moves to examine those firms which lost their competitive status over time. We want to see what contribution distinctive competence and its relationship to competitive advantage make to explaining why some firms lost top-performance positions in the industry over the 50 years of the study.

The first group of firms we looked at is the antibiotic firms. In the 1950s these firms emerged with competencies in a new technology which allowed them to produce products with hugh demand. Were those products a source of competitive advantage? Here the score is mixed. Some firms, particularly Lilly and Glaxo, were able to develop competencies in developing cephalosporins, antibiotics which were used largely in hospitals, and to continually develop new generations of products from the 1950s through the 1980s. Other firms, however, were not so successful in distinguishing their products. Several firms, including Bristol-Myers, had ended up in similar competitive positions with their research and their products became close substitutes for each other. The resulting "tetracycline conspiracy" represented the clearest evidence of the inability of these firms to distinguish their products in the market (Costello, 1980). In that case the firms simply agreed not to challenge each other's patents for tetracycline in exchange for promises not to license the drug beyond a small group of manufacturers nor to compete on price. The tetracycline conspiracy produced litigation which spanned two decades. These firms were unable to use their initial

R&D skills to develop differentiatable new products and hence another base for competitive advantage was needed.

With price competition eliminated, and with no technological advantages with which to develop new products, the antibiotic pioneers shifted their competitive energies to promotion. It was at this time, and with these products, that the firms began to build their advertising and promotion competencies. Pfizer is largely credited with the first advertisements directed to physicians. Others followed. Lederle spent the then unheard of sum of two million dollars to conduct promotions for chlortetracycline (Aureomycin) in 1948. In 1952 their direct mail cost alone was one million dollars for their tetracycline (Achromycin) (Measday, 1972). The firms effectively moved the competition to marketing where there seemed to be greater opportunities for competitive advantages to be built.

What caused these firms to lose their edge was not the increased price competition which resulted from the end of the price fixing. What hurt the firms was the inability to continue to develop new, distinctive, patent-protected drugs. A few firms such as Lilly and Glaxo were able to move into second-generation cephalosporins, but the hospital market is very competitive and in that market the firms were played off against each other by purchasing agents and the use of formularies. Further, as products moved more and more toward commodity status, the differentiating ability brought about by marketing skills became less and less significant. When the use of generic substitutes in retail prescriptions was eased in the US in the mid-1970s, the resulting price competition hurt these firms even more. It should be recalled that in our cases we saw that Bristol-Myers, Lilly and Squibb all began more aggressive therapeutic class diversifications, moving their research programs away from antibiotics at about this time. Fortunately, this was also the time that rational drug design techniques began to take over in the laboratory, facilitating the move. Still, these programs

alone did not allow the antibiotic firms to recapture the lost prestige of the 1950s and 1960s. Only through merger do Bristol-Myers Squibb hope to keep up with the pace in new research set by Merck and Glaxo.

In the case of the antibiotic firms the initial technology only created a single base on which distinctive competence could be built. When that base became overcrowded with close substitutes the skill level of the participants had obtained in their research was overwhelmed by the lack of distinction which those skills brought to the product-market. This clearly illustrates one of our points about the dynamics of distinctive competencies: They must be continually improved at a level which gives the firm a degree of differentiation sufficient to command super-normal profits.

By contrast the Hoffmann-LaRoche case illustrates how a single firm can gain distinctive products for a period of time, then fail to maintain a competence. A review of the technological environment for psychotropic drugs clearly indicates that there was still room for further advances beyond the drugs Roche introduced. Further, Roche did not lack financial resources or effort in trying to maintain its competitive position in the drug class. They simply lacked the core research skills to produce subsequent products needed to replace the benzodiazepines. Meanwhile, other firms in this study, most notably Lilly, Bristol and Upjohn, were able to produce new and very successful drugs in that therapeutic class.

These two situations, antibiotics and the benzodiazepines, provide interesting examples of how competitive advantage can be lost. Many antibiotic firms had their advantages in the therapeutic class shrink as more and more firms matched the leader with similar drugs. No one firm could either significantly distinguish themselves from the competition or push out the technological boundary through internal research. In Roche's case competitors bypassed the leader with new drugs. History showed that in both situations

there was still an opportunity to push out the technological horizon through new product research. An advantage largely held by one firm was now aggressively sought by several firms, each of which was able to make firm-specific advances in the technology which produced drugs of significant demand. Indeed, it was noted that Merck was able to re-enter antibiotics as a holder of major patent protected products in the late 1980s, just as many of the traditional antibiotic firms were diversifying away from that class of drugs. Thus, firms with a competitive product at one point in time were constantly challenged to maintain that advantage by rivals. Failure to learn and increase core skills ahead of rivals leads to a loss of economic profits.

Clearly the technological barriers for maintaining a competitive advantage became more difficult over time, but that is precisely why competitive advantages can be unique and sustainable for the few firms which can effectively maintain them with internally protected skills and knowledge. When the barriers were low in the early days of the antibiotics several firms made similar advances in skills and competencies. As a result no advantage ensued, save through conspiracy. In recent times the increased difficulty of vaulting the technological barriers has allowed only the most highly skilled, those with true competencies, to launch successful new products. (In this vein, the question can be asked about the extent of Roche's skills in the first place--did luck play a larger than expected role in their initial breakthrough? Regardless, the market shows that the true competencies which lead to competitive advantage in this class of drugs resided elsewhere.) In both antibiotics and psychotropics the analysis supports our proposition that competitive advantage which is not based on replicable and growing distinctive skills will not be sustainable in the long run.

Research Question # 3 The two prior discussions lead directly into an analysis of learning in sustaining competence. Two things are clear about the changes in technology, marketing and regulation discussed here. First, the environment in all three areas is constantly changing. Second, not all firms pick up on these changes. A third point with respect to the technological and marketing areas is also important: Internally developed skills often drive the ability to better meet existing demands. Learning, particularly firm-specific learning, is therefore critical for long term maintenance of competitive advantage. In the technology area we saw how firms in major drug classes were able to succeed or fail based on their ability to learn about that class of drugs and its underlying biology and chemistry. Recall that we are using learning here in the sense of truly experimenting and discovering. The firms which stayed in the lead (eg. Merck and Hoechst) were able to effectively pursue this type of learning. They mixed the results of their experimentation with new public information to maintain an overall level of knowledge which was inclusive and unique. Others (eg. Roche) did not.

The importance of staying ahead in learning can also be seen in the smaller firms examined. Burroughs-Wellcome was able to stay ahead on anti-virals for some time. But, one can ask how much of that lead was attributed to distinctive tacit skills and how much was due to lack of interest by the rest of the industry which considered the anti-virus area to be unprofitable? Only time will tell if BW can continue to push out antiviral knowledge through internal learning at a pace which allows it to maintain its lead in new product introductions. Time did prove to be unfavorable in the case of Marion. Their first mover advantages were quickly learned by others and there was no additional skill which Marion could add to maintain their distinctiveness. In smaller markets where competition is less vigorous, competitive advantage and economic profits may endure for some time. Yet in the light of

strong competitors, a firm must lead in learning if it is to maintain its advantage in the market. Our analysis strongly underscores the role of every firm's ability to learn as a critical factor in maintaining long-term competitive advantage.

We can now return to an important distinction about keeping advantage in the light of aggressive competition: Acquisition is not necessarily a form of or a substitute for learning. The Bristol-Myers Squibb merger allowed these firms to combine their past successes. But does this mean that the new firm, at double the size of either old firm, can continue to learn in each of these therapeutic classes it now covers? Financial theory supports the proposition that the firm must learn if the acquisition is to retain value. Buying one's way to the leading-edge of technology should require a purchase price that reflects the present value of the expected economic profits which will accrue from that leading-edge core skill. Thus, the purchasers should not receive any economic gain from their acquisition unless they can push the technological edge out further still through additional learning. In merger or acquisition, dynamic learning requires the state of knowledge to change position, not just possession. New or combined product areas create the need for learning to continue in areas or ways where the firm was not positioned to learn before. Roche's recent acquisition of a controlling interest in Genentech is the interesting case here. Roche clearly would like to push out Genentech's leading-edge core skills, but whether its acquisition will include Genentech's ability to learn beyond the skills already possessed is another issue. Roche possessed leading-edge core skills in psychotropic drugs at one time too, but they were unable to position that knowledge further out over time. Through learning other firms passed them in the race for competitive advantage in the therapeutic class.

Similarly, acquisition must not be seen as a replacement for core products as the base for growth into new markets from the existing core competence. Core products lead to new

marketplace products because learning takes place in the organization through the building of core products and team-based organizational skills. Over time the number of product/market interfaces where competitive advantage exists may increases, even while the number of core competencies which have to be nurtured by learning remain the same. Hoffmann-LaRoche was able to develop two different tranquilizers and a sleeping pill, all of which were major products, from its base discovery in the benzodiazepines.

Finally, we note that how well others can copy a firm's core skills clearly limits the firm's ability to maintain competence. Glaxo was able to use a skill in launching ranitidine, but has it been copied? Speed and efficiency in copying what others have learned once it becomes public is the effective limit on the returns which internal learning can bring. Recently some bio-technology start-ups have been unable to develop skills in dealing with regulators and their products are slow to reach the market. But have enough firms effectively mastered this skill so that it no longer represents a competitive advantage to a Merck or a Pfizer, only a weakness to those firms which do not have it? If internal learning is the key to maintaining competitive edges and skills, then the external dispersion of these skills so they can be learned by others is the way in which the resulting competitive advantage can be lost.

Strategic Groups and Competitive Advantage Throughout the discussion of the pharmaceutical industry it is clear that the nature of the opportunity to which distinctive competence is targeted changes from time to time. Dynamic strategic group studies reflect these variations across an industry and over time (Cool and Schendel, 1987; Fiegenbaum and Thomas, 1990). The larger study of competition in the pharmaceutical industry shows that there are alternative bases on which competence were built at different points in an industry's history. In general, the ability of firms within the same industry to choose

alternative competitive postures is not new (Galbraith, 1973, Miles and Snow, 1978). In dynamic strategic group studies clusterings of firms are developed based on the patterns of resource allocations of the member firms. As industries evolve, differing competitive alternatives will appear and rivalry is anticipated to be most keen within each group of similarly competing firms (Porter, 1980). Thus, core competence and competitive advantage would seem to be most significant in intra-group competition.

The reason competitive rivalry builds up so intensely within each strong group is an outcome of the on-going pursuit of competitive advantage through similar competence which this paper describes. Because groups represent the alternative patterns of resource allocations across an industry, each group contains firms which are attempting to build similar competencies. These rivals invest in the development of core skills and tacit knowledge over time. They develop resource bases or bundles which can not be easily changed and which are dedicated to the pursuit of the strategic posture which the group represents. A firm which has gained competitive advantage along the dimensions which define a certain viable competitive position will out perform its rivals. The others, however, have difficulty abandoning the trajectory which they have developed through prior resource allocation decisions. To do so requires the building of alternative core skill bases from the ground up and competing against entrenched competitors in other viable positions. Instead, followers will try harder to win in the group which they currently are members, thereby increasing rivalry and the incentive for usurping leaders over time.

Only wholly new opportunities, with no entrenched competitors, represent an easy opportunity for change. The difficulty in shifting competitive groups can be illustrated in the case of Lilly. When the antibiotic market opened in the 1940s Lilly and several other firms aggressively entered, looking for competitive advantage. Lilly was one of the few developing

skills which sustained them at the top of this therapeutic class for decades. However, when Lilly wanted to diversify out of their narrow base in antibiotics they had to enter drug classes with established competitors. This transition took more than a decade for Lilly to make. The incentive to win in the strategic group a firm is currently in increases the pressure on the leader to learn and to stay ahead--the trailing rivals aren't going to just go away.

CONCLUSIONS

We conclude that competitive advantage must be based on distinctive core competence if it is to be sustained over time. But such relationships are neither stable over time or uniform at any one point in time. A core competence must continue to give competitive advantage as the demands of the environment, and hence what constitutes a competitive advantage, changes. Therefore, the skills which underlay the core products and services of the firm must be constantly changing and improving over time.

This process of change and improvement in core skills involves decision makers who need to employ their cognitive abilities to manage this on going change. Through an interactive process of learning, firms alter their core competencies continuously in an attempt to maintain competitive advantage in a changing environment. Our analysis of the pharmaceutical industry shows that this is the key to successful tying of core competence to competitive advantage in the long-term, but it is difficult. Few if any firms can continuously maintain the lead position in this process over the long term. In our study we saw different firms dominating the pharmaceutical industry with different skills at different times. Still, those firms which consistently built on their core skills and aggressively pursued the competitive advantages which their environment made available tended to be the most successful over the long term.

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Figure One

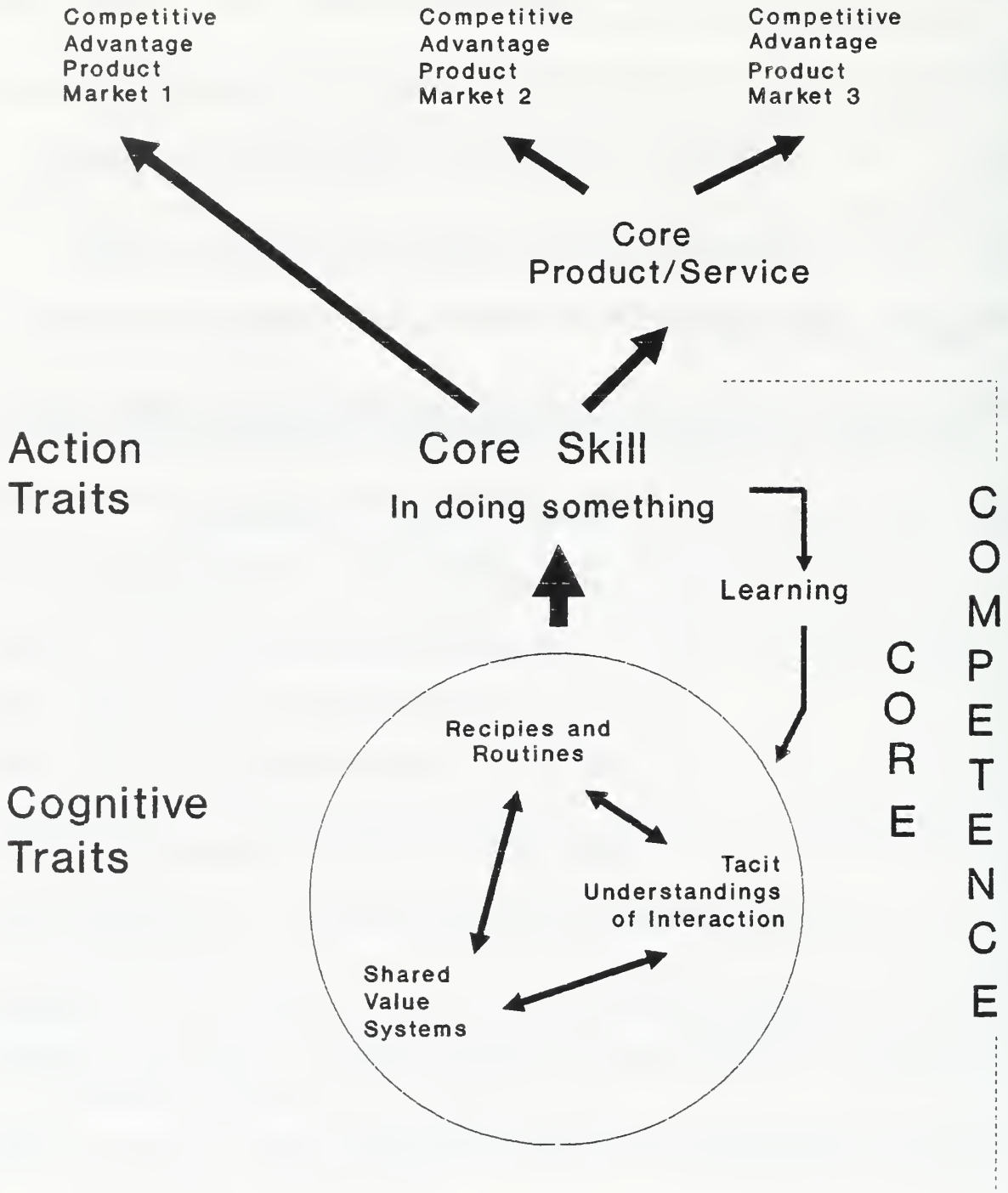
Competitive Advantage Product Market 1
Competitive Advantage Product Market 2
Competitive Advantage Product Market 3
Core Product/Service
Action Traits
Core Skill
In doing something
Learning
Cognitive Traits
Recipies and Routines
Tacit Understandings of Interaction
Shared Value Systems
CORE COMPETENCE

Table One

Firms in Data Base

Abbott Labs
American Home Products
American Hosp. Supply [2]
C.R. Bard [2]
Becton-Dickson [2]
Bristol-Myers
ICN
Eli Lilly
Johnson & Johnson
Marion Labs
Merck
Norwich-Eaton (P&G)
Pfizer
Richardson-Vicks (P&G)
Merrell Dow
A.H. Robins
Rorer
Schering-Plough
G.D. Searle
SmithKline Beckman
Sterling
Sybron [2]
Syntex
Upjohn
Warner-Lambert

Beecham*
Boots*
Glaxo*
ICI*
Burroughs-Wellcome*
Ciba-Geigy*
Hoffmann-LaRoche*
Sandoz*
Hoechst*
American Cyanamid
Squibb
Barr [1]
Bolar [1]
Mylan [1]
Par [1]
Zenith [1]

* European firms studied here.

[1] Generic firms added to original list.

[2] Hospital supply firms dropped from the original list.

Table Two
Strategic Groups in the U.S. Pharmaceutical Market

-1969

Group One	Group Two	Group Three	Group Four
Beecham	Abbott Labs	American Home Products	Pfizer
Bolar	Bristol-Myers	American Cyanamid	
ICN	Burroughs-Wellcome	Hoffmann-LaRoche	
Marion Labs	Eli Lilly	Imperial Chemical	
Merrell	Johnson & Johnson	Merck	
Mylan	Parke-Davis	Searle (G.D.)	
Norwich-Eaton	Robins (A.H.)	Smith Kline & French	
Rorer	Schering-Plough	Syntex	
Zenith	Sterling	Upjohn	
	Squibb		

1970-1977

Group One	Group Two	Group Three	Group Four
Beecham	Abbott	Ciba-Geigy	Barr
Boots	American Cyanamid	Hoechst	Bolar
Bristol-Myers	American Home Products	Hoffmann-LaRoche	Marion Labs
Burroughs-Wellcome	Eli Lilly	Imperial Chemical	Merrell
ICN	Squibb	Merck	Mylan
Johnson & Johnson	Warner-Lambert	Pfizer	Norwich-Eaton
Robins (A.H.)		Sandoz	Par
Rorer		Searle (G.D.)	Zenith
Schering-Plough		Smith Kline & French	
		Sterling	
		Syntex	

1978-1980

Group One	Group Two	Group Three	Group Four
Burroughs-Wellcome	American Home Products	Ciba-Geigy	Barr
Glaxo	Beecham	Hoechst	Bolar
Johnson & Johnson	Bristol-Myers	Hoffmann-LaRoche	Boots
Robins (A.H.)	Eli Lilly	Imperial Chemical	ICN
Rorer	Pfizer	Merck	Marion Labs
Schering-Plough	Smith Kline & French	Sandoz	Merrell
Searle (G.D.)	Squibb	Sterling	Mylan
Syntex	Warner-Lambert	Upjohn	Norwich-Eaton
			Par
			Zenith

Group Five
Abbott Labs
American Cyanamid

Table Two, continued
Strategic Groups in the U.S. Pharmaceutical Market

1981-1984

Group One	Group Two	Group Three	Group Four
Boots	American Home Products	American Cyanamid	Barr
ICN	Bristol-Myers	Beecham	Bolar
Marion Labs	Burroughs-Wellcome	Ciba-Geigy	Par
Merrell	Glaxo	Eli Lilly	Zenith
Mylan	Johnson & Johnson	Hoechst	
Norwich-Eaton	Robins (A.H.)	Hoffmann-LaRoche	
Rorer	Schering-Plough	Imperial Chemical	
	Searle (G.D.)	Merck	
	Smith Kline & French	Pfizer	
	Syntex	Sandoz	
	Warner-Lambert	Squibb	
		Sterling	
		Upjohn	

Group Five
Abbott Labs

1985-

Group One	Group Two	Group Three	Group Four
Boots	Burroughs-Wellcome	American Cyanamid	Barr
ICN	Glaxo	American Home Product	Bolar
Marion Labs	Johnson & Johnson	Beecham	Mylan
	Merrell Dow	Bristol-Myers	Par
	Norwich-Eaton	Ciba-Geigy	Zenith
	Robins (A.H.)	Eli Lilly	
	Rorer	Hoechst	
	Sterling	Hoffmann-LaRoche	
		Imperial Chemical	
		Merck	
		Pfizer	
		Sandoz	
		Schering-Plough	
		Searle (G.D.)	
		SmithKline Beckman	
		Squibb	
		Syntex	
		Upjohn	
		Warner-Lambert	

Group Five
Abbott Labs

Table Three
Firm's/ Sample Analysis

Merck	Fine chemical firm, a few, key non-antibiotic products; jumped into rational drug design to take R&D lead; responded to Glaxo with broader, deeper, detailing; "knows" the FDA; #1 firm in the world.
Glaxo	History of focused research (cephalosporins, Zanax, new migraine drug); developed "blockbuster marketing" concept, first in Italy, then in the U.S.; #2 firm in the world.
Bristol Myers-Squibb	Two firms with narrower product backgrounds merge to try to match Merck in product scope and R&D focus--have they matched the competence? or do they continue to lag? #3 firm in the world.
Hoechst	Largest corporation among top drug producers/ deep skill in organic chemistry/ source of many pre-WWII breakthrough drugs/ marketing skills still deficient outside of Western Europe/ #4 Rx firm in the world.
Eli Lilly	Traditionally considered an antibiotic house/ major shift diversifies sales and products over broader range of therapeutic classes/ marketing also reorganized to fit different physician profiles/ #9 firm in the world.
Hoffmann-LaRoche	Once the leading firm in the world/ narrow focus on psychotropic drugs and related discovery/ acquisition of Genentech (60%) in 1989/ fallen to 11th in the world.
Schering-Plough	Medium sized firm, but much smaller than the largest ones here/ focused on a major potential product line--interferon related cancer products/ failed to pan out/ company struggles/ 15th in the world in 1988.
Burroughs-Wellcome	Medium sized firm as well/ focused on major potential product line--antiviral products/ success with herpes and HIV treatments in the 1980s/ can this single competence support the firm?/ 23rd in the world in 1988.
Marion	"Search and develop" strategy not distinctive/ no long-term "distinctive" competence/ acquired by Dow in 1989/ 33rd in the world in 1988.

Table Four
Core Competencies in the Rx Industry
Competencies in R&D

Technology	Impact and Nature	Firms/Role
Organic Chemistry 1870s-Present	Established by Central-European dye firms through molecular manipulation, trial & error	Hoechst, Ciba-Geigy: Sustained competence in product development for over a century.
Fermentation and Soil Screening 1940s- Present	Established antibiotic firms in the United States. Narrow competence not transferable to other drug classes.	Lilly, Squibb: Dominant products brought industry leadership for twenty years, then began to lag.
Rational Drug Design 1970s-Present	High cost drug development driven by advances in bio-chemistry.	SmithKline, Merck: Able to develop drugs, required cutting edge research across classes.
Biotechnology 1980s-Present	Non organic approach to drug therapy.	Genentech, Amgen: Specialized, cutting-edge research, knowledge and insight.

Competencies in Marketing and Promotion

Skill	Impact and Nature	Firms/Roles
Direct Selling to Physicians 1950s	Allowed for the effective marketing to gatekeepers in economic transactions.	Pfizer, Lederle: Created effective differentiation of products among gatekeepers.
"Blockbuster" Marketing Early-mid 1980s	Single product focus of entire detail force and promotion. Effective with narrow product line.	Glaxo: Created a new way to sell; through selling, gave blockbuster potential to a chemically indifferent drug.
Specialized Selling	Specialized Sales forces for different therapeutic classes/medical specialties. More focus with broad product line.	Merck: Specially trained and focused units in cardio, hospital etc.

Table Four, continued
Core Competencies in the Rx Industry
Competencies in R&D

Competencies in Marketing and Promotion

Handling regulatory requirements	Speeds drugs to market expanding time available under patent for economic profits.	Merck, Marion: Of limited value without competence in acquiring new drugs

Table Five
Prescription Sales Levels
(Millions $)

Firms	1990 Sales[1]	Rank	1988 Sales[2]	Rank	1977 Sales[3]	Rank
Merck	6,365	1	4,240	1	1,261	5
Glaxo	6,063	2	3,160	2	621	17
Bristol-Myers Squibb	5,261	3				
Bristol-Myers			2,010	12	698	13
Squibb			1,710	14	660	15
Hoechst	4,992	4	2,700	4	1,882	1
Eli Lilly	3,700	9	2,090	11	912	10
Hoffmann-LaRoche	3,463	11	1,940	13	1,571	3
Schering-Plough		NA	1,670	15	640	16
Burroughs-Wellcome		NA	1,340	23		NA
Marion[4]		17	730	33		NA

[1] Top 15 firms as reported in PMA Newsletter, January 13, 1992, p. 3.
[2] Top 35 firms as reported in Financial World, May 30, 1989, p. 77.
[3] Top 25 firms as reported in European Chemical News, July 21, 1978, p. 8.; sales figures converted from £m.
[4] Acquired by Dow Chemical in 1989, actual pharmaceutical sales not reported.
NA = Firm's sales not sufficient to be ranked