Causal Ambiguity, Barriers to Imitation, and Sustainable Competitive Advantage

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This article addresses the issues of competitive advantage and competitor imitation. It is argued that tacitness, complexity, and specificity in a firm's skills and resources can generate causal ambiguity in competency-based advantage, and thus raise barriers to imitation Reinvestment in causally ambiguous competencies is necessary to protect the advantage Without reinvestment, attritional effects of continued competitive action will cause decay in the barriers to imitation. From this theorizing, research propositions are suggested, which, ultimately, will lead to an improved understanding of competitive advantage sustainability.

Barney (1986a, p. 792) pointed out that the original intent of industrial organization thinking was the maintenance of intraindustry competition. This intent has been inverted to produce models aimed at helping firms realize supernormal returns by circumventing competition. Given the IO roots of much strategy thinking, it is not surprising that establishing and sustaining a competitive advantage has been given so much emphasis.

Advantage can be sustained in numerous ways and, as a complete subject for discussion, it is beyond the scope of any single paper This article has finite horizons. We are primarily concerned with causal ambiguity and how it can create barriers to limitation. The discussion focuses on ambiguity in skill and resource deployments that are sources of advantage We also discuss how firms can sustain advantage by reinvesting in causally ambiguous competencies to maintain their barriers to imitation. Our objectives are twofold: to investigate the relationship between causally ambiguous competencies and barriers to imitation; and, thus, to develop theory that underpins the concept of competitive advantage sustainability In so doing, the intention is to provide a platform on which future empirical research may be based.

This article is organized into four main parts. The first part considers the three established concepts of competency, competitive advantage, and causal ambiguity. Hofer and Schendel (1978) were the first to formally argue a direct relationship between (distinctive) competency and competitive advantage. They suggested that advantage is achieved through the unique position a company attains, relative to its competition, by the deployment of its competencies. Lippman and Rumelt (1982) used causal ambiguity to describe the phenomenon surrounding business actions and outcomes that makes it difficult for competitors to emulate strategies. When an advantage is based on competencies that have causally ambiguous characteristics,

then it will be difficult for competitors to overcome the advantage by imitation. Causal ambiguity creates barriers to imitation.

In the second part of the article, we propose the existence of three characteristics of competency that, individually or in combination, can generate causal ambiguity They are tacitness (Polanyi, 1967), complexity (Barney, 1985; Nelson & Winter, 1982), and specificity (Williamson, 1985) *Tacitness* refers to the implicit and noncodifiable accumulation of skills that results from learning by doing. *Complexity* results from having a large number of interdependent skills and assets. *Specificity* refers to the transaction-specific skills and assets that are utilized in the production processes and provision of services for particular customers Any or all of these competency characteristics can produce ambiguity between the firm's business actions and outcomes that create its advantage. This, in turn, creates barriers to imitation

The third part of the article builds upon the previous two to consider decay in barriers to imitation and sustainability of competitive advantage. The ease with which competitive advantage may be sustained or, alternatively, the speed with which it is subject to imitation depends upon the height of the barriers Where barriers are low, the advantage may be easily and quickly challenged. It is argued that the height of the barrier depends on the amount of ambiguity that ensues from tacitness, complexity, and specificity. Ambiguity is moderated by the number of process and product transformations that occur within the firm. Also, it is argued that there is an interaction between ambiguity and competition. For highly competitive rivals, a given barrier will pose less of an obstacle to imitation than for less competitive rivals Ghemawat (1986) and Fahey (1989) argued that competitive advantage is contestable, and Mac-Millan (1989) described how this is a function of time. We argue that the time-related rate of decay in barriers to imitation is dependent upon the amount of competition, and, consistent with Porter (1985), sustaining a firm's advantage re-

quires maintenance of its barriers by offsetting decay with reinvestment

The final part of the article synthesizes the major issues of the preceding theoretical deductions and debate We also provide a discussion of the research implications in testing the developed theory This includes suggestions for the measuring and operationalizing of key constructs

Competency, Competitive Advantage, and Causal Ambiguity

The purpose of discussing competency, competitive advantage, and causal ambiguity is twofold First, it is to reestablish in the mind of the reader the underlying fundamentals for each concept Second, it is to resolve some subtle definitional differences in the extant literature, and thus provide a solid foundation upon which to build theory

Competency

Distinctive competence emerged in the 1960s as a desired end-result of business policies (Ansoff, 1965, Learned, Christensen, Andrews, & Guth, 1969). Subsequently, it became the subject of empirical study by Hitt and Ireland (1985, 1986) and others In the interim, Hofer and Schendel (1978, p 25) described distinctive competence under the broad heading of resource deployment. Specifically, they defined *competence* as the "patterns of . . resource and skill deployments that will help it [the firm] achieve its goals and objectives " Snow and Hrebiniak (1980) pointed to functional areas of the firm as areas of competency Hitt and Ireland (1985) listed 55 different distinctive competence activities within functional areas. Although these works vary in their descriptions of competency, they remain consistent on two important themes. (a) the source of a competency is always internal to the firm, (b) competency is produced by the way a firm utilizes its internal skills and resources, relative to the competition. From this, *competency* is defined here simply as being the

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particular skills and resources a firm possesses, and the superior way in which they are used

The extant literature provides the temptation to equate competency with competitive advantage, but the two concepts are not synonymous. A competency does not necessarily have to generate a competitive advantage Equally, an advantage does not necessarily have to emanate from competencies.

Competitive Advantage

There is substantial agreement within the literature on the price, cost, and differentiation definition of competitive advantage. As such, it is accepted here. There is, however, some disagreement on the role that competitive advantage plays in a firm's strategy, and this needs resolving.

The fundamental concept of competitive advantage can be traced back to Chamberlin (1939), but Selznick (1957) can be attributed with linking advantage to competency. The next major development came when Hofer and Schendel (1978, p. 25) described competitive advantage as "the unique position an organization develops vis-à-vis its competitors through its patterns of resource deployments." In this, they are suggesting that competitive advantage ensues from competencies They also viewed competitive advantage as something that can be used within the firm's strategy. As such, competencies and competitive advantage are independent variables and performance is the dependent variable

Day (1984) and Porter (1985) provided the next generation of conceptualization. Rather than being something that is used within strategy, they saw competitive advantage as the objective of strategy, the dependent variable. The rationale behind this is that superior performance is correlated with competitive advantage, and achieving an advantage will automatically result in higher performance. Both the Hofer and Schendel and the Day and Porter schools of thought are used in existing research

Competitive advantage can be derived from numerous sources. For example, advantage can come from competencies. Competencies are within the firm's control and can be manipulated within strategy to generate advantage for performance. In this case, the Day and Porter school of thought is most appropriate. Advantage also can be the result of some manifestation of luck (Barney, 1986b). In this case, the Hofer and Schendel school of thought is most appropriate An event has occurred that the firm can capitalize upon by incorporating it within its strategy to generate superior performance. Luck as a source of advantage is beyond the scope of this work Here, the concern is with the first situation, where advantage is the end-result of strategies that are based on the firm's competencies.

Causal Ambiguity

Porter (1985, p. 20) suggested that sustainability is achieved when advantage "resists erosion by competitor behavior" because of barriers that make imitation difficult. Arguably, the most effective barriers to imitation are achieved when competitors do not comprehend the competencies on which the advantage is based. Lippman and Rumelt (1982, p. 420) stated that "ambiguity as to what factors are responsible for superior (or inferior) performance acts as a powerful block on . imitation." This statement reflects their definition of causal ambiguity: it is the "basic ambiguity concerning the nature of the causal connections between actions and results" (p 420)

At the extreme, ambiguity may be so great that not even managers within the firm understand the relationship between actions and outcomes. Lippman and Rumelt (1982, p. 420) pointed out that ambiguity may not only block imitation by rivals, but may also block factor mobility They modify this by suggesting that factor immobility may be due more to "uniqueness" than to ambiguity. This work is not concerned with conditions of extreme ambiguity Where ambiguity is so great that managers do not un-

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derstand intrafirm causal relationships, or factor immobility exists, it may be impossible to utilize competencies for advantage. Here, the concern is with situations in which managers understand causal relationships better than their competitors, and where competencies can be manipulated for advantage These are situations where competitors have sufficient understanding to attempt imitation (i.e , uncertain imitability does not exist). When advantage is derived from causally ambiguous competencies, the potential exists for averting imitation by rivals

Simultaneous Sources of Advantage and Ambiguity

Existing literature suggests three characteristics of competencies (tacitness, complexity, and specificity) that can be simultaneous sources of advantage and ambiguity. Tacitness is embodied within the skill component of competencies. The range of skills that can be a source of advantage is as broad as the range of activities of the firm. Such skills include efficient inventory control, better market research, and so forth (Hitt & Ireland, 1985, pp. 289–291). Complexity results from the interrelationship between skills, and between skills and assets. To suggest that complexity itself is a direct source of advantage would be misleading However, the way in which the firm combines its skills and resources can be a source of advantage. For example, preplanned maintenance programs for production equipment can be combined with competent quality inspection to maintain high product quality Specificity, the commitment of skills and resources to the requirements of individual customers, can also generate advantage. Central to the idea of specificity is a symbiosis between the firm and the customer that produces mutually profitable, long-term relationships These relationships have the effect of denying the customers to competitors.

The following discussion explores how the competency characteristics of tacitness, complexity, and specificity can create causal ambiguity

Tacitness

Polanyi (1967) implied that skill-based competencies include tacit knowledge. Such competencies are based on a learning by doing that is accumulated through experience and refined by practice. Wagner and Sternberg (1985 p 439) stated that tacit knowledge is "probably disorganized, informal and relatively inaccessible, making it potentially ill-suited for direct instruction." Crucial to the value of tacitness, then, is the inability of even a skilled performer to codify the decision rules and protocols that underlie performance. Thus, tacitness generates ambiguity through the skilled operator's own level of unawareness of the actions that he or she undertakes Consequently, the causal relationship between actions and results remains less than apparent or is not understandable to rivals.

Nelson and Winter (1982, p 123) suggested that the possibility for the successful imitation of a competitor varies from one situation to another At one extreme, imitation will be feasible by "reverse engineering" a product that contains little more than an unusual combination of standardized technological elements. In other words, there is little tacitness in the production processes. They go on to say that "at the other extreme, the target routine may involve so much idiosyncratic and 'impacted' tacit knowledge that even successful replication is problematic, let alone imitation from a distance" (p 124). This extreme of tacitness equals a condition of extreme ambiguity and factor immobility. Clearly, in between the extremes, tacitness is a source of ambiguity to rivals and, as such, it creates barriers to imitation

Complexity

Core competencies that are complex can generate ambiguity Complexity and, thus, ambiguity arise from large numbers of technologies, organization routines, and individual- or team-based experience Complexity within and between the firm's competencies guarantees that

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few individuals, if any, have sufficient breadth and depth of knowledge to grasp the overall performance package (Nelson & Winter, 1982) This safeguards such information against expropriation when employees are recruited by competitors In a similar vein, Barney (1985, p 12) stated that "in complex, highly inter-dependent human or technological systems, the causes of success and failure are often difficult to assign . . [and] . . . the establishment of cause-effect relationships can be very difficult, and the concomitant assessment of performance may be highly ambiguous." MacMillan, McCafferty, and Van Wijk (1985) similarly concluded that the product complexity that arises from the necessary combination of skills from numerous departments makes imitation difficult (p 77) In short, causal ambiguity ensues from complexity and the potential for imitation by rivals, through observation, is limited.
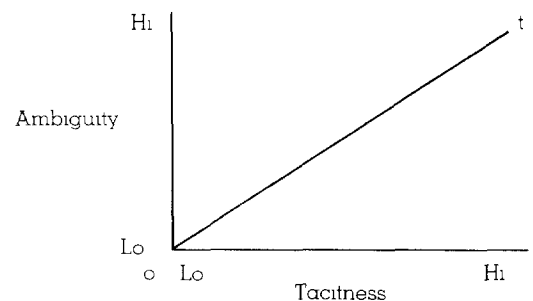
Specificity

Williamson (1985) identified four types of asset specificity: site, physical asset, dedicated asset, and human asset. Each type of specificity "refers to durable investments that are undertaken in support of particular transactions" (p 55). Because the transactions dovetail with relationships between the firm and the customer, the "continuity of the relationship is valued" (p 55). Further, as a firm evolves specific means to extract maximum value from its exchange relations, it also incurs transaction-specific investments, with each party, that are difficult to supplant (Williamson, 1975) Therefore, the business actions that result from resource and skill deployment (competencies) can be highly specific and interdependent with the firm's internal or external transaction partners. Because of these relationships, skill and resource deployments can remain ambiguous to the competition, and through their specificity, such competencies raise barriers to imitation

Relationships with Ambiguity

It was suggested previously that there are degrees of ambiguity. From the literature, we can infer that tacitness, complexity, and specificity also exist in degrees. Therefore, logically, high (low) degrees of tacitness, complexity, or specificity will produce high (low) degrees of ambiguity. Figure 1 illustrates these relationships. Tacitness, complexity, and specificity are characteristics of competency and are, therefore, in-

1a. Tacitness

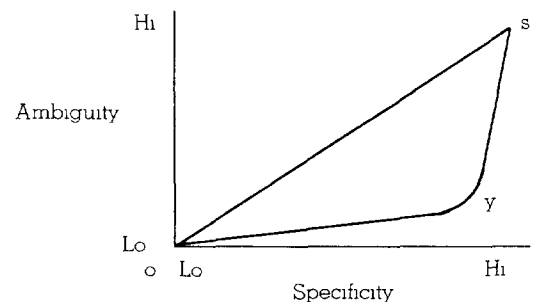

1b. Complexity
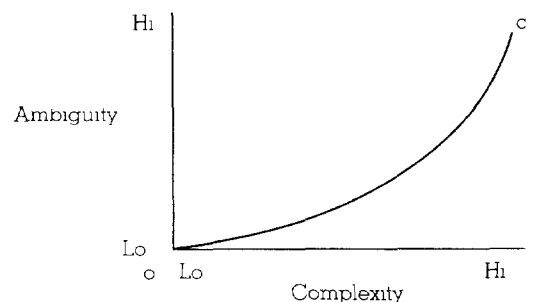
1c. Specificity

Figure 1. **Tacitness, complexity, specificity, and ambiguity.**

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dependent variables, whereas ambiguity is the dependent variable.

Wagner and Sternberg (1985, p. 453) noted that the importance of tacit knowledge is beginning to be recognized. Although still limited, the extant literature is sufficient to permit the formulation of propositions on the relationship between tacitness and ambiguity. Evidence exists to suggest that the relationship is linear (see Figure 1c line ot).

Differences in tacit knowledge can range from "novice" to "expert" (Wagner & Sternberg, 1985, p. 453). Schon (1983, p. 58) suggested that the skill-learning process (i.e., moving from novice to expert) is achieved in a series of stages, which overlap, and for the specialist practitioner increased levels of practical knowledge "tend to become increasingly tacit" (p. 60) These arguments suggest that tacitness increases in a linear form. Given the previous arguments that tacitness directly promotes ambiguity, it is reasonable to surmise that an increase in tacitness will bring about a proportional increase in ambiguity. This leads to the proposition.

Proposition 1 Ambiguity may be derived from tacitness in skill-based competencies, and the form of the tacitness-ambiguity relationship is linear

In the previous discussion, it was argued that ambiguity results from complexity in the patterns of skill and resource deployments Blau (1970) demonstrated that during periods of organizational growth the separate units of a firm will increase in arithmetic form, but the administrative costs that result from interunit heterogeneity will increase geometrically. The reasoning behind this is that not only do the units require individual administration but their interrelationships also require administration. Jones and Hill (1988) made similar arguments about the costs of bureaucratic control between divisions of firms that had high interdependence Using parallel logic, ambiguity will increase geometrically as the number of skill and resource deployments increase arithmetically. Three separate skills can have up to 4 interactions, 4 skills can have

10 interactions, 5 can have 19, and so forth. Even if all potential interactions do not occur, the ambiguity that is derived from the complexity of interaction is still likely to increase at a greater than arithmetic rate (see Figure 1b) We derive the proposition

Proposition 2 Ambiguity may be derived from the complexity of skills and/or resource interactions within competencies and from interaction between competencies The form of the complexity-ambiguity relationship is curvilinear

It can be inferred from Williamson's research (1985, pp 53, 96) that human asset specificity is highly correlated with tacitness. As such, the relationship for this type of specificity with ambiguity will be similar to that of tacitness (i.e. directly proportional) If increases in tacit knowledge lead to greater ambiguity, then so will the transaction specific investments that the firm makes in certain individuals There is no implied link between tacitness and site specificity, physical asset specificity, and dedicated asset specificity

In keeping with Nelson and Winter's (1982) reverse engineering arguments, the amount of ambiguity that can be derived from sites or physical assets will be limited A competitor can simply observe site-embodied performance effects and, through technological deduction, can deduce the same for physical assets. However, dedicated assets (plants specifically designed for the production of goods or services for a specific customer) are protected by the security and exclusivity of the firm-customer relationship. That relationship between the firm and the customer produces ambiguity for rivals and creates a barrier to imitation.

Because of the multifaceted nature of specificity, its relationship with ambiguity is multifunctional (see Figure 1c) In Figure 1c, line os represents human asset specificity, line oy represents site and physical asset specificity, and line ys represents dedicated asset specificity. Point y is the transition between asset "mobility" and assets being "locked in" (Williamson, 1985, p. 95). Mobility of physical assets is derived from

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commonly available designs that permit broad application. In contrast, dedicated assets are designed to meet the production requirements of an individual customer and, thus, create proportionally greater amounts of ambiguity for rivals. This leads to the following proposition

Proposition 3· Ambiguity may be derived from skill and resource specificity (human, site, physical asset, dedicated asset) and the aggregate form of the specificity-ambiguity relationship is multifunctional

Barriers to Imitation

Others have argued that economies of scale, switching costs, first mover advantage, and so forth, constitute barriers to imitation. However, the literature does not provide us with a precise definition of the barrier concept. In this absence, it is suggested that a *barrier* is the restraining or obstructing of imitation by competitors.

Porter (1985, p. 98) suggested that it may be difficult for competitors to gain information about the costs of a firm that has an advantage Such a notion is comparable to Williamson's (1985) and Barney's (1986b) discussion of asymmetric information. Asymmetric information and causal ambiguity have similar properties because they both can create barriers to imitation. But, causal ambiguity, which stems from tacitness, complexity, and specificity, goes beyond asymmetric information. If competitors have full information they may be able to immediately and fully understand how an advantage arises. When causal ambiguity is present, their understanding would be neither complete or instant. There is a fundamental difference between having information and understanding it. In itself, causal ambiguity does not guarantee that a firm will be able to maintain a competitive advantage, but it does create a very effective barrier to imitation

Although tacitness, complexity, and specificity can each generate ambiguity, they can also act in combination. A potential two-way interaction effect (tacitness and complexity, tacitness

and specificity, or, complexity and specificity) should increase ambiguity beyond the simple sum of individual effects from each characteristic. Maximum ambiguity and, therefore, the highest barriers to imitation and greatest potential for sustaining of advantage should occur when tacitness, complexity, and specificity are all high and produce a three-way interaction effect This leads to the proposition:

Proposition 4 Interaction effects of tacitness, complexity, and specificity serve to heighten ambiguity effects and barriers to imitation.

Industry and Competition

Competitive advantage may be lost for various reasons, including technological change and social change in markets. Porter (1985) and Ghemawat (1986) argued that discontinuities in technology, industry demand, and factors of input make sustainability of advantage difficult. Conversely, a gradually evolving industry environment permits some protection of advantage behind barriers to imitation This point is key to all subsequent discussion.

Porter (1985, p. 20) argued that "barriers to imitation are never insurmountable." But, some barriers will be higher than others and therefore more difficult for rivals to overcome. The height of barriers to imitation determines how contestable or how sustainable the firm's advantage will be Ghemawat (1986, p. 58) suggested that sustainability (contestability) of a competitive advantage is also controlled by such factors as the source of advantage, the industry, and the amount of competition. Weigelt and MacMillan (1987) showed that competitive action, reaction, and interaction of firms have the potential to be vastly complex. Their work implies that the degree of interfirm, intraindustry competition will affect individual company performances. A highly competitive rival will make it more difficult for a company to achieve and maintain high levels of performance. Under the supposition that some firms are more naturally competitive than others (Ghemawat, 1986, p. 58), it also is fair to conclude that causal relationships in busi-

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ness actions and their results will create differing degrees of ambiguity for different competitors. In other words, a given amount of ambiguity will prove more effective against less aggressive competitors.

Figure 2 shows the relationship among ambiguity, competition, and barriers to imitation. The height of a barrier to imitation is dependent upon both the amount of ambiguity and competition. If ambiguity is low and competition is
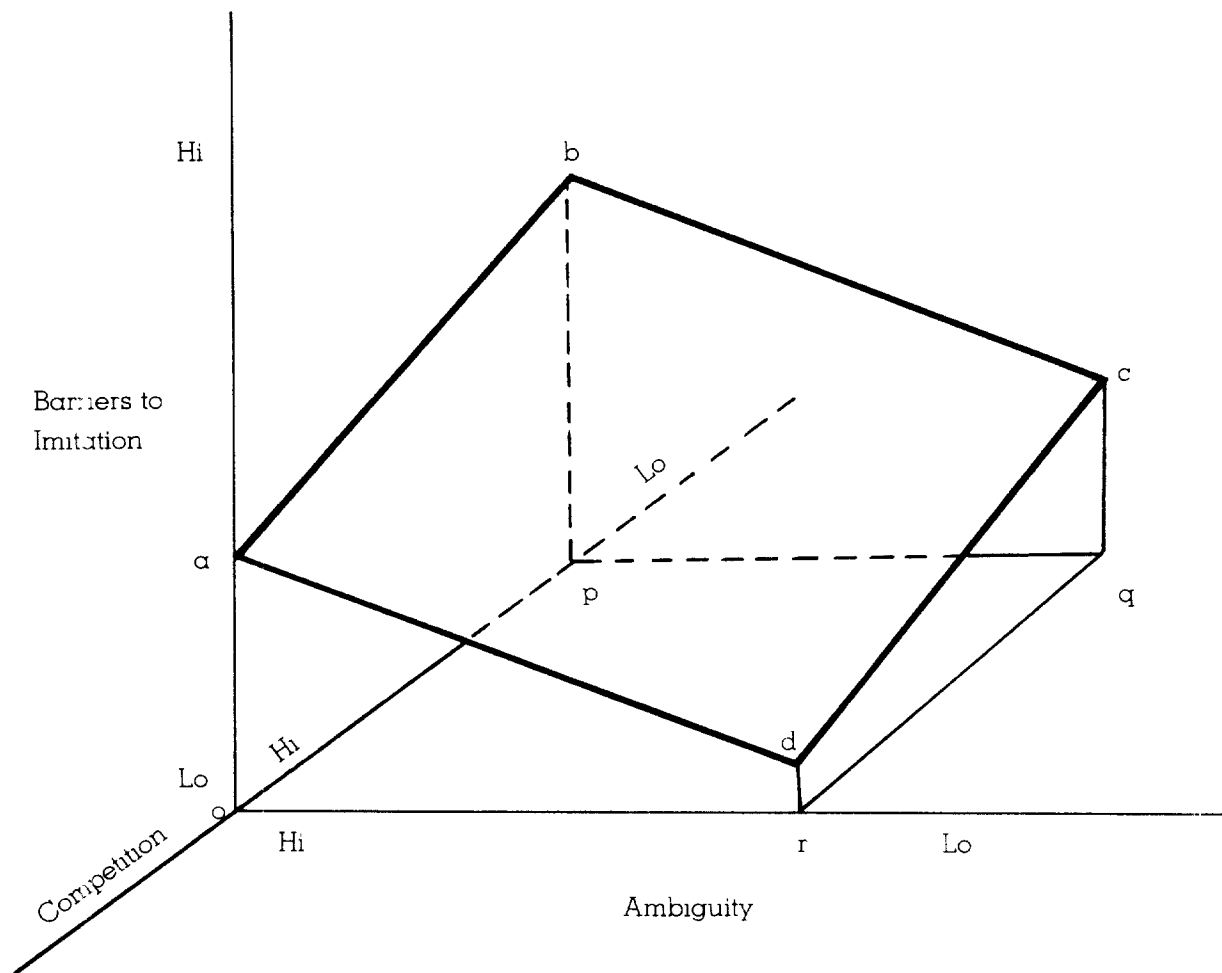
Legend:
a = Ambiguity high, competition high
b = Ambiguity high, competition low
c = Ambiguity low, competition low
d = Ambiguity low, competition high

(rd < oa, pb, qc, pb > qc, rd, oa)

Figure 2. Ambiguity, competition, and barriers to imitation.

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high, the height of the barrier (rd) is low. At the other extreme, where ambiguity is high and competition is low, the barrier to imitation is high (pb). In between these two extremes is the middle ground of low ambiguity and low competition (qc) and high ambiguity and high competition (oa) The plane abcd describes the full range of the heights of the barrier. From the above discussion we derive·

Proposition 5 Barrier height is a function of the level of competition. A given amount of ambiguity in a highly competitive environment results in a lower barrier than the equivalent ambiguity in a less competitive environment

Economic researchers have long held that interindustry differences exist, and those differences affect performance (e.g , Eatwell, 1971; Harris, 1987, Scherer, 1970) Differences include levels of capital investment, range of operational activities, skill intensities, and so forth. Ghemawat (1986, p 58) suggested that "first-mover advantages tend to be most potent in industries characterized by durable, irreversible, market-specific assets, either tangible or intangible." In other words, the potential advantage is greatest in industries where firms need large investments in specialized skills and assets Porter (1985, p. 34) argued a similar case He stated, "the extent of integration into activities plays a key role in competitive advantage " Where there is integration into activities, and/or substantial investment in skills and assets, we may expect to find large numbers of intrafirm product transformations and, thus, high value-added. More intrafirm product transformations mean a greater array of competencies on which advantage can be based. Therefore, the potential for competency-based ambiguity is greater when value-added is high.

The effect of value-added can be explained in terms of Figure 2 For the moment, assume a given level of competition. In low value-added firms the maximum potential for ambiguity is less than that of high value-added firms The plane abcd is then not fixed in one position It is effectively hinged along line cd because *high*

ambiguity is now a relative term. For a low value-added firm the plane abcd swings downward, and edge ab is lower For a high value-added firm the reverse is true: the plane swings upward, and edge ab is higher. Thus, value-added is a moderating variable for ambiguity. Firms with high value-added have the potential for both higher levels of ambiguity and higher barriers to imitation than do firms with low value-added.

Porter (1985) suggested that advantage sustainability is dependent on the existence of barriers to imitation Here it is argued that the height of barriers to imitation is determined by the amount of ambiguity surrounding the firm's competency-based advantage and the level of competition the firm faces. Further, maximum potential ambiguity is moderated by value-added. This leads to the proposition·

Proposition 6 Barriers to imitation are dependent upon the ambiguity in a firm's competency-based advantage, and the potential barrier height is moderated by the firm's value-added

The focus of this article has been limited to existing competition. However, Baumol, Panzar, and Willig (1982, p 7) pointed out that low entry and exit barriers make markets contestable by others Ascending to their arguments on "first-arrival" advantage (p 4), high ambiguity may also deter entry, or mobility (Caves & Porter, 1977) So, too, may existing competition (Porter 1985, p 210). Although remaining beyond the scope of this work, these questions have great potential as an area for future research.

Decay and Sustainability of Advantage

Competitors typically gain detailed knowledge about a firm's new products within one year of development, and much of the learning on production processes also gets diffused (Ghemawat, 1986, p 53). MacMillan (1989) identified three consecutive stages in the rise and fall of

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competitive advantage—building advantage, a lull, then collapse as rivals direct their attack on the advantage and achieve imitation. The length of the lull depends on barriers to imitation (MacMillan et al., 1985, p. 75). Although the length of the last stage, collapse, depends on a number of factors, it is directly tied to the aggressiveness of the competition. The message contained in the cited works is that continued competitive action makes sustainability difficult without barriers to imitation

It has been argued that competition and ambiguity, moderated by value-added, determine the height of the barriers to imitation Because competition continues over time and, thus, has a cumulative effect, barriers to imitation can eventually be overcome, and the factors that generate an advantage can be imitated Decay in barriers to imitation is, among other things, a temporally related phenomenon To maintain barriers, and to sustain an advantage from imitation, decay must be averted This means that the firm must continually reinvest in the factors that create the ambiguity and barriers to imitation. Figure 3 shows the effects of decay and reinvestment on a given barrier, height b

Decay

The most effective means of overcoming a barrier to imitation is by technological break-
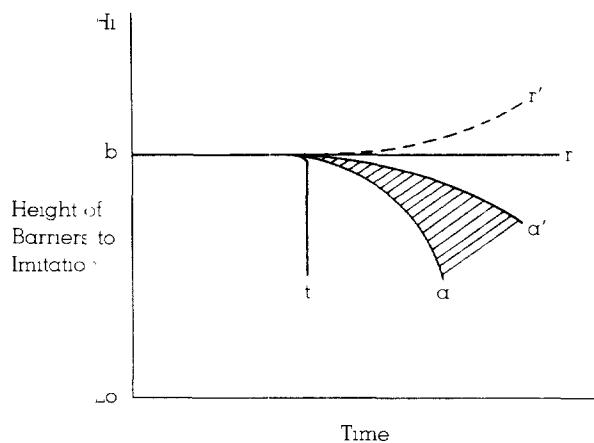

Figure 3. Decay in barriers to imitation.

Time

through A breakthrough allows competitors to improve efficiencies to become cost leaders. It can also facilitate superior differentiation (Porter, 1985). Consequently, competitors can wholly overcome or simply circumvent imitation barriers. Decay is instantaneous (Figure 3, line bt).

Where there is no technological breakthrough, decay will still follow an inexorable downward path. Continued aggressive competition will wear down barriers more quickly than low competition. Line ba (Figure 3) denotes the frontier of maximum decay. This occurs when ambiguity is low and competition is high. Low ambiguity allows competitors to observe and understand the source of the competitive advantage. This permits them to target their actions with the result that decay will occur at a greater rate Line ba' denotes the frontier of minimal decay and reflects high ambiguity and low levels of competition High ambiguity makes the task of the competition more difficult. Assuming that competitors continue to learn from their previous experience, decay becomes a compound function. The following propositions thus emerge·

> *Proposition 7 Regardless of the level of competition or degree of ambiguity, decay in the barriers to imitation remains a temporally related phenomenon*

> *Proposition 8 For a given level of competition, the rate of decay will be proportional to the amount of ambiguity For a given level of ambiguity, the rate of decay will be proportional to the amount of competition*

Reinvestment

If the height of the barrier to imitation, b, depends upon ambiguity and competition, the ability to resist decay also will depend on these factors Regarding the sustaining of an advantage, Porter (1985, p 20) suggested that the firm must offer a "moving target to its competitors by reinvesting in order to continually improve its position " Through reinvestment, barriers can be maintained (Figure 3, lines br and br') and

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the advantage can be sustained. By maintaining barriers to imitation, competitors are permanently trapped in MacMillan's (1989) lull period But, for sustainability of a competitive advantage, the reinvestment must be at least equal to the rate of decay. These arguments raise three issues What is sustainability? How should a firm reinvest, and in what? How much should be reinvested?

What Is Sustainability? Despite numerous authors discussing sustainability, the concept remains largely undefined In its most basic sense, *sustaining an advantage* simply means keeping it going over time. One of the underlying assumptions of this article is that strategy is used to achieve a competitive advantage for the performance benefits that it can offer Building on that assumption, and assuming that firms plan strategy, the necessary skill and resource deployments for advantage are thus achieved within the firm's planning horizons Once advantage is established, planning and resource deployment does not cease Instead of aiming to achieve an advantage, planning and resource deployment is aimed at sustaining advantage Thus, sustainability is linked to the planning horizons of the firm As such, the question of "how long is sustainable" remains particularistic to each firm For firms in a gradually evolving environment planning horizons will be longer Within this scenario, planned resource deployments aimed at sustaining advantage are the same as reinvesting in barriers to imitation.

How Should a Firm Reinvest, and in What? Because the height of barriers to imitation depends upon ambiguity and competition, reinvestment should be directed toward these areas. On multipoint competition, Porter (1985, pp. 353–363) recommended that the firm deflects attention away from the source of advantage by attacking competitors in other areas The option suggested here, reinvestment in ambiguity, raises more complex issues.

Reinvestment in ambiguity should be aimed at the competencies on which advantage is based and from which ambiguity is derived An analogy of how to reinvest in ambiguity comes from research and development expenditure. Firms invest in R & D for product and process developments that will produce an anticipated future payoff. Firms spend appropriate amounts on R & D, and they learn what is appropriate by making iterative adjustments based on their interaction with competitors (Grabowski & Baxter, 1973). Investing in the same manner in causally ambiguous competencies, to maintain barriers to imitation, will also produce a future payoff from sustained advantage Logically, it would follow that reinvestment would be directed toward (a) providing support for the people with tacit knowledge and to utilize that knowledge in other activities (e g., as occurs within total quality control procedures), (b) improving security to protect complex procedures, and (c) increasing levels of human, site, physical asset, and dedicated asset specificity This leads to the proposition

> *Proposition 9 Sustainability of competency-based competitive advantage is dependent upon reinvestment in causally ambiguous competency characteristics of tacitness, complexity, and specificity*

Ghemawat (1986, p 58) suggested that the search for sustainability involves commitment. Reinvestment in barriers to imitation means commitment to a particular way of doing things In Porter's (1985, pp. 511–512) terms, this is *defending a position* These arguments are particularly appropriate for reinvestment in value-added. Maintaining barriers by increasing the number of product transformations, and, thus, by extending the value chain (Porter, 1985), implies a probable commitment to vertical integration. More product transformations extend the array of competencies from which advantage can ensue They also provide the opportunity for extending and capitalizing on existing tacitness, complexity, and specificity. This equates directly to Williamson's (1985, pp 112–113) arguments on the importance of economies of scope in vertical integration. The following proposition is derived

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Proposition 10 All other things being equal, vertically integrated firms will benefit from greater ambiguity and have higher barriers to imitation than other firms

How Much Should Be Reinvested? Porter (1985, p. 512) suggested that low or falling barriers to imitation bring into question whether or not a position of advantage is defensible. Low barriers require more investment than high barriers. How much reinvestment is needed to maintain barriers and sustain advantage is determined by initial barrier height. It is also determined by the rate of decay. Remember that competition is a continuous process, and therefore the investment also should be continuous. Also remember that performance is correlated with advantage, and therefore the total reinvestment is governed by the anticipated payoff from the advantage over the firm's planning horizon. Untenable reinvestment decisions would result from a multiplicity of factors. They include limited ambiguity in competencies and low barriers to imitation, high competition and high rates of decay, small advantage and short planning horizons. Logically, sustainability of advantage would result from the reverse scenario.

Discussion

Chamberlin's (1939) work may be considered the seminal piece on competitive advantage. The concept then languished for almost 40 years until Hofer and Schendel (1978) brought it back to the attention of scholars and researchers. Another lull occurred until Porter's (1985) work reignited interest. The purpose of this article is to keep that momentum going by extending understanding and bridging the gap between theory development and empirical testing of those theories.

The theoretical scope of this article is limited to addressing issues that lead to sustainability of competitive advantage in gradually evolving industries. Also, we have been concerned with barriers to imitation for competitive advantage that is derived from competencies, not from luck.

These limitations have been necessary for two reasons. First, existing knowledge on discontinuous environments and their effects is not well enough developed to permit theory building on sustainability. Second, and for similar reasons, it is difficult to theorize on advantage derived from luck.

Research Implications

The most obvious and major research implication arises from the theoretical development of the barriers to imitation concept. From this, progress can be made toward empirically based research on sustaining first mover advantage, scale advantage, cost advantage, and advantage through differentiation. An equally important but less immediately obvious implication is the improved understanding of the composition and interrelationship of competencies, causal ambiguity, and sustainability of competitive advantage. Although some research attention has been focused on these concepts, with the emphasis remaining mainly on competencies, their true research potential remains largely untapped.

A two-stage research program is recommended. In the initial stage the research should seek to address the underlying premise that causally ambiguous competencies are associated with sustainable competitive advantage. An appropriate framework for beginning this analysis may be found in the strategic group concept (Cool & Schendel, 1988). Theory tells us that sustained competitive advantage leads to consistently improved performance. Any firms within a strategic group that fit this performance profile may be considered to have a sustained advantage. After taking into account the effects on performance of any readily identifiable factors of advantage, such as location or superior technology, then what difference remains may be due to the presence of causally ambiguous competencies. Confirmation of this can be achieved using case analyses in which high and low performance firms are compared. The indepth studies should be designed to address the

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existence of ambiguity in competencies. At this level, the measures of ambiguity may remain relatively unsophisticated, may be ordinal, and may even be subjective.

If the initial stage of the research program confirms an association between causally ambiguous competencies and sustained performance, the second stage should then seek to investigate the specifics of the relationship by using the propositions listed here. The first step to these ends is the measurement and operationalization of the constructs

By nature, tacitness produces something of a measurement problem because it remains unobservable and noncodifiable. Further development into component factors may be needed Winter's (1987) extensive dimensionalization of knowledge assets provides a platform for such work. Measurement of complexity may be derived from primary source observations of the numbers of skill and resource interactions A basis for measurement for specificity may exist within Williamson's (1985) discussion of fixed, variable, and contracting costs

Although ambiguity emerges from tacitness, complexity, and specificity, it remains unidimensional and, therefore, lends itself to simplification. A first step would be to address this as a ratio variable An alternative approach that permits some use of subjectivity and adjustment is to categorize the levels of ambiguity as low, medium, and high. However, the price for this is restriction in the range of analytical techniques that may be applied. Whichever approach is used, convergence can be sought by applying the same logic that is used in competitive benchmarking (Garvin, 1988) Because ambiguity reflects the level of the competitor's understanding of the sources of advantage, simple solicitation of primary source information would be the most logical way to deal with this.

The economics literature provides an abundance of well-established, industry-specific proxies through which measurement of competition levels may be achieved These include concentration and price (George, 1971), R & D

(Grabowski & Baxter, 1973), advertising intensity (Simon, 1970), and so forth. In assessing competition it should be remembered that firms face intraindustry mobility barriers (Caves & Porter, 1977) Not all firms in an industry will necessarily compete. Therefore, competition may be more properly measured at the strategic group level. Like the proxies for competition, the measurement of value-added is also well established within the literature and, thus, poses few problems (e.g , Adelman, 1955).

Within the context of this work, barriers to imitation are dependent upon ambiguity and the level of competition. Like ambiguity, the height of barriers remains unidimensional and, therefore, measurement may be ratio scaled or categorical. Decay rates are also unidimensional. Conversely, reinvestment is multidimensional. Even though dollar amounts infer quantity and direction of investment, they are unable to imply quality. Therefore, quality of investment may remain subjective

Conclusion

It has been argued that competitive advantage based on causally ambiguous competencies can be sustained in gradually evolving environments Ambiguity in business actions and outcomes creates a barrier to competitive imitation The height of the barriers and their rate of decay are determined by the aggressiveness of the competition and the degree of ambiguity. Sustainability of advantage arises from the maintenance of the barriers. To achieve this, reinvestment in the sources of ambiguity (tacitness in skills, complexity in skill and resource interaction, specificity of assets) is required Reinvestment in the firm's value-added activities can also moderate ambiguity. The amount of reinvestment depends upon barrier height, the rate of decay caused by competitive action, and the potential payoff from the advantage over the firm's planning horizons.

The ideas contained in this work are consistent with a more dynamic modeling of competitive behavior than is commonly found in much

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existing strategy theory. In keeping with Klein's (1977) work, this article may be seen as part of an emerging trend in strategy to formulate modeis based on assumptions of disequilibria, rathe- than static efficiency. The discussions reinfcrce the view that strategy is a function of continuous competitive interaction. It also emerges that sustained competitive advantage is not derived from a fixed stock of competencies Rather, it arises from a continual competency accumulation which both generates and replenishes causal ambiguity and the barriers to imitation that permits sustainability of advantage over rivals

References

Adelman, M A (1955) Concept and statistical measurement of ve ·ical integration In National Bureau of Economic Resear :1, *Business concentration and price policy* (pp 281–322) Princeton, NJ Princeton University Press

Ansoff, H I (1965) *Corporate strategy An analytical approa h to business policy for growth and expansion* New York McGraw-Hill

Barney J B (1985) Information cost and the governance of econ ·mic transactions In R D Nacamalli & A Rugiadini (Eds *Organizations and markets* (pp 347 372) Milan, Italy Societa Editrice it Milano

Barney J B (1986a) Types of competition and the theory of strate gy Toward an integrative framework *Academy of Man agement Review*, 11, 791–800

Barney J B (1986b) Strategic factor markets Expectations, luck and business strategy *Management Science*, 32, 1231 1241

Baumc. W J , Panzar, J C , & Willig, R D (1982) *Contestable markets and the theory of industry structure* New York Harcourt Brace Jovanovich

Blau, F M (1970) A formal theory of differentiation in organizat ons *American Sociological Review*, 35, 201–218

Caves, R E , & Porter, M E (1977) From entry barriers to mob lity barriers Conjectural decisions and contrived deterre-ce to new competition *Quarterly Journal of Economi :s*, 91, 241–261

Chamberlin, E (1939) *The theory of monopolistic competition* Cambridge, MA Harvard University Press

Cool, < , & Schendel, D (1988) Performance differences among strategic groups *Strategic Management Journal*, 9, 20 7–233

Day, G S (1984) *Strategic market planning The pursuit of competitive advantage* St Paul, MN West

Eatwell J (1971) Growth, profitability and size The empirical evidence In R Marris & A Wood (Eds), *The corporate economy Growth, competition and innovative power* (pp 389–421) London Macmillan

Fahey, L (1989) Discovering your firm's strongest competitive advantages In L Fahey (Ed), *The strategic planning management reader* (pp 18–22) Englewood Cliff., NJ Prentice-Hall

Garvin D A (1988) *Managing quality The strategic and competitive edge* New York Free Press

George, K D (1971) *Industrial organization Competition, growth and structural changes in Britain* London A en & Unwin

Ghemawat, P (1986) Sustainable advantage *Harvard Business Review*, 86(5), 53–58

Grabowski, H G , & Baxter, N D (1973) Rivalry in industrial research and development *Journal of Industrial Economics*, 21, 209 234

Harris, F H de B (1987) Market structure and price-cos. performance under endogenous profit risk *Journal of Industrial Economics*, 35, 35–59

Hitt, M A , & Ireland R D (1985) Corporate distinctive competence, strategy, industry and performance *Strategic Management Journal*, 6, 273–293

Hitt M A , & Ireland, R D (1986) Relationships among corporate distinctive competencies, diversification strategy, corporate structure and performance *Journal of Management Studies*, 23, 401–416

Hofer, C W & Schendel, D (1978) *Strategy formulation Analytical concepts* St Paul, MN West

Jones, G R , & Hill, C W L (1988) Transaction cost analysis of strategy-structure choice *Strategic Management Journal*, 9, 159–172

Klein, B H (1977) *Dynamic economics* Cambridge MA Harvard University Press

Learned, E P , Christensen, C R , Andrews, K R , & Guth, W D (1969) *Business policy Text and cases* Homewood, IL Irwin

Lippman S , & Rumelt, R P (1982) Uncertain imitability An analysis of interfirm differences in efficiency under competition *Bell Journal of Economics* 13, 418–438

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MacMillan, I C (1989) How long can you sustain a competitive advantage? In L Fahey (Ed), *The strategic planning management reader* (pp 23–27) Englewood Cliffs, NJ Prentice-Hall.

MacMillan, I , McCafferty, M L , & Van Wijk, G (1985) Competitor's response to easily imitated new products—exploring commercial banking product introductions *Strategic Management Journal*, 6, 75–86

Nelson, R , & Winter, S (1982) *An evolutionary theory of economic change* Cambridge, MA Belknap Press

Polanyi, M (1967) *The tacit dimension* Garden City, NY Anchor

Porter, M E (1985) *Competitive advantage Creating and sustaining superior performance* New York Free Press

Scherer, F M (1970) *Industrial market structure and economic performance* Chicago, IL Rand McNally

Schon, D A (1983) *The reflective practitioner* New York Basic Books

Selznick, P (1957) *Leadership in administration* New York Harper & Row

Simon, J L (1970) *Issues in the economics of advertising* Urbana University of Illinois Press

Snow, C C , & Hrebiniak, L G (1980) Strategy, distinctive competence and organizational performance *Administrative Science Quarterly*, 25, 317–336

Wagner, R K , & Sternberg, R J (1985) Practical intelligence in real world pursuits The role of tacit knowledge *Journal of Personality and Social Psychology*, 49, 436–458

Weigelt, K , & MacMillan, I (1987, August) A dynamic strategic analysis framework Paper presented at the meeting of the Academy of Management, New Orleans.

Williamson, O E (1975) *Markets and hierarchies* New York Free Press

Williamson, O E (1985) *The economic institutions of capitalism* New York Free Press

Winter, S (1987) Knowledge and competence as strategic assets In D J Teece (Ed), *The competitive challenge* (pp 159–184) Cambridge, MA Ballinger

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