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Working Paper #9602-06

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Strategies for profiting from an innovation—a dynamic perspective

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Abstract:

This paper explores three generic strategies that firms can use to profit from their innovations: *block* in which a firm prevents entry into its technology space; *run* in which a firm frequently introduces new products, cannibalizing its products before anyone else; and *team-up* in which a firm collaborates with competitors. The paper argues that, for many industries, none of these strategies alone is enough to profit from an innovation long-term. Sustained profitability comes from the right combination of the generic strategies over the evolution of each technology and at a discontinuity when a new technology invades an older one. Which combination of strategies a firm pursues is a function of its competences, product technology, corporate strategy, and the phase of the technology life cycle in which the technology is. For managers, this suggests that competitive advantage may lie in knowing when to block, team-up and/or run, and in exercising the right trade-offs.

[Key phrases: **innovation, appropriability, block, run, team-up, strategies, profit**]

1. Introduction

Many an innovator has been overwhelmed by imitators who quickly copy the innovation and collect most of the profits from it. RC Cola introduced the first canned cola, the first diet cola, and the first caffeine-free cola only to see Coca Cola and Pepsi collect most of the profits from them. EMI invented and first commercialized the CAT scan only to surrender its leadership position to GE. Intel introduced the first Dynamic Random Access Memory (DRAM) chip only to see its leadership position eroded by Japanese firms are now folklore to scholars of innovation. In explaining the saga of these firms, Teece (1986) suggested that a firm profits from an innovation if the innovation is appropriable—protectable from imitators—and/or if the firm has complementary assets that are difficult to acquire. On the other hand, Harhoff (1991), Conner (1988), and Garud and Kumaraswamy (1993) suggest that, for certain technologies, a firm may find it more profitable to give its technology away to competitors. That would be the case, for example, if the technology exhibits network externalities and the benefits of a larger network outweigh the monopoly rents from keeping the technology proprietary.

This paper argues that in today's technology-pervasive competitive landscape (Bettis and Hitt, 1995; D'Avenir, 1994), maintaining tight appropriability or hard-to-replicate complementary assets may not be enough to profit from an innovation. Giving away a technology may not be enough either. In particular, the paper suggests that it takes a combination of three generic strategies to profit from an innovation: *Block, Run and Team-up.*[1] (1) In the *block* strategy, a firm tries to maintain tight appropriability of its technology by preventing competitors from imitating the technology, or limits access to difficult-to-get assets. In the *run* strategy, a firm frequently introduces new products and cannibalizes its own products before anyone else. In the *team-up* strategy, a firm allies with others to, for example, improve its chances of gaining a standard or dominant design. The thesis of the paper is that none of these strategies alone is enough to sustain profitability from an innovation. Profitability comes from the right combination of these strategies at the right time. Which combination of strategies a firm pursues is a function of its competences, product technology, corporate strategy, its proximate environment, and the phase of the technology life cycle. For managers, this suggests that competitive advantage may lie in knowing when to block, team-up and/or run, and in exercising the right trade-offs.

The paper is organized as follows. In Section 2, we review the role of appropriability and complementary assets in profiting from an innovation. In Section 3, we describe the three generic strategies. In Section 4, we explore why it often takes combinations of the strategies to maintain profitability. In Section 5, we use the cases of Intel and Sun Microsystems to illustrate why one generic strategy may not be sufficient. Section 6 offers the conclusions.

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[1]The use of sports metaphors was encouraged by the practitioners that the author encountered in the research for this paper.

2. Appropriability and Complementary Assets

2.1 The Teece Model[2]

In his seminal paper, Teece (1986) suggested that two factors are instrumental to profiting from an innovation: appropriability and complementary assets. Appropriability is the extent to which the technology cannot be imitated. Inimitability may come from the intellectual property (patents, copyrights, trademarks and trade secrets) protection of the technology, or from the fact that imitators just do not have the competences to imitate the given technology (Rumelt, 1984; Teece, 1986; Wenerfelt, 1984; Cool and Schendel, 1988; Prahalad and Hamel, 1990; Barney, 1991). Complementary assets are all the other capabilities—apart from those that underpin the technology—that the firm needs to exploit the technology. These include manufacturing, marketing, distribution channels, service, reputation, brand name, and complementary technologies. Figure 1 suggests when an innovator is likely to profit from an innovation in this model. If appropriability is weak in that the technology can easily be imitated, it is difficult for the innovator to make money if complementary assets are easily available or unimportant (cell I of Figure 1). If, however, complementary assets are tightly-held and important, the owner of such assets makes money (cell II). For example, CAT scans were easy to imitate, and EMI did not have complementary assets such as distribution channels and the relations with US hospitals that are critical to selling such expensive medical equipment. GE had these assets and quickly captured the leadership position. Coca Cola and Pepsi were able to profit from RC Cola's innovations because they had brand name reputation and distribution channels that RC did not, and the innovations were easy to imitate.

If appropriability is tight in that it is difficult to imitate the technology, the innovator stands to profit from it if complementary assets are freely available or unimportant (cell IV). For example, the owner of the Stradivarius profited enormously since no one could imitate it, and complementary assets for it were neither difficult to acquire nor important. If, as in cell III,

[2] A major assumption in this model and the ones that follow is that firms have recognized the potential of the innovation.

appropriability is tight and complementary assets are important and difficult to acquire, whoever has both or the more important of the two wins. The better negotiator can also make money. Pixar is a good example. Appropriability of its digital studio technology is tight. But offering customers movies made with that technology requires distribution channels, brand name recognition and financing which are tightly held by the likes of Disney and Columbia Pictures. Pixar formed an alliance with Disney to make the very successful Toy Story and, so far, Disney has been making most of the profits from the alliance (Schlender, 1995).

Complementary Assets

Appropriability		Freely available or unimportant	Tightly held and important
	Weak	**I** Difficult to make money	**II** Holder of Complementary Assets **CAT scan**
	Tight	**IV** Inventor **Stradivarius**	**III** Inventor or party with bargaining power

Figure 1: Who profits from innovations

2.2 Strategic Implications

Figure 1 suggests that an innovator would prefer to keep appropriability of its innovation tight. That is, a firm would do all it can to prevent imitation of its innovation. It can do that by protecting its intellectual property in courts, or by limiting access to the competences and endowments that underpin the generation of the intellectual property. This is echoed by a lot of the economics-based literature which suggests erecting entry and mobility barriers to limit competition (See for example, Porter, 1980; Tirole, 1988; and Ghemawatt, 1991.)

3. Generic strategies

3.1 Compelling technological factors

Several technological factors suggest, however, that it may not be enough for a firm to depend on tight appropriability of its innovations. First, many technologies exhibit network externalities. That is, the more people that own the technology, the more valuable it is. For such products, a firm may actually want to weaken appropriability of the technology (Katz and Shapiro, 1986; Garud and Kumaraswamy, 1993). Second, technologies are not static; they evolve, often punctuated by discontinuities (Tushman and Rosenkopf 1992; Utterback, 1994). Thus a firm may need different strategies for each phase of the technology it is exploiting (Hariharan and Prahalad, 1994; Afuah and Utterback, 1995). For example, a firm may need alliances early in the life of the technology to win a standard. Third, the rapid pace of technological innovation suggests that there are more substitutes for products and therefore firms may have to cannibalize their own products before someone else does. Fourth, the proliferation of technology facilitates imitation, making appropriability difficult. For example, with today's computer aided design (CAD) tools, computer workstations, and scanning electron microscopes, it is easier to reverse-engineer a microchip than ten years earlier. Finally, increasing globalization means that a firm may sometimes be forced to license its technology to a foreign firm as a way to enter a lucrative foreign market.

These factors suggest that profiting from an innovation may require strategies other than erecting entry barriers around a technology. We argue that it takes combinations of *block*, *run* and *team-up*[3] strategies at different stages of the value chain and at different phases of the evolution of a product to maintain profitability. Which of these strategies a firm chooses is a combination of the firm's competences, corporate strategies, the type of product in question and where in the product life cycle the product is (see Figure 2).

[3]From now on, the use of the words *block*, *run* and *team-up* is limited to the strategic context defined here. Henceforth, there is therefore no need to *italicise* them.

3.2 Block

We will call any strategy that an innovation uses to prevent entry into its technology space a *block* strategy. There are three primary ways of preventing entry. First, the innovator can protect the intellectual property or competences that underpin the innovation. Second, it can limit access to important complementary assets. Third, if all firms have equal access to the technology and complementary assets, an innovator may still be able to prevent entry by signaling that post-entry prices will be low. Such signals can prevent profit-motivated potential entrants from entry. We now explore each the blocking schemes.

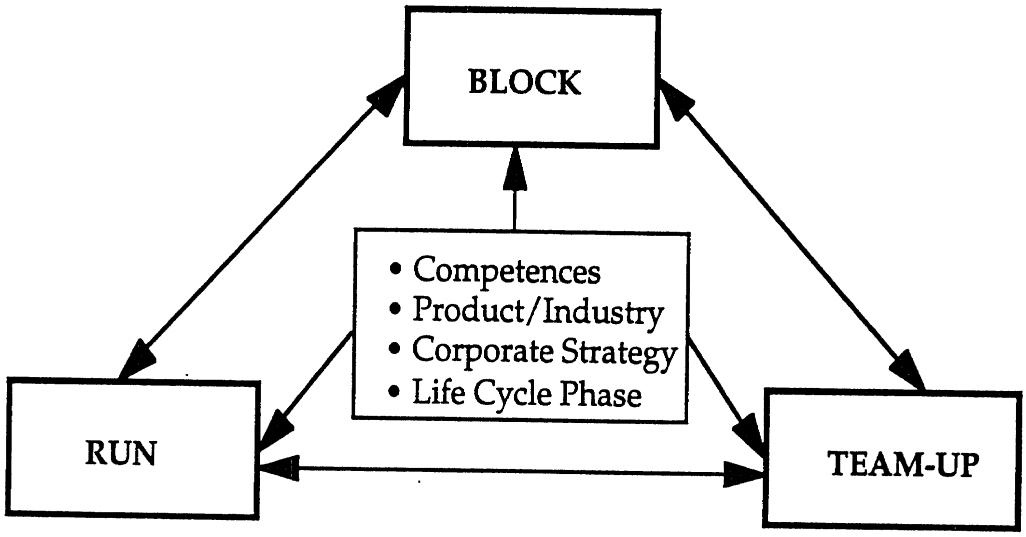

Figure 2: It takes a combination of two or more of *block*, *run* and *team-up* to profit from an innovation

3.2.1 Protect intellectual property

Protecting patents, copyrights, trade secrets, and trademarks can be a very good tool for preventing entry. While the degree of protection accorded by each property varies from industry to industry, copyrights are more difficult to circumvent than patents. The nature of competences that underpin the technology can also play a critical role in maintaining tight appropriability. Take Apple's Macintosh for example. Apple was able to keep the design of its Macintosh proprietary because of two things. First, its intellectual property rights made it difficult for other firms to copy its microcode without legal repercussions. Second, it is not easy to imitate the "look and feel" of the Macintosh. Microsoft's efforts to offer a similar system resulted in Windows 95 in the summer of 1995. By some estimates, Windows 95 just matches Macintosh's 1987 operating system.

3.2.2 Limit access to complementary assets

If an innovator has important and tightly-held complementary assets, it may be able to limit access to them (Barney, 1991). For years, Caterpillar's worldwide distribution and service networks have given it a competitive advantage over competitors in the earth moving equipment industry. Competitors have had difficulties replicating them.

3.2.3 Low post-entry price signals as block

If all firms have access to the technology and complementary assets, an innovator can still deter entry through signaling that post-entry prices will be low. This has been the subject of extensive research in economics (e.g. Tirole, 1988). The underlying assumption here is that potential entrants will enter the market only if they believe that they will make profits, and an important piece of information in deciding whether to enter or not is the post-entry price. Given the market uncertainty usually associated with innovation, it is often difficult to obtain pricing information. By observing the innovator, however, potential imitators can pick up signals that provide some information on the nature of post-entry prices. If the signals suggest that post-entry prices will be low, potential imitators will not enter. For examples, a firm whose management is committed to its existing technology or is emotionally attached to it, is less likely to let go of the old technology, and would fight entry by lowering its prices. New entrants who understand this are less likely to enter. As another example, if an innovator has a history of retaliating (by lowering its prices) against entry, that may be a signal that it will lower its prices with entry (Tirole, 1988).

3.2. Contingencies

The success of a firm with a block strategy depends on several factors. First, it depends on the firm's competences and endowments. For example, copyrights are easier to defend than are patents. Thus, all else equal, it is easier to block entry into a microprocessor technology space than into a DRAM technology space since microprocessors have copyrightable microcode and DRAM's do not. Second, it depends on the type of product or industry in question. Patents are easier to protect in pharmaceuticals than in semiconductors. Third, it depends on the firm's corporate strategy. For example, a firm that globalizes into developing countries may find out that patents and copyrights are not as protectable there as in the home country. Fourth, it depends on the life cycle of the technology. Finally, it depends on the firm's proximate environment (Porter, 1990).

3.3 Run

The blocking strategy works only so long as tight appropriability can be maintained, or complementary assets remain unique and inimitable. But given the proliferation of technology cited earlier, competitors can circumvent patents and copyrights or create substitute products. Moreover, advantages secured through blocking last only until such discontinuities as deregulation/regulation, changing customer preferences and expectations, and radical technological change render them obsolete (Foster, 1986; Tushman and Anderson, 1986; Utterback, 1994). The *run* strategy admits that blockades to entry, no matter how formidable they may appear, are often penetrable or eventually fall. Sitting behind these blockades only gives competitors time to catch up or leapfrog the innovator. The innovator must *run* . That is, it must be innovative enough to build new capabilities and introduce new products rapidly and do so well ahead of competitors. It must be able to introduce new products often, sometimes cannibalizing its products before competitors do (Banbury and Mitchell, 1995).

A run usually has two kinds of impact on a firm: one on the capabilities of the firm in question, and the other on the extent to which the *run* cannibalizes existing products. Figure 3 classifies runs as a function of these two impacts. A firm's success with the run strategy depends on the type of run. For expositionary reasons, we have labeled them as Type I, II, III and IV. In the Type I *run* , the innovator introduces a new product that cannibalizes existing ones, but the capabilities required to develop it build on the firm's existing capabilities. This is equivalent to an incremental innovation (Freeman, 1982; Foster, 1986). For example, when Intel introduces a new generation of microprocessors, older generations are cannibalized. However, the capabilities that it needs to offer these new generations build on its existing capabilities. Its copyrights, accumulated competences in circuit design, semiconductor device physics and process technology serve it well in offering the new products. Since the technological knowledge needed to carry out such *runs* builds on existing stocks of knowledge, roadblocks to *runs* would come from the fear of cannibalization or erosion of organizational political power.

		Product Cannibalization	
		Low	High
Competence Destruction	High	**Type III** Microwave oven	**Type II** HP and RISC
	Low	**Type IV** Shrink of Pentium	**Type I** Pentium

Figure 3: Examples of different *runs*

In the Type II *run* , the capabilities required to offer the product are different from existing ones, and the product creates new markets while rendering existing products non-competitive. The replacement of vacuum tubes by transistors, and of electromechanical cash registers by electronic point of sale registers, are all examples of type II *runs.* This is a radical innovation (Tushman and Anderson, 1986; Utterback, 1994).

In Type III, the *run* requires new technological and market knowledge but leaves existing products intact. The microwave oven offers a good example. In Type IV, changes in capabilities are negligible and the new product is no threat to existing ones.

In the context of this paper, innovation strategies such as offensive, defensive, imitative, dependent, traditional, and opportunistic (Freeman, 1982), or prospector, defender, analyzer, and reactor (Miles and Snow, 1978) can be viewed as degrees of runs—that is, how quickly a firm embraces a run.

3.4 Team-up

The third strategy is almost the opposite of *block*. Rather than prevent entry, the innovator actually encourages it. It can do that by licensing the technology or forming strategic alliances that allow for the sharing of the technology. The question is: Why would a firm want to give away its technology? The rationale is fivefold. First, a firm may need an alliance to help it win a standard (Hariharan and Prahalad, 1994; Kogut, Walker, and Kim, 1995). Early in the life of a product, different designs compete for a standard. For a product that exhibits network externalities, making a design open can improve its chances of emerging as the de facto standard or dominant design.

Second, a firm can give away its technology to downstream firms if in doing so, it can increase demand for its products upstream (Harhoff, 1991). For example, Intel can give away software to PC users if the software increases demand for PCs and hence, demand for its microprocessors that go into each PC. Third, some customers are reluctant to incorporate a component in their systems without the assurance that compatible generations of the component will be forthcoming. In semiconductors, for example, large buyers like IBM often insist on second sources for the components they buy. Encouraging other firms to adopt one's technology assures such customers of second sources, and may increase the number of customers who are willing to adopt the innovation.

Fourth, some governments require local ownership of certain kinds of businesses. For foreign firms, the price for operating in these countries may be licensing their technology to local competitors. Fifth, the scale of some technological innovations may be such that one firm alone cannot carry it out. Many semiconductor firms have had to form alliances in order to develop and manufacture 64M DRAM memory chips because of the costs associated with their development, plants and equipment. Motorola's alliance with Siemens to build a $1.5 billion DRAM fab in Richmond, Virginia, is the latest in the trend of such alliances (Baker and Swisher, 1996). Finally, there is teaming up to block. A firm can form an alliance with competitors to prevent entry by others.

Forming alliances, licensing and even tacit collusion can be viewed as different types of teaming up.

4. Dynamics of strategies

As suggested earlier, each of these strategies alone may not be enough for maintaining profitability. In this section, we explore why, when and what.

4.1 Why combinations

4.1.1 Block, and Run or Team-up

There are two reasons why maintaining tight appropriability of a technology alone may not result in long-term profitability. First, as we have already suggested, the fast pace of technological change suggests that competitors can quickly circumvent patents and copyrights, or leapfrog a firm that depends only on blocking entry into its existing technology space. The firm may have to also *run*. That is, while fighting imitation of its innovations, a firm can keep developing new product generations to cannibalize existing products before competitors circumvent its intellectual property protection. Second, advantages secured through blocking last only until such discontinuities as deregulation/regulation, changing customer preferences and expectations, and radical technological change render them obsolete. In the face of such discontinuities, the firm may be better off *teaming-up* in order to exploit technologies and markets that are unfamiliar to the firm (Roberts and Berry, 1985).

4.1.2 Team-up, and Block or run

As we suggested above, one reason why a firm may want to *team-up* is to improve its chances of gaining a standard. If its alliance wins the standard, the firm must still do something distinctive that allows it to perform better than members of its team if it is going have a competitive advantage. It must *block* or *run* somewhere else in its value chain or product life cycle timeline. For example, one reason why the IBM PC became the standard was because IBM "gave away" the technology by making the architecture non-proprietary. Within the PC standard, each firm has had to distinguish itself somehow. For example, early in its life, Compaq had a *run* strategy, introducing PCs with the latest generation of Intel microprocessors well before anyone else did. What has allowed IBM to stay in the market so far have been its brand name reputation, and distribution channels. In the cases of Section 5, we will show how Intel and Sun successfully used the combinations of *Team-up* and *block* or *run* strategies.

4.1.3 Run, and Team-up or block

There are several reasons why a run may need to be complemented by team-up or block. First, where the run involves radically different technological and market knowledge, and the firm is unfamiliar with them, it may need to form alliances (Roberts and Berry, 1985). Second, in some industries, new product development can be very expensive. Thus, by fighting entry, a firm can slow down competitors enough so that it does not have to introduce products as quickly as it would otherwise. Third, a firm may not have the competences to depend on new product introductions alone. By fighting entry, it may be able to slow the rate of imitation enough to allow it time to introduce new products at its own pace, and still stay ahead of the race. Finally, as a technological trajectory evolves, there may reach a time when costs are so high that a firm can no longer develop products alone. It may have to *team-up*. The DRAM case cited early is an example.

4.1.4 Interacting effect.

The synergistic effect of combinations of strategies can also be large. Take *block* and *run*. If a firm keeps its design proprietary by, for example, rigorously prosecuting anyone who tries to infringe on its copyrights, potential entrants have to spend time and resources trying to circumvent the copyright. While they are doing that, the innovator can concentrate on developing and introducing another generation of products. That is, as competitors struggle through blockades that an innovator has erected, it can run further away. On the other hand, the fact that an innovator can introduce designs faster than new entrants may discourage potential entrants from attempting entry. There is also a relationship between run and team-up. A firm's ability to frequently introduce new designs makes it easier for it to attract takers when it wants to license its technology.

4.2 When

Having provided some reasons why combinations of strategies, not a single strategy, are conducive to sustained profitability, the question becomes: when should a firm pursue these combinations?

4.2.1 Combinations along the value chain

A firm would successfully run or block only at those stages of its value chain where it has the capabilities that underpin each strategy. For example, a firm in the semiconductor industry can exercise block and run strategies only if it has the intellectual property, and the competences in circuit and logic design that are critical to introducing new products. At any one time, a firm can pursue different strategies along its value chain as shown in Figure 4. The innovator can license its design to any firm that wants to imitate the design so as, for example, to help the design emerge as the standard. At the same time, however, the firm protects its idea generation and development capabilities. Thus, although competitors can offer compatible designs, they may not have the capabilities to offer products as often as the innovator. The Sun Microsystems case that follows illustrates this.

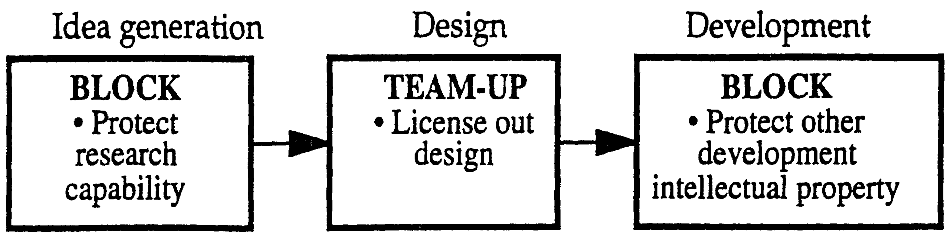

Figure 4: strategies along the value chain.

4.2.2 Combinations over innovation life cycle

As illustrated in Figure 5, the strategies that a firm pursues over the life cycle of a technology also vary. Prior to the emergence of a dominant design, an innovator may want to team-up to improve its chances of winning the dominant design. Following the emergence of the dominant design, the firm may want to introduce versions of the design more frequently (run) than its competitors. It may also want to defend its intellectual property or brand name reputation (block). At a discontinuity, the type of strategies pursued depend on the nature of the discontinuity If the discontinuity is competence-enhancing (Tushman and Anderson, 1986), the firm may pursue a run and/or block strategy since the capabilities required build on existing ones. If it is competence-destroying, it may require a team-up strategy (Roberts and Berry, 1985).

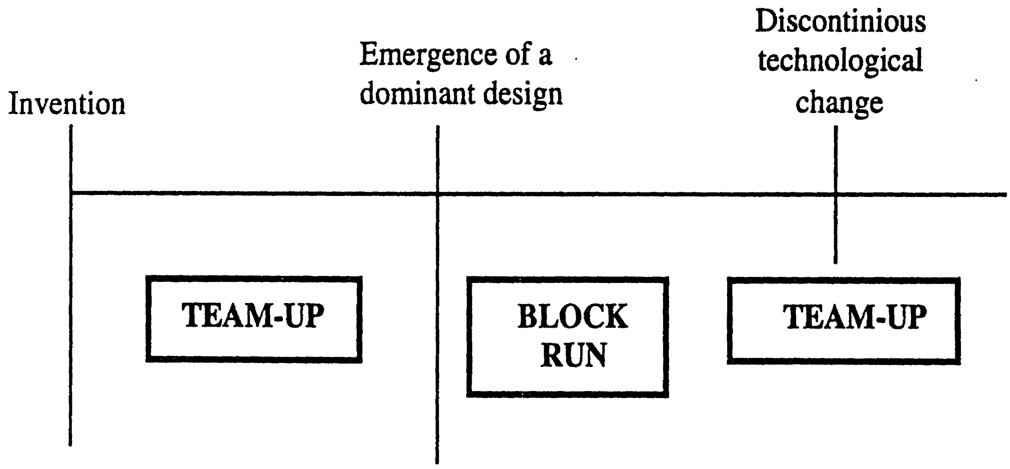

Figure 5: Sample strategies along the evolutionary path of an innovation

5. The Cases of Intel and Sun

We now use the cases of Intel and Sun Microsystems to illustrate the significance of combinations of strategies (See Figure 6).

5.1 Intel

The case of Intel illustrates the importance of combined generic strategies over the life cycle of a technology. In the 1970s, Intel licensed its microprocessor technology to AMD, NEC, Mostek and others. This had two effects. First, it assured potential customers of a second source for the microprocessor. Second, the licensees, together with Intel, developed the many complementary chips that are critical to the success of a microprocessor. In 1980, IBM chose Intel's microprocessor as the brain for its personal computer (PC), partly because of the many inexpensive complementary chips available for the microprocessor, thanks to the alliances. The IBM PC quickly became the dominant PC design and the Intel microprocessor, the dominant microprocessor design. As the Intel architecture emerged as the dominant design, Intel took two decisions to keep newer versions of the chip proprietary. First, it stopped licensing its technology; not even to those who had helped it establish the architecture as a standard. Second, it prosecuted any firms that attempted to imitate its technology, filing a lawsuit first against NEC and, later, against AMD. It won.

While very successful at discouraging entry, Intel's rigorous protection of its intellectual property has not totally prevented entry. At one time or the other, AMD, Cyrix, NextGen, IBM, and Chips & Technologies have produced Intel-compatible microprocessors. Consequently, in addition to protecting its intellectual property, Intel has had to seek other ways to keep profiting from its microprocessors. It has been introducing newer generations of microprocessors, with higher complexity (as measured by the number of transistors in each chip), and mind-numbing increases in performance (as measured by the number of instructions that the microprocessor executes per second), at a dizzying rate. For example, the P6 (Pentium Pro) will be introduced only three years after the Pentium and should be about twice as complex and twice as fast as the

Pentium. This compares favorably with the 486 that was introduced four years after its predecessor, the 386. Many new generations of microprocessors have been introduced before sales of the earlier generation have peaked.

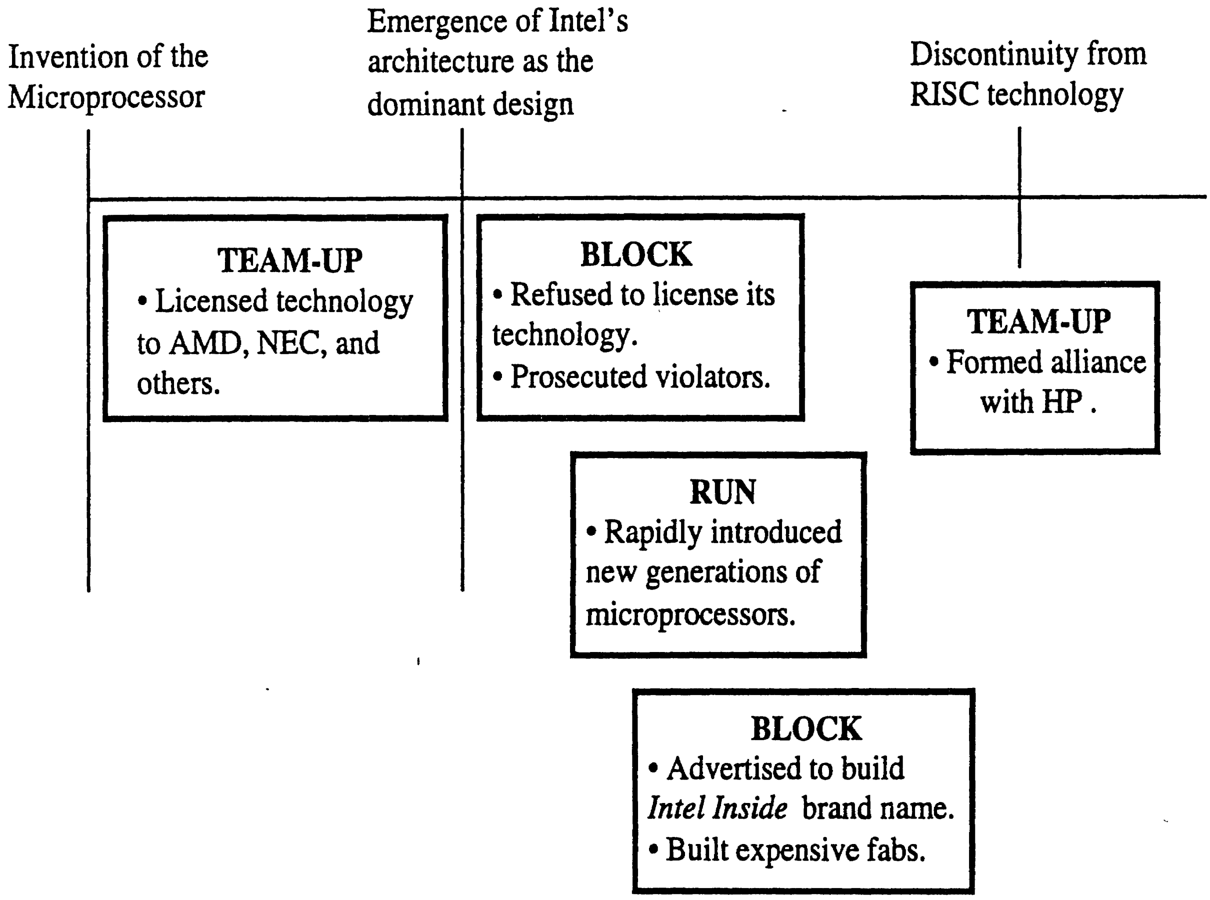

Figure 6: Intel's strategies over the life cycle of its microprocessors

The result of all these efforts is that new entrants have not been able to make a dent in Intel's profits. Some examples: AMD did not introduce a 486 until 1993, some three years after Intel—a very long time in "semiconductor years". By that time, Intel was ready to introduce the Pentium. AMD plans to introduce its version of the Pentium in 1996 when Intel plans to introduce the next generation Pentium, the Pentium Pro. NexGen, another new entrant, introduced the Pentium about two years after Intel but it did not have the Math co-processor that Intel's had—that is, it was not fully compatible with Intel's installed base, and would not run all customer's old software. As of 1995, Cyrix, another 486 cloner, did not have a Pentium chip. In addition to the fact that Intel has stayed ahead of its competitors, none of them have been able to make a sustained run at Intel. Each generation of products has seen a different competitor be the first to introduce a product *after* Intel; none has been able to introduce a product before Intel.

Intel has also been working hard to establish a brand name identity. Although the microprocessor has been responsible for most of the performance improvements in personal computer performance, this processor has been buried in the black box that is the personal computer, and with it, Intel's identity. In 1991, Intel decided to do something about its anonymity. It went directly to end-users with its case, advertising heavily and promoting its *Intel Inside* logo. In addition to advertising in numerous technical and business magazines, it took spots on nationally televised TV programs. It also promoted the Intel Inside logo by offering PC makers discounts on chips if they displayed the logo on the PCs they sold.

Finally, Intel has one other advantage: the high cost of a semiconductor plant which at $1.5 billion[4], now constitutes a barrier to entry for many firms. The fact that Intel has already built these plants or has the money to build them, and has a war chest[5] of about $10 billion dollars sends a signal to potential entrants that any entry attempts will be fought.

It is important to note that the competences that have allowed Intel to improve its rate of product introductions build on existing competences and endowments. That is, the innovations have been competence-enhancing. The design skills, CAD tools, circuit design, semiconductor device physics, instruction set design skills, hardware/software interface, applications engineering, for each new generation of microprocessors (e.g. 486) all build on the competences and endowments of previous generations (e.g. the 386). That is, the product introductions have been Type I *runs*. Type II *runs* in which both existing capabilities are obsoleted and present output cannibalized can be more difficult to make. The closest thing to a Type II *run* that Intel has faced has been RISC (Reduced Instruction Set Computer) technology. RISC technology results in faster

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[4] *Wall Street Journal.* October 17, 1995.

[5] Intel's profits for 1995, estimated at more than $3.5 billion, while inviting entry, also suggests that it has even more money to fight entry.

microprocessors than those from CISC technology which Intel has chosen to stick with for the PC market[6]. RISC technology is an architectural innovation and would be capabilities-obsoleting to Intel (Henderson and Clark, 1990). To reduce the effects of this type of *run*, Intel has formed an alliance with HP which has been committed to RISC technology since 1983. Intel's P7 microprocessor is supposed to benefit from this team-up.

5.2 Sun Microsystems

The case of Sun Microsystems illustrates how a firm can "give" away its design technology but still be able to make money through *run* and *block* strategies elsewhere in its value chain. See Figure 7.

In 1987 when Sun Microsystems introduced the first workstation using its SPARC[7] RISC technology, it also announced that it would license the technology to anyone who wanted it. It was literally giving away the technology it had developed, instead of using its intellectual property protection rights as a barrier to entry. It backed this promise in 1989 with the formation of SPARC International Inc., an independent corporation with responsibility for supporting any firm that wanted to produce Sun workstation clones. On the surface, the offer was too good for potential entrants to resist. For one thing, SPARC was compatible with the largest installed base of workstations that ran the largest number of applications software in the workstation market. Entering such a market meant access to the large installed base of customers. For the other, the workstation market was the fastest growing computer market at the time. Surely, it would be easy for new entrants to come in and make money. Many firms took advantage of the "free" entry and offered SPARC workstation clones. We will come back to their fate shortly. For the moment, lets see what the decision to encourage entry meant to Sun.

[6]Intel has been producing RISC chips since 1988 but they are not earmarked for the personal computer CPU market. They are used largely in such embedded control applications as printers.
[7]SPARC (Scalable Processor Architecture) is Sun's RISC technology.

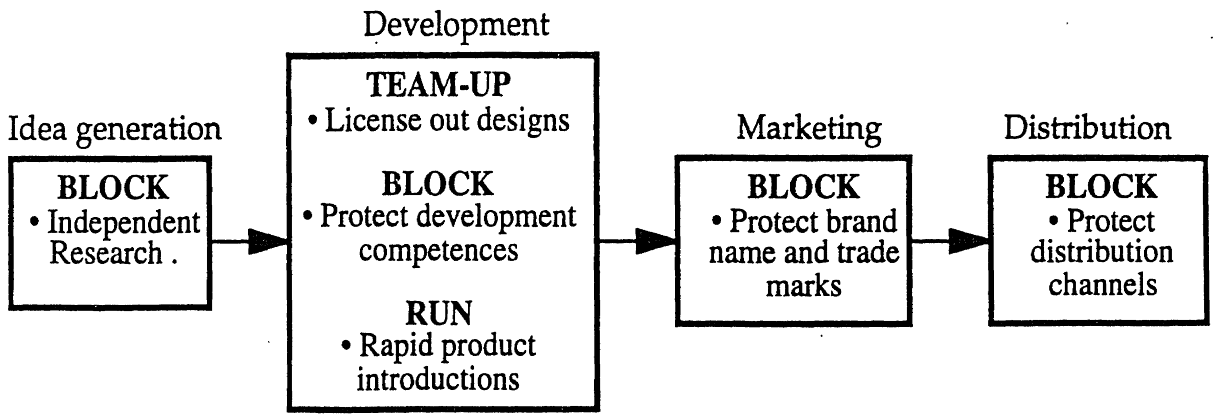

Figure 7: Sun's strategies along its value chain.

For several reasons, giving away its SPARC technology was an important strategic move for Sun. First, in making their decisions today about what network to join, users of products that exhibit network externalities (and computers do) care about what the size of the network will be tomorrow (Kartz and Shapiro, 1986). That is, future network size is important to users. By making its SPARC standard open, Sun was sending a signal to customers that there would be many firms offering SPARC workstations and therefore a large user network. Such a large network would give customers the benefits of network externalities: computers they could share and more software. Second, Sun was sending a signal to independent software vendors (ISVs), the firms that develop software for computers, that the size of the network of SPARC customers would be large and therefore these ISVs could commit their scarce resources to developing software for SPARC. Third, some workstation users were developing a bitter taste for RISC technology given what had happened to a gorilla called IBM. IBM had introduced a RISC workstation in 1986 and it had failed woefully. By providing a united front behind SPARC, Sun hoped customers would be more willing to give RISC technology another chance. Finally, there were other RISC technologies, albeit on the drawing board, that would be competing for supremacy in the workstation market. Cooperating with computer makers in its RISC camp would be better than fighting against them from other RISC camps. The more such firms in its camp, the better the chances of SPARC, especially since it already had the largest installed base of compatible workstations and software running on it.

RISC Technology	Market Share (%) 1989	1990	1991	1992
SPARC	56.36	63.74	62.75	51.93
MIPS	19.75	18.19	15.20	18.16
PA-RISC	0.81	0.00	6.23	15.31
IBM	4.53	7.56	8.37	9.18
Clipper	15.93	6.67	4.98	3.52
MC88X00	1.66	2.99	2.17	1.25
Alpha	0.00	0.00	0.00	0.47
i860	0.00	0.00	0.18	0.12
Other	0.97	0.86	0.13	0.07
Total	100.00	100.00	100.00	100.00

Table 1: Workstation/Workstation Server shipments by RISC technology. (Data source: IDC)

As Table 1 shows, Sun's strategy may have paid off for the SPARC camp as the technology captured a substantial share of the RISC workstation market. The more important question for Sun, though, is how well it has done within the SPARC camp. For that, we turn to Table 2. It is clear that Sun has maintained a very high share of the SPARC market. Its strategy of encouraging entry has allowed the SPARC camp to maintain a large market share while within the camp, Sun has managed to maintain an extremely high market share. The question is, why has Sun done so well while the cloners have not. To understand why, we need to look at what it did on the entire value chain, not just at the design level. Sun allowed other firms to clone its workstation design. But downstream along the value chain, it protected its brand name reputation and distribution channels. Some customers were not willing to forgo Sun's reputation and brand name for the expected lower prices of cloners (which turned out not to be very low compared to Sun's). Commented a Sun customer when asked why his company had not switched to clones: "I am loyal to Sun" (Ould, 1991). Sun also offered excellent service that cloners could not.

	Market Share within SPARC camp (Units)			
	1989 (%)	1990 (%)	1991 (%)	1992 (%)
Sun	98.90	97.70	93.68	92.18
Tatung	0.00	0.75	1.39	1.67
Fujitsu	0.00	0.00	0.00	1.57
CompuAdd	0.00	0.00	1.00	1.07
Axil Worstation	0.00	0.00	0.00	0.85
DTK Computer	0.00	0.00	0.00	0.64
Aries Research	0.00	0.04	0.05	0.37
Solbourne	0.89	0.95	2.49	0.31
Opus Systems	0.00	0.36	1.00	0.21
Others*	0.21	0.21	0.39	1.13
Total	100.00	100.00	100.00	100.00

* Others include: Matsushita, Solflower Computer, Integrix, Twinhead, CMS Computing, Mobius Computing, Vertos Technology, and Samo America

Table 2: Workstation market share for SPARC open standard. (Data Source: IDC)

Cloners also found out that it was not easy to convince Sun's distributors to carry their workstations as it took advantage of the relationships that it had forged with its distribution channels and customers prior to licensing out is technology. Asked a Sun manager, "Why should another vendor, whose products compete directly with Sun's, be allowed to step in and leverage Sun's investment in its reseller partners to their benefit and Sun's expense?" (UNIX World, 1991). Upstream in R&D, Sun still slugged it alone allowing it to make advances that some cloners could not. Moreover, copying a firm's design is one thing, and imitating the competences that allow the firm to offer the design at lower cost or to introduce new generations more frequently is another. In Sun's case, it was able to offer discounts to customers that cloners could not always match. It also introduced new generations of products more often than most cloners.

6. Summary and conclusions

For some innovations, maintaining tight appropriability or limiting access to complementary assets may be enough for an innovator to maintain short-term profitability. This paper argued that for most innovations, however, sustained profitability requires a combination of two or more of three generic strategies: *block* in which an prevents entry into its technology space; *run* in which the innovator frequently introduces new products, cannibalizing its existing products before anyone else; and *team-up* in which an innovator collaborates with competitors. The pervasivenes of technology, rapid pace of technological change, the nature of certain products, and the resulting competitive landscape make it difficult to maintain long-term profitability with just one of these strategies.

An innovator pursues combinations of these strategies along its value chain, or over its innovation's life cycle. Just what combinations of the strategies it pursues is a function of its competences, corporate strategy, type of product and the phase of the technology life cycle.

The cases of Intel and Sun illustrated why combinations of these generic strategies, not one, are critical to profiting from an innovation. They also suggested when and where the strategies can be used. Early in the life of its microprocessor, Intel formed alliances that were instrumental to IBM choosing the Intel microprocessor architecture for the PC. Following the emergence of its architecture as the dominant design, Intel decided to go it alone and refused to renew old licenses or offer new ones to potential imitators of its microprocessors. At the same time, it increased the pace at which it introduced new products while also building a brand name reputation with its *Intel Inside* advertising. Thus it teamed-up early in its innovation's life cycle, but switched to *blocking* and *running* post-dominant design.

Sun Microsystems also licensed out its SPARC RISC technology, but at the same time kept its development competences, distribution channels, and service to itself. The SPARC alliance captured the largest workstation market share. Within the alliance, Sun maintained the dominant market share because of its *blocking* and *running*.

For the practicing manager in the technology-pervasive competitive landscape, this paper reiterates the fact that maintaining tight appropriability or giving away a technology may not always be enough to maintain profitability. More importantly, it suggests a closer look at just what kinds of combinations of strategies are best for a firm and when these combinations may be used.

For the academic, it raises some interesting questions. First, there is the question of substitutability. Since running can, for example, discourage entry, the question becomes how much *running* a firm should pursue in place of *blocking*? Given the cost of litigation, this may not be a trivial question. On the other hand, given the high cost of some product developments, might a firm not be leaving money on the table by *running* too fast?

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