Strategy Lessons in IBM Story

BY LARRY W. COX*

Collaboration is key to building capacity and ability to respond to unanticipated contingencies; IBM visited

When Tom Peters and Robert Waterman went "in search of excellence" in 1982, they scoured the corporate countryside for U.S. firms "considered to be innovative and excellent." They sought to uncover "America's best-run companies" and distill winning strategies from in-depth analysis and comparison. They only considered those companies that were acknowledged as "excellent" by the business community as a whole. Of this group, they included only those that had posted 20 years of industry-leading growth and economic health. Finally, of the remainder, they selected only those firms regarded as historically "innovative" by a panel of industry experts. The result was a collection of blue-ribbon enterprises that had defined excellence in American business for two decades — an assortment of giant corporations producing a wide array of products and services — the vanguard and future of the U.S. economic machine.

One of the companies rated as "excellent" in 1982 was, of course, International Business Machines. After the phenomenally successful launch of the IBM PC just one year earlier, its selection was inevitable. Even among this elite group of top performers, IBM was exceptional. It retained the most talented (and fanatical) employees in the world, spent an average of $6 billion a year on R&D, produced reliable, high-quality products, totally out-classed its rivals and completely dominated every market it entered. It was a monolithic monster, crushing smaller competitors and dictating industry standards in every area of office technology. (Indeed, the phrase "IBM-compatible" is an enduring testament to its supremacy.)

No one (including Peters and Waterman) could have imagined that in just one decade IBM would be struggling for its corporate life. None of the "industry experts" could have dreamed that "innovative" IBM would soon be bending to standards set by upstarts like Microsoft and Intel (what Ferguson & Morris call "the revenge of the nerds." None of the "Wall Street wizards" could have projected that in just 10 years "behemoth" IBM would be steadily losing market share in virtually every product line, that it would post a $500 million loss between 1991 and 1992, and that stockholders who purchased IBM in 1987 would lost 7% per year. The business community could not have believed that in such a short time "excellent" IBM would be drastically down-sizing its workforce and looking to foreign competitors for manufacturing support. Yet today's IBM is announcing record losses, declining sales, and massive layoffs.

"We are not making forecasts. But there is reasonable question whether IBM is on the brink of a colossal Wang-like implosion. The possibility is all too real." [Ferguson & Morris, 1993, p. 88]

However, IBM's fall from grace has not followed the legendary American pattern of underinvestment, shoddy manufacturing standards, and aging technology. On the contrary, IBM has continued to "lead the pack" in basic research and product development. It has invested billions of dollars in R&D — more than any company in history. Its laboratories have created the hard-disk and floppy drives for personal computers, the relational database, FORTRAN, microcode, and semiconductor main memory.

Its engineers have long utilized advanced semiconductor manufacturing and testing technologies, and outstanding computerized semiconductor design tools. IBM is still the first to produce each new generation of Dynamic Random Access Memory (DRAM) chip. But as we shall see, IBM has failed to properly manage many of the excellent technologies it has helped to produce. Specifically, it has fumbled away two key technologies to former partners. It has momentarily lost control of the industry.

"If a modern-day Dante were taken on a tour of Businessmen's Hell, he would doubtless encounter, deep in the gloom, writhing executives from American basic industries . . . who let both their technologies and the businesses slip into second-rate status. But in an even deeper ring he would find a separate group of blue-suited men whose crime was far worse: they had had the finest technologies in the world, but let their company founder anyway." [Ferguson & Morris, 1993, p. 84]

A BRIEF HISTORY

Radical Decentralization Alters the Environment

For 30 years, from 1952 to 1981, "mainframes" were buried deep in the belly of every large organization. Computer processing was performed by colossal whirring machines, and lab-coated technicians. "Dumb" terminals were sprinkled about the firm. Computer power was applied only to large-scale data processing and available only to companies with extremely deep pockets. It was an era of upper-end users, low flexibility and limited accessibility. Further, it was a time of great frustra-

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tion for those who were excluded (for reasons of cost or expertise) from the quantum leap in productivity afforded by these "electronic wonders." It was a period of slow, steady innovation controlled by one utterly dominant firm, IBM.

From its first "mass-produced" business computer, the IBM 650 introduced in the 1950s to its "system solution" computers, the IBM 360 and 370 unveiled in the sixties and seventies, IBM "owned" the mainframe computing world. By 1979, a full 70% of mainframe computer installations featured IBM equipment. More importantly, virtually all mainframes and peripherals were IBM-compatible and ran on IBM operating software. IBM was the largest and most profitable industrial company in the world. By comparison, Burroughs, UNIVAC, NCR, Control Data, and RCA/-Honeywell, formidable competitors through the 1950s, were merely "the bunch" — a collection of "also rans," relegated to the unenviable positions of clone makers and peripheral suppliers. (Indeed, "bunch" salespeople bitterly complained that they didn't compete so much *against* IBM, as they did *within* IBM — that is, within a computing environment defined and dictated by IBM alone.) IBM was a gigantic carrier steaming effortlessly through a rippleless sea.

However, in 1975 in a run-down building in Albuquerque, New Mexico, two young computer hackers were unwittingly pounding a crack in IBM's impenetrable hull. Paul Allen and Bill Gates were successfully writing computer code that could fit inside a microprocessor, a device invented just four years before by a neophyte company called Intel. And although their "Altair" machine looked nothing like today's personal computer, it marked the beginning of a rapid and increasingly frenetic movement toward "radically decentralized computing." That is, a computing environment in which every unit on every desktop has the power *in and of itself* to perform complex and useful functions. It was a climate characterized by decreasing costs, increasing power, greater flexibility and universal accessibility. Allen and Gates and their clumsy "toy" were sparking a revolution so powerful that by 1986 it had become a $6 billion industry, growing to $10 billion by 1991.

IBM Enters the PC Market

Initially, IBM was reluctant to enter the PC market, despite having in the late 1960s developed the world's first PC (dubbed the "SCAMP"). By the mid 1970s it had created the 5100, a desktop computer for science labs, as well as the Displaywriter, a dedicated word processor utilizing its latest invention, the floppy disk.

"[IBM] senior managers, by and large, were distinctly unenthusiastic; making personal computers simply did not fit the IBM way of doing business. Personal computers were sold through dealers, like a retail product; quality standards were low; software was amateurish; the multiplicity of products and the rapid product cycles seemed chaotic — all too quick-moving and faddish, a battle for commandos, not carriers." [Ferguson & Morris, 1993, p. 22]

However, by 1980, it had become clear to IBM that it was time for the flagship mainframe company to fire its first volley in the PC battle. Frank Cary, then chairman of IBM, charged his Boca Raton laboratory to develop an IBM personal computer by August 1981.

The most remarkable aspect of the development of the IBM PC was Boca Raton's unparalleled decision to out-source the majority of its component parts. IBM had traditionally built all of its own components. It was proud of the fact that if needed, even the screws could be manufactured in-house. However, the lab felt that utilization of existing (i.e. non-IBM) technology could eliminate the need for much of IBM's legendary (and time consuming) product testing. Project leaders strongly felt that speed to market was more important than quality control. As a result, the first IBM PC utilized Tandon disk drives, Zenith power supplies, SCI Systems circuit boards, and Epson printers. More significantly, however, it featured an Intel microprocessor, the 8088, and MS-DOS, and operating software initially purchased and later developed by Bill Gates and Microsoft.

From the outset, the IBM PC was a huge success. For the first 18 months, orders hopelessly outran manufacturing capability, and actual sales consistently exceeded projections by five to eight times. By 1984, revenues from the IBM PC exceeded $4 billion. The PC division of IBM was the fastest growing "company" in history. Furthermore, a subsequent smash hit, the IBM PC-XT, promised to position IBM as the ottoman of yet another millennial empire. Unfortunately for IBM, however, the empire was wrested from their grasp by a rag-tag group of imitators and ex-partners.

The Clones Take Charge

The phenomenal success of the IBM PC attracted competition. Compaq and other clone makers mounted an attack on its supremacy. Their strategy was simple — produce machines that could imitate the IBM PC *exactly*, but for less money. Their task was to convince potential customers that the *current* cloned hardware was as good as the original, and the *future* of computerization lay with the clone makers. Customers needed assurance that their investment in a look-alike product would not be lost when the traditional leader (IBM) changed the core architecture and upgrade to the next generation.

Fortunately for the clone makers, IBM mistakenly utilized Intel's 286 chip in its PS/2 and they were able to leapfrog to the 386. But even more fortuitous was the fact that in its haste to develop the PC, IBM had ceded control of the operating system and microprocessor architectures to Microsoft and Intel, respectively. Remarkably, IBM had never bothered to obtain rights to the DOS source code from Microsoft, or acquire a controlling interest in the (then) fledgling company. Instead, it successfully created the *de facto* industry standard with someone else's product. Consumers increasingly looked to Microsoft and Intel for industry leadership, and IBM found itself precariously vulnerable to lower-priced clones. Soon, clones proliferated. The balance of power took a precipitous tilt away from IBM.

Currently, IBM is losing on all fronts. Its market share in mainframes and minicomputers has evaporated from 37% in 1986 to just 28% in 1991.[1] Its share of the rapidly expanding PC and Workstation market has likewise plummeted from 29% in 1986 to 17% in 1991.[2] Unfortunately, the future does not appear any brighter, at least in the short run. Since approximately 65% of its revenues are still generated by the sale and service of mainframes and minicomputers, IBM will undoubtedly continue to have difficulty adapting to the radically decentralized computing environment that continues to threaten its existence. Clearly, IBM needs to rethink its strategy. It needs to consider when and how to use strategic alliances and strategic licensing agreements. In the next section, we will consider three principles that help to understand these important tools.

STRATEGIC ALLIANCES AND STRATEGIC LICENSING

The Inevitability of Collaborative Competition

Since the dawn of the Industrial Revolution, we have tended to view industrial organizations as "medieval fortresses" [Badaracco, 1991]. They are seen as clearly bounded, totally autonomous units that create value within their borders. They interact with equally autonomous vendors and customers only via arms-length market transactions.

We have assumed that the boundary of an organization is located precisely at the edge of its hierarchical control, that a firm must own all of its crucial assets, that all organizational members must share a common purpose, and that interactions with "outsiders" must involve formal, contractual arrangements. We have argued that cooperation (especially between competitors) is inherently bad and should be avoided (even prosecuted) in every instance. Until recently, this perspective adequately described reality and conformed to our normative ideas regarding how businesses should operate:

> *"In a world of atomized business units, managers can be held accountable for their actions, the rights of property owners are preserved, resources flow to their most productive uses, and society is protected against the economic and political abuses that arise when firms, especially large ones, collude with each other."* [Badaracco, 1991, p. 4]

However, the "citadel paradigm" no longer reflects the business environment that surrounds us.[3] Nor is it seen as the ideal model for organizational structuring.

Successful organizations in today's global marketplace look more like Italian "city-states" than "citadels" [Badaracco, 1991]. Their boundaries are blurred and permeable. They do not have hierarchical control over every aspect of their operation. They do not own all crucial assets (especially knowledge). Their members do not necessarily share common purposes. Finally, their "outside" interactions are not always contractually defined.

Relationships are often open-ended and ambiguous. Much like city-states, modern firms cooperate with rivals and spin complex webs of formal and informal alliances. They value diplomacy above rivalry and exchange information with erstwhile competitors while simultaneously seeking to build their own competitive advantage.

According to Badaracco, several theories have been traditionally offered to explain the recent surge in interfirm alliances and the rise of the "city-state paradigm," including:

1. **Collusion** — Firms are motivated to form alliances in order to reduce competitive pressures and increase profits.

2. **Risk Sharing** — The costs of doing business on a global scale are so high that no firm can afford to "go it alone." Partners are required in order to share risk in new ventures (especially the expense of R&D).

3. **Complementary Assets** — Individual firms cannot be skilled in every area. Nor do they have the capacity to produce every product, or the wherewithal to enter every market. Joint enterprises provide a vehicle for "rounding out" capacities and commercializing new technologies.

4. **Surmounting market barriers** — Often, the most expedient (and the only legal) way to enter a foreign market is to form an alliance with a local partner.

In addition, some authors have suggested that factors such as geography, host-country policies, industry, and firm differences contribute to the likelihood of alliance formation. Yet, while each of the above motives and factors are helpful in understanding the reason behind specific alliances, none of them alone adequately explains the phenomenon itself. Are strategic alliances a permanent feature or a passing fad? When are they most likely to occur? And in which industries?

It has been suggested that strategic alliances are most beneficial when firms are *expanding* their capabilities, not *exploiting* them. Further, it has been argued that firms move through natural cycles of expansion and exploitation, and hence, natural cycles of alliance formation. According to this view, the recent boom in strategic alliances is a cyclical aberration. Further, it is likely that the number of alliances will decrease as firms "cash in" on the capabilities they acquired via collaboration.

Others have argued that since knowledge-based competition centers on the *continual* appropriation of knowledge, firms in knowledge-intensive industries will *always* be expanding their capabilities by means of collaboration. As knowledge proliferates and grows in importance, and as organizations approach the limit of their ability to develop essential knowledge in-house, alliances will increase in frequency. The implication is that they are a permanent feature in virtually every industry and will especially dominate those arenas where knowledge is the primary strategic weapon.

In today's business environment, then, strategic alliances are an in-

1. Source: The McKinsey Database, as quoted in Ferguson & Morris, 1993, p. 85.
2. Ibid., p. 85.

3. See Table 1. Notice the dramatic ten year increase in IBM's joint ventures with outside firms, and especially in the number of alliances formed for the purpose of joint research and development.

dispensable competitive tool, especially in knowledge-driven (i.e. high-tech) industries. Therefore, one could argue that IBM's Boca Raton laboratory was absolutely correct to break tradition and utilize collaborative arrangements as they entered the PC environment. Unfortunately, however, they misunderstood the underlying nature of strategic alliances and lost rather than gained advantage.

The Nature of Strategic Alliances

In order to understand "the underlying nature" of strategic alliances, we must first realize that there are two types of knowledge — "migratory" and "embedded." The former resides in "packages" (i.e. designs, machines, and individual minds) that can be readily copied, reverse engineered, or relocated. The latter is found in relationships between individuals, work groups, and organizations (i.e. in norms, attitudes, information flows and decision-making processes). It cannot be easily articulated or acquired. While migratory knowledge is what typically comes to mind when we think of "technology," Michael Porter's [1987] "value chain" illustrates that it is really the "intangible" technology embedded in the organization that guides and coordinates each activity, and allows it to gain competitive advantage (Figure 1). As Reich puts it, "(Valuable) production experience is essentially social. It exists in employees' minds, hands, and work relationships. It cannot be patented, packaged, or sold directly." [Reich & Mankin, 1986, p. 84] In other words, it is *embedded* knowledge that truly gives meaning and value to *migratory* knowledge. Also, it is precisely because embedded knowledge is difficult to copy that it lies at the heart of *sustainable* advantage. Second, we must acknowledge that strategic alliances are the best vehicle for assimilating and disseminating embedded knowledge. By definition, arms-length licensing arrangements cannot capture embedded knowledge. Also, it is obvious that no firm has deep enough pockets to purchase in the open market (either through licensing or acquition) all of the knowledge it needs to compete. (Even a company as large as IBM can no longer buy competitive advantage in this manner.

Further, mergers often destroy the embedded knowledge they seek to capture by reorganizing the target firm and forcing it to adjust its processes and personnel to fit the new enterprise. Both mergers and acquisitions waste resources if the acquiring firm only wishes to appropriate one of the capabilities held by another firm. Clearly, strategic alliances address each of these issues, and provide a lower cost, less disruptive way to gain an intimate acquaintance with another firm's embedded knowledge.

Finally, we must recognize that the primary purpose of a strategic alliance should not merely be to add a low-cost, high-quality product to a

A TEN-YEAR HISTORY OF IBM JOINT VENTURES (1982-1991)

YEAR	JOINT VENTURE PARTNER	PURPOSE	JOINT VENTURE NAME
1982	Carnegie Mellon U.	Develop prototype LAN system	Transarc
	Matsushita	Manufacture personal computers	
1983	Matsushita	Manufacture data processing / office automation equip.	
	(Japan)	Computer leasing	Japan Computer Leasing
	(Japan)	Computer communications software	
1984	Sears & CBS	Provide videotext	Trintex
	Merrill Lynch	Financial news service	MarketNet
	Hyundai	Possible computer venture	
	British Telecom	Computer communications system	
	Stel (Italy)	Develop automated factory systems	
1985	Texas Instruments	Offering token ring LAN	
	Agri-Data	Data service of ag markets	
1986	(France)	Telecom services marketing firm	
1987	Sterling Software	Market check processing system	
	Kirchman	Market community bank systems	
	Fiat	Offer manufacturing computer services	Intesa
	(Italy)		Initiative Telematiche
	Copenhagen Telephone	Market telecom services	
	(France)	Data transmission service firm	Axone
1988	Supercomputer Systems	Build supercomputer	
		Promote X Window System as industry standard	MIT X Consortium
		Set DF & communication standards for financial ind.	FISO
	3 US & 5 foreign firms	Develop new Unix OS - create open system standard	Open Software Foundation
		Introduce Prodigy on-line info & mktg service	Prodigy
	Montedison (France)		Institute of Technology
1989	Siemens	Sell telecom products in U.S.	Rolm Co.
	16 U.S. firms	Coordinate U.S. HDTV development efforts	
	Intel	Use Digital Video Interactive technology to make chips	
	5 U.S. firms	Manufacture DRAM's	U.S. Memories
	MCI	Commercial link between mail services	Advanced Network & Service
	Toshiba	Market LCD's globally	

A TEN-YEAR HISTORY OF IBM JOINT VENTURES (1982-1991) *(continued)*

YEAR	JOINT VENTURE PARTNER	PURPOSE	JOINT VENTURE NAME
1989	Baxter Healthcare	Sell computer hardware to health care industry	Spectrum Healthcare Solutions
(cont.)	(Singapore)		Advanced Integrated Systems
	Toshiba	Produce color LCD's	Display Technologies
1990	Siemens	Develop new generation of computer memory chips	
	Motorola	Computer network using radio waves	ARDIS
		Market securities trading software	Sear Technologies
	Eastman Kodak	Develop improved computerized publishing system	
	Diebold	Manufacture and market automatic teller machines	
	Metaphor Comp Systems	Develop GUI/object-oriented software	Patriot Partners
	Check Consultants		Check Solutions
	(Australia)	Provide telecom services to medical sector	Health Systems Australia
	(China)	Manufacture PS/2's	Tianjin Advanced Info Prdts
	(Singapore)	Software services company	United Software Solutions
1991	Utility Graphics	GIS consulting	UGS Consulting
	British Telecom	Market telecommunications globally	
	SID (Brazil)	Manufacture microcomputers	
	Dassault Systems	Cadam/Catia design software	
	Coopers & Lybrand	Computer consulting	Meritus Consulting Services
	USSR	Develop air traffic management system	Global Air Transportation
	Micrografx	Increase capabilities of OS/2	
	Apple Computer	Develop object-oriented operating system	Taligent
	Apple Computer	Develop multimedia PC's	Kaleida
	VideoCart	Develop electronic ad system for shopping carts	
	Thinking Machines	Develop supercomputers	
	Motorola	High speed microprocessors	CDC
	Rogers Cable	Study using cable TV's fiber-optic networks	
	Intel	Develop central processing units	
	(France)	Market software/hardware service	Istec
	Dassault (France)	Market computers	DE31
	IBBI & Sainco (Spain)	Build intelligent buildings	Intelligent Building Systems
	(Italy)	Industrial automation company	San Giorgio System Tech
	(Germany)	Automated pay service	Telecash Kommunikations
	(Canada)	GIS software firm	Intera Tydac Technologies
	(Sweden)	Electronic data interchange	Tedim
	Siemens	Produce DRAM's in France	
	(Brazil)	Produce PS/2's	MCA (Brazil)
	Tata Industries (India)	Make computer hardware & software	
	(France)	Small business services	Progipart
	(Austria)	Insurer computer services	Syntegra Softwarevertrieb
	(Japan)	Design new car development software	

Adapted from Predicasts F S Index of Corporate Change: 1992 Edition

Table 1

line, or to outsource a necessary component, or even to share risks. Rather, the central purpose of an alliance should be to broaden a "core capability." That is, to strengthen the ability to harmonize streams of technology, or to enhance the organization of work and the delivery of value.

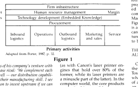
"In the short run, a company's competitiveness derives from the price/performance attributes of current products. But the survivors of the first wave of global competition, Western and Japanese alike, are all converging on similar and formidable standards for product cost and quality — minimum hurdles for continued competition, but less and less important as sources of differential advantage. In the long run, competitiveness derives from an ability to build, at lower cost and more speedily than competitors, the core competencies that spawn unanticipated *products. The real sources of advantage are to be found in management's ability to consolidate corporatewide technologies and production skills into competencies that empower individual businesses to adapt quickly to changing opportunities."* [Prahalad & Hamel, 1990, p. 81, italics added]

Japanese firms have long utilized alliances to this end, while Western companies have tended to focus on the above-mentioned short term benefits. In 1986, Clinton cabinet member Robert Reich claimed that alliances with Japanese firms were "giving away our future" [Reich & Mankin, 1986]. He lamented that, "in contrast, U.S. strategy appears dangerously shortsighted. In exchange for a few lower skilled, lower paying jobs and easy access to our competitor's high-quality, low-cost products, we are apparently prepared to sacrifice our competitiveness in a host of industries." Likewise, in the same year, D.K. Prahalad, a professor of corporate strategy at the University of Michigan, warned that "the ultimate aim of many Japanese companies in partnerships with U.S. and European firms is to extract a partner's skills and technology, then reduce the Western partner to a dependent status, or simply break away and compete against the former partner." [Beauchamp, 1986, p. 12]

Hamel, Doz and Prahalad [1989] relate the following anecdote regarding a U.S.-Japanese joint venture:

"A senior U.S. manager offered this

THE VALUE CHAIN



Primary activities

Adapted from Porter, 1987, p. 32.

Figure 1

analysis of his company's venture with a Japanese rival: 'We complement each other well — our distribution capability and their manufacturing skill. I see no reason to invest upstream if we can find a secure source of product. This is a comfortable relationship for us.' An executive from this company's Japanese partner offered a different perspective: 'When it is necessary to collaborate, I go to my employees and say, ''This is bad, I wish we had these skills ourselves. Collaboration is second best. But I will feel worse if after four years we do not know how to do what our partner knows how to do.'' We must digest their skills.' '' [p. 134, italics added]

It is lamentable that western firms that form strategic alliances so naively misgauge their purpose and impact. Clearly, IBM viewed its collaborative relationships with Microsoft and Intel as "product development" rather than "capability development" ventures. As a result, it won the battle — the development of a highly successful product, the IBM PC — but lost the war. It was complete subjugation to brash upstarts and clone makers.

Had IBM sought to internalize Bill Gates' knowledge of operating systems rather than outsource that component of its product development, it might have controlled the personal computer market as it did the market for mainframes.

The Role of Strategic Licensing

The visible expression of "invisible" core competencies are "core products" means components that have the potential to obtain a controlling share of the manufacturing market even though they might not dominate the end product market (as with Canon's laser printer engines that hold over 80% of the former, while its laser printers are a minuscle part of the latter). In the computer world, the core products are the "architectures" for key components such as the operating system, the microprocessor, the bus, the BIOS, the logic, and the applications software. According to Ferguson & Morris [1993], the "architecture creates the environment in which products compete," and "the lesson is that the big winners in computers are companies that establish long-term proprietary, general-purpose, expandable, industry-standard architectures."

Since architectures are typically embodied in physical products, they represent migratory knowledge. In addition, since they are essential to end products downstream, one would expect competitors to eventually appropriate them one way or another. As a result, firms would be well advised to manage the rate of their diffusion to the industry rather than treat them as "trade secrets." Of course, too much exposure too early may negate any "first-mover" advantages. However, "hoarding" a technology will result in the unrecoverable loss of market share and the resultant inability to control industry architectures. Apple learned the hard way that "holding cards too closely to the vest" allows competitors (i.e. IBM and subsequent clones) to establish unassailable market positions. Indeed, despite the user-friendliness of the MacIntosh computer and the fanaticism of its followers, it will never possess more than a small fraction of the market. IBM's policy of "open architecture" and Microsoft's broad licensing fomented hundreds of application programs which, in turn, convinced the market that the IBM-compatible architecture and not the Mac architecture held the future. As Figure 2 depicts, strategic licensing is a means by which core products can be diffused to other manufacturers and strengthened in their bid to become industry leaders.

THE IBM-TOSHIBA-SIEMENS ALLIANCE: A CASE IN POINT

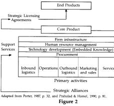
On July 13, 1992, three giants in the semiconductor industry, IBM, Toshiba, and Siemens, announced what some have called the "alliance of all alliances." They made public an arrangement uniting, in order, the world's first, second and 11th largest Dynamic Random Access Memory (DRAM) manufacturers[4] in an eight-year pact to develop and produce a 256 Megabit DRAM chip. They will utilize the latest x-ray technology to etch 0.25 micron lines on a tiny silicon surface linking approximately 600 million transistors. Development costs are estimated to be over $1 billion. Volume production will add another $3 billion to the total bill.

However, the final chip will have unprecedented capacity — enough memory to store the equivalent of two copies of everything Shakespeare ever wrote. It is hoped that the technology can be leveraged to create microprocessors with the power of today's supercomputers.

All would agree that the enormous costs associated with such a project argue for an alliance such as this. Certainly, IBM, Toshiba and Siemens could not be faulted for wishing to minimize their financial exposure in a venture of this magnitude. However, as we have seen, risk sharing has only limited strategic value, and one could dispute the claim made by Port, et al. that "astronomical costs are the reason

4. Currently, IBM does not sell its chips on the open market. However, Ferguson & Morris (1993) estimate IBM's annual DRAM production to be approximately $5 billion. According to Dataquest (as quoted by *The Economist*, July 18, 1992), the total world market for DRAM's (excluding IBM's production) is $7 billion, of which Toshiba produces 14% (i.e. $980 million) and Siemens manufactures 3.8%, (i.e. $266 million), respectively.

THE VALUE CHAIN AND COMPETENCIES



Adapted from Porter, 1987, p. 32, and Prahalad & Hamel, 1990, p. 81.

Figure 2

GROWTH IN MEMORY CAPACITY (1985-1999)

YEAR	Capacity (Megabits)	Line Width (Microns)	R&D Cost (Millions)
1985	1	1.2	$ 100
1988	4	0.8	200
1991	16	0.6	350
1995#	64	0.35	600
1999#	256	0.25	1,000

Adapted from Port, et al., 1992, p. 59.
Estimated DATA: IBM, DATAQUEST INC., BW

Table 2

such huge international alliances are sure to become the norm in the future.'' [1992, p. 59]

If cost sharing were the prime motive behind the 256 M DRAM alliance, then it would have made more sense for the joint venture to have been formed between non-competitors. Surely, IBM could have found a firm outside the semiconductor industry willing to share the risks associated with such a potentially lucrative technological advance. The fact that three rivals embraced each other rather than more benign partners would indicate that the alliance has deeper causes and farther-reaching implications than first appear.

If one looks below the surface, it is clear that neither the x-ray technology (admittedly, a state-of-the-art process), nor the 256 Megabit DRAM (a high-potential product), nor the costs associated with their development fully justify the risk each partner faces in collaborating with its competitors. Should IBM, then, be involved in such an alliance? By following the model developed in this paper (Figure 2), we shall briefly propose an answer to this question.

Are Strategic Alliances Necessary Within This Industry?

Clearly, the semiconductor and computer industries are knowledge-based arenas in which both the quantity and pace of knowledge creation is growing exponentially. It is axiomatic in these industries that each generation of DRAM only lasts about four years, and that memory capacities quadruple with each new generation. (Table 2.) R&D expenditures almost double every four years. Capital equipment has a useful life of only five years. Truly, these are industries in which strategic alliances will play an expanding role.

Will the IBM-Toshiba-Siemens Alliance Enhance IBM's Core Competencies?

The x-ray lithography technology at the heart of this alliance is owned by Motorola. Presumably, IBM had access to it apart from the alliance with Toshiba and Siemens. However, Toshiba is legendary for its advanced manufacturing methods and systems. Since IBM has been manufacturing DRAMs only for its own use, its production efficiency may be well below that of Toshiba's. As a result, IBM has much to gain from absorbing Toshiba's embedded process technologies — not only for the manufacture of DRAMs but also for microprocessors. In fact, interviews with IBM officials confirmed that they hope to learn much from Toshiba's advanced production technologies and processes.

Will the IBM-Toshiba-Siemens Alliance Create a Core Product

DRAMs themselves are ''the most ubiquitous of all chips'' [Ferguson & Morris, 1993, p. 109] and although extremely difficult to manufacture, are not a ''core product'' that will provide industry leverage. Rather, since they have well-defined, nonproprietary designs, they are very much like commodities. Developing a 256 Meg DRAM will not provide a sustainable advantage for IBM. The other Japanese firms as well as the Koreans will undoubtedly obtain the same or similar technology and soon drive down profit margins. However, if IBM combines Toshiba's superior process techniques with Motorola's laser technology to develop ''supercomputer-like'' microprocessors, it might just find itself leading the ''computer wars'' once more. Contacts within IBM confirmed their hope that technologies developed in this alliance can and will be leveraged in the production of logic and other types of memory chips.

MANAGING TECHNOLOGY IN THE "CITY-STATE" PARADIGM

Form Strategic Alliances That Are Truly Strategic

Many so-called "strategic alliances" might properly be labeled "tactical alliances." They do not bear the marks of true strategic thinking. While they may be "important," "expensive," or even "high-tech," collaborative agreements that are concerned with short-term gain, do not reflect corporate-wide, cross-functional planning, and/or focus on product development rather than the building of core capacities, are decidedly not strategic and should be avoided. Such alliances foster unbalanced dependencies, exploitation and eventual doom for unwary partners.

To ensure that alliances are truly "strategic," firms must first take inventory of all in-house technology. They must explicitly list and value all current migratory and embedded knowledge. They must possess a working knowledge of the capabilities of existing and potential competitors. Finally, they must shed the "tyranny of the strategic business unit" and develop a corporate-wide and functionally integrated strategy for developing core competencies.

To this end, it may be necessary to appoint a Chief Technology Officer who is responsible for the management of corporate technologies and capacities. At the very least, top management must take responsibility for implementing strategies (e.g. alliances, licensing agreements, etc.) in response to the following questions:

- How long could we preserve our competitiveness in this business if we did not control this particular core competence?
- How central is this core competence to perceived customer benefits?
- What future opportunities would be foreclosed if we were to lose this particular competence?
- Does the new market opportunity add to the overall goal of becoming the best player in the world?

Does it exploit or add to the core competence?

Protect Core Capabilities from Predatory Partners

After a five-year study of the inner workings of 15 international collaborative agreements, Hamel, Doz and Prahalad (1989) concluded that Western companies were too transparent in sharing information with foreign partners. They observed that westerners frequently transferred large quantities of sensitive technology to their unreciprocating counterparts. They stated that western firms often brought easy-to-imitate migratory knowledge to the table, hoping to exchange it for difficult-to-exhume embedded knowledge. However, they also asserted that Westerners "leaked" knowledge to their collaborating competitors through informal channels.

"In their excitement and pride over technical achievements, engineering staffs sometimes shared information that top management considered sensitive. Japanese engineers were less likely to share proprietary information . . . As one Japanese manager noted, 'We don't feel any need to reveal what we know. It is not an issue of pride for us. We're glad to sit and listen. If we're patient we usually learn what we want to know.' " (p. 138)

Clearly, Western firms in particular must establish guidelines to limit the unwitting dissemination of sensitive technologies. One approach would be to formally control the flow of information through detailed formal agreements and specific performance measures. However, the greater danger lies in informal leakages that may be curtailed by specifying "gatekeepers," limiting facility access, and monitoring expatriate personnel.

"When the partner houses, feeds, and looks after engineers and operating managers, there is a danger they will 'go native.' Expatriate personnel need frequent visits from headquarters as well as regular furloughs home." (Hamel, Doz, & Prahalad, 1989)

Assume a Learning Posture Within the Alliance

As already stated, the overarching purpose behind any strategic alliance should be to learn something from your collaborator that will enhance a core competency. Unfortunately, however, Western firms are not often adept at learning.

"We asked a senior executive in a Japanese electronics company about the perception that Japanese companies learn more from their foreign partners than vice versa. 'Our Western partners approach us with the attitude of teachers,' he told us. 'We are quite happy with this, because we have the attitude of students.' " (Hamel, Doz, and Prahalad, 1989)

As a result, it is imperative that Western firms encourage contact personnel to "keep their eyes open" not only for new technologies, but also for embedded knowledge that could provide insight into relative market position technological prowess. Employees who interact with partners must continually be "debriefed" for valuable pieces of information, and informed of potential ways to bolster their company's strategic position.

CONCLUSION

This research developed a model for understanding the nature of strategic alliances and strategic licensing agreements within the context of knowledge-based competition. It argued that traditional theories regarding the formation of strategic alliances do not adequately explain the phenomenon. Instead, "collaborative competition" is best explained as a natural response to the explosion of knowledge in the competitive environment. In addition, it proposed that embedded knowledge is a key source of strategic advantage, and that strategic alliances are the best tool for appropriating such knowledge. Finally, it suggested that strategic licensing agreements should be utilized to control the rate of technological diffusion and create a demand for a firm's "core product."

The author examined IBM's early experience with the development of its PC and made the point that part of the reason IBM is suffering today is because of its failure to understand the nature and purpose of collaborative agreements. As a result, IBM ceded control of two key architectural components to former partners, Microsoft and Intel. The author also evaluated the recent alliance between IBM, Toshiba and

Siemens in light of the model that had been developed within the paper, and from IBM's perspective. It was concluded that this particular alliance only makes sense if IBM looks beyond the mere production of advanced DRAM's to more advanced microprocessors and more efficient production capabilites.

In summary, it is clear that alliances will increase in both quantity and strategic importance in response to a more knowledge-intensive and competitive environment. Winners will be those firms that properly utilize collaboration to build their capacity to respond to unanticipated contingencies. Successful organizations will resemble Italian city-states with permeable borders and fluid information flows. Trust will (of necessity) replace formal contracts and nationalism will be usurped by global economic interests. It is hoped that Western firms will be able to imitate the Japanese and will learn how to maximize their advantage via collaborative competition.

REFERENCES

Badaracco, Jr., Joseph L. (1991). *The Knowledge Link: How Firms Compete Through Strategic Alliances*. Boston: Harvard Business School Press.

Beauchamp, M. (1986). Use a long spoon. *Forbes*, 138:122.

Chip diplomacy. *The Economist*, July 18, 1992, pp. 65-66.

Collins, T.M., & Doorley, III, T.L. (1991). *Teaming Up For the 90's: A Guide to International Joint Ventures and Strategic Alliances*. Homewood, IL: Business One Irwin.

Crothers, B., & Greenberg, A. (1992). IBM eyes flash storage in talks with Toshiba. *Electronics News*, June 29, 1992, pp. 1+.

Davis, D.B., & Berkman, B.N. (1990). The strategic alliance to beat all strategic alliances. *Electronic Business*, 16: 34-35, May 28, 1990.

Ferguson, C.H., & Morris, C.R. (1993). *Computer Wars: How the West Can Win in a Post-IBM World*. New York: Times Books.

Gomes-Casseres, B. (1986). Joint venture cycles: The evolution of ownership strategies of U.S. MNE's, 1945-75. In Contractor, F.K. & Lorange, P. (Eds.), *Cooperative Strategies in International Business*. Lexington, MA: Lexington Books, pp. 111-128.

Greenberg, A., Lineback, J.R. (1992). IBM, Toshiba, Siemens in 256M DRAM alliance. *Electronics News*, July 20, 1992, pp. 1+.

Gross, N., Port, O., & Brandt, R. (1991). Making deals - Without giving away the store. *Business Week*, June 17, 1991, pp. 96-98.

Hamel, G., Doz, Y.L., & Prahalad, C.K. (1989). Collaborate with your competitors - and win. *Harvard Business Review*, 67:133-6+.

Hergert, M., & Morris, D. (1986). Trends in international collaborative agreements. In Contractor, F.K. & Lorange, P. (Eds.), *Cooperative Strategies in International Business*. Lexington, MA: Lexington Books, pp. 99-109.

Lewis, J.D. (1990). *Partnerships for Profit*. New York: The Free Press.

Lyons, M.P. (1991). Joint-ventures as strategic choice - A literature review. *Long Range Planning*, 24(4): 130-144.

Magnusson, P. (1991). The new chip pact: This time it'll probably pay off. *Business Week*, June 17, 1991, p. 98.

The marriage of true minds. *The Economist*, September 19, 1992, pp. 79-80.

Peters, T.J., & Waterman, Jr., R.H. (1982). *In search of excellence*. New York: Warner Books.

Port, O., Brandt, R., Gross, N., & Levine, J.B. (1992). Talk about your dream team. *Business Week*, July 27, 1992, pp. 59-60.

Porter, M.E. (1987). Changing patterns of international competition. In D.J. Teece (Ed.), *The Competitive Challenge*. Cambridge, MA: Ballinger Publishing, pp. 27-57.

Prahalad, C.K., & Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, 68: 79-87+.

Predicasts F & S Index of Corporate Change: 1992 Edition. Cleveland, OH: Predicasts.

Reich, R.B. & Mankin, E.D. (1986). Joint ventures with Japan give away our future. *Harvard Business Review*, March-April, pp. 78-86.

Reimers, N. (1993). Management of technology in the new economy. Paper presented at the 12th International NRDO Conference in Munich, Germany.

Robertson, J. (1990). Toshiba orders Micrascan; IBM may have say on shipment. *Electronics News*, April 23, 1990, pp. 1+.

Robertson, J. (1990). Toshiba R&D facility to install Micrascan I. *Electronics News*, September 24, 1990, pp. 1+.

Schlender, B.R. (1989). Is U.S. business giving away its technology - again? Fortune, September 11, 1989, p. 10.

Toshiba, IBM to jointly build large color LCD's. *Business Japan*, 34: 50-51, December, 1989.

When multinationals marry. *The Economist*, September 19, 1992, pp. 19-20.