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Richard S. Rosenbloom*

Strategic Maneuvering and Mass-Market Dynamics: The Triumph of VHS over Beta

This article deals with the diffusion and standardization rivalry between two similar but incompatible formats for home videocassette recorders (VCRs): the Betamax, introduced in 1975 by the Sony Corporation, and the VHS (Video Home System), introduced in 1976 by the Victor Company of Japan (Japan Victor or JVC). Despite being first to the home market, the Beta format fell behind the VHS in market share during 1978 and declined thereafter. By the end of the 1980s, Sony and its partners had ceased producing Beta models. This study analyzes the history of this rivalry and examines its context—a mass consumer market with a dynamic standardization process subject to “bandwagon” effects that took years to unfold and that were largely shaped by the strategic maneuvering of the VHS producers.

This article explores the evolution of a dynamic mass market and the strategic maneuvering to establish a product standard among firms that commercialized the videocassette recorder (VCR) for household use. The VCR was only one of several consumer

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electronics products (others include televisions, radios, stereos, audio tape recorders, and miscellaneous items ranging from digital watches to calculators) whose basic technology and initial applications came from within the United States or Europe. In each case, Japanese firms mastered the essentials of consumer-oriented product design and then went on to develop superior capabilities in mass production and mass distribution. As a result, during the 1970s and 1980s Japanese industry came to dominate the global consumer electronics business. In the U.S. market, for example, of an estimated \$30 billion in sales for 1986, American firms accounted for merely 5 percent, compared to nearly 100 percent of U.S. sales in the 1950s.¹

After its first appearance in the early 1970s, the VCR surpassed color television to become the largest single consumer electronics product in terms of sales by the early 1980s. One format, the U-Matic, developed primarily by the Sony Corporation, soon emerged as the dominant design for professional and educational uses, replacing other kinds of video players and recorders. By the mid-1970s, variations of this machine embodying more integrated electronics and narrower (1/2-inch) tape resulted in two formats designed exclusively for home use: the Betamax, introduced in 1975 by Sony, and the VHS (Video Home System), introduced in 1976 by the Victor Company of Japan (Japan Victor or JVC) and then supported by JVC's parent company, Matsushita Electric, as well as the majority of other firms in Japan, the United States, and Europe.² Despite their common ancestry and technical similarities, Beta and VHS machines remained incompatible, because they used different tape-handling mechanisms and cassette sizes, as well as coding schemes for their video signals that varied just enough so that tapes were not interchangeable.

Beta was the first compact, inexpensive, reliable, and easy-to-use VCR; it accounted for the majority of VCR production during 1975–77 and enjoyed steadily increasing sales until 1985. Nonetheless, it fell behind the VHS in market share during 1978 and steadily lost share thereafter. By the end of the 1980s, Sony and its partners had ceased producing Beta models, with Sony promoting another similar but incompatible standard using a smaller

¹ Michael L. Dertouzos, Richard K. Lester, and Robert M. Solow, *Made in America: Regaining the Productivity Edge* (Cambridge, Mass., 1989), 216–18.

² Betamax is a trademark of the Sony Corporation. VHS is a trademark of the Victor Company of Japan (JVC).

(8mm) tape, primarily for home movies (see Tables 1 and 2). The outlines of this competition have been discussed before, both in English and in Japanese.³ This study examines how and why the VCR rivalry unfolded as it did.

The literatures on both management and economics contain discussions of the strategic challenges that a new large-scale industry poses to innovators and later entrants. Of importance to this story, given the particular characteristics of the VCR product and market, are the roles of first movers versus other technological pioneers and later entrants. The first movers—the first firms to commercialize a new technology—often benefit from superior technology and reputation, which they may sustain through greater experience or a head start in patenting. Being first often provides a unique opportunity to shape product definitions, forcing followers to adapt to a standard or to invest in order to differentiate their offerings.⁴ The first movers may also exploit opportunities for the early acquisition of scarce critical resources, as exotic as specialized production equipment or as mundane as retail shelf space; they can accumulate above-average profits if they enjoy a de facto monopoly position, as occurred in the early days of the industrial video recorder used by television stations (invented and commercialized by Ampex), the mainframe business computer (commercialized most successfully by IBM), and the plain-paper copier (commercialized by Xerox).⁵ Rather than to inventors, however, the largest payoffs may actually go to the firms

³ In English see, for example, James Lardner, *Fast Forward: Hollywood, the Japanese, and the VCR Wars* (New York, 1987); and P. Ranganath Nayak and John M. Kettingerham, *Breakthroughs!* (New York, 1986); in Japanese see, for example, Nihon Keizai Shimbunsha, ed., *Gekitotsu: Soni tai Matsushita: bideo ni kakeru soryokusen* [Crash! Sony versus Matsushita: the all-out war waged on video] (Tokyo, 1978); and Itami Hiroyuki, *Nihon no VTR sangyo: naze sekai o seiha dekita no ka* [Japan's VTR industry: why it was able to dominate the world] (Tokyo, 1989).

⁴ Marvin B. Lieberman and David B. Montgomery, "First-Mover Advantages," *Strategic Management Journal* 9 (1988): 41–58; and Michael A. Porter, *Competitive Advantage: Creating and Sustaining Superior Performance* (New York, 1985), 186–89.

⁵ For discussions of these cases, see Richard S. Rosenbloom and Karen J. Freeze, "Ampex Corporation and Video Innovation," in *Research on Technological Innovation, Management, and Policy*, ed. R. S. Rosenbloom (Greenwich, Conn., 1985), 2: 113–86; Franklin M. Fisher, James W. McKie, and Richard B. Mancke, *IBM and the U.S. Data Processing Industry: An Economic History* (New York, 1983); and Gary Jacobson and John Hilkirk, *Xerox: American Samurai* (New York, 1986).

Table 1
Beta-VHS Annual Production and Cumulative Shares, 1975–1988

Units: (A) = annual production in thousands of units; (B) = cumulative production in thousands of units; (C) = share of total VHS and Beta production/share of total VHS and Beta cumulative production in percent

| Year | BETA FORMAT | | | VHS FORMAT | | |
|-------------------|-------------|--------|---------|------------|---------|---------|
| | (A) | (B) | (C) | (A) | (B) | (C) |
| 1975 | 20 | 20 | 100/100 | — | — | — |
| 1976 | 175 | 195 | 61/64 | 110 | 110 | 39/36 |
| 1977 | 424 | 619 | 56/58 | 339 | 449 | 44/42 |
| 1978 | 594 | 1,213 | 40/48 | 878 | 1,327 | 60/52 |
| 1979 | 851 | 2,064 | 39/44 | 1,336 | 2,663 | 61/56 |
| 1980 | 1,489 | 3,552 | 34/39 | 2,922 | 5,585 | 66/61 |
| 1981 | 3,020 | 6,572 | 32/35 | 6,478 | 12,063 | 68/65 |
| 1982 | 3,717 | 10,289 | 28/32 | 9,417 | 21,480 | 72/68 |
| 1983 | 4,572 | 14,861 | 25/30 | 13,645 | 35,125 | 75/70 |
| 1984 | 6,042 | 20,903 | 20/26 | 23,464 | 58,589 | 80/74 |
| 1985 | 3,387 | 24,290 | 8/20 | 40,977 | 99,566 | 92/80 |
| 1986 | 1,106 | 25,396 | 4/16 | 29,553 | 129,119 | 96/84 |
| 1987 | 669 | 26,065 | 2/13 | 39,767 | 168,886 | 98/87 |
| 1988 | 148 | 26,213 | 0.3/11 | 44,761 | 213,647 | 99.7/89 |
| <i>8mm FORMAT</i> | | | | | | |
| 1984 | 10 | 10 | | | | |
| 1985 | 566 | 576 | | | | |
| 1986 | 1,051 | 1,627 | | | | |
| 1987 | 1,351 | 2,978 | | | | |
| 1988 | 1,531 | 4,509 | | | | |

Sources: For 1976–83, *Nikkei Business* (in Japanese), 27 June 1983; for 1981–83, *Nihon Keizai Shimbun* (Japan Economic Journal, in Japanese), 21 Dec. 1984; for 1975 and 1985–88, and 8mm format, JVC, Public Relations Dept.

that lead in creating the necessary systems and investments for successful mass production and mass distribution.⁶

With technologies and markets that require years to develop, being the inventor or first mover in commercialization may not be as useful as coming into the market second or third, as long as the rapid followers have comparable technical abilities, which usually result from having been among the pioneers who participated in

⁶ This definition of “first movers” is used in Alfred D. Chandler, Jr., *Scale and Scope: The Dynamics of Industrial Capitalism* (Cambridge, Mass., 1990).

Table 2
VCR Production and Format Shares, 1975–1984
(percent)

| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|-------------------|------|------|------|------|------|------|
| BETA Group | | | | | | |
| Sony | 100 | 56 | 51 | 28 | 24 | 22 |
| Others | — | 5 | 5 | 12 | 15 | 11 |
| Subtotal | 100 | 61 | 56 | 40 | 39 | 34 |
| VHS Group | | | | | | |
| Matsushita | — | 29 | 27 | 36 | 28 | 29 |
| JVC | — | 9 | 15 | 19 | 22 | 18 |
| Others | — | 1 | 2 | 5 | 11 | 19 |
| Subtotal | — | 39 | 44 | 60 | 61 | 66 |
| | 1981 | 1982 | 1983 | 1984 | ... | 1989 |
| BETA Group | | | | | | |
| Sony | 18 | 14 | 12 | 9 | | |
| Sanyo | 9 | 10 | 8 | 6 | | |
| Toshiba | 4 | 4 | 4 | 3 | | |
| Others | 1 | 1 | 2 | 2 | | |
| Subtotal | 32 | 28 | 25 | 20 | | 0 |
| VHS Group | | | | | | |
| Matsushita | 28 | 27 | 29 | 25 | | |
| JVC | 19 | 20 | 16 | 17 | | |
| Hitachi | 10 | 10 | 11 | 15 | | |
| Sharp | 7 | 7 | 9 | 9 | | |
| Mitsubishi | 3 | 3 | 3 | 4 | | |
| Sanyo | — | 3 | 4 | 5 | | |
| Others | 2 | 2 | 2 | 5 | | |
| Subtotal | 68 | 72 | 75 | 80 | | 100 |

Sources: Same as Table 2 plus Yoichi Yokomizo, "VCR Industry and Sony" (MS Thesis, MIT, Sloan School of Management, 1986).

developing the technology for commercial applications.⁷ These firms, which, along with the inventors, are also technological pioneers, may follow the first mover quickly enough to neutralize its advantages while still exploiting the benefits that come from being a leader in creating the set of complementary assets in manufacturing, marketing, and distribution needed for market domi-

⁷ Richard S. Rosenbloom and Michael A. Cusumano, "Technological Pioneering and Competitive Advantage: The Birth of the VCR Industry," *California Management Review* 1, 4 (1987): 51–76.

nance.⁸ For example, rapid followers who are also pioneers should be able to copy the best features of the first product while adding others to differentiate their offerings. They may have better information about buyer preferences after watching early consumer reactions and have more time to plan for manufacturing, distribution, licensing, or the use of complementary products and services. Follower pioneers and later entrants may also exploit investments made by the first mover, such as in solving engineering and manufacturing problems (if the solutions become public knowledge) or in educating buyers in the use of a new product (as occurred with the video recorder and the personal computer). They may benefit as well from the mistakes or inflexibility of the first mover as the market develops and the technology changes.⁹

In a mass consumer market, the time required to create a dominant standard may be so great that first-mover advantages are minimal, especially for products subject to what economists and others have termed "bandwagon" effects and "network externalities." The bandwagon effect refers to situations where early sales or licensing of a particular product lead (either accidentally or deliberately) to rising interest in that product. A momentum builds up that encourages other potential licensees, distributors, and customers to support the product that seems most likely to become the industry standard, regardless of whether it is technically superior, cheaper, or "better" in other ways than alternatives. The support for one standard over another can become especially dynamic and self-reinforcing if, for reasons apart from the main product itself (such as the need for and relative availability of a complementary product like software programs for computers or prerecorded tapes for VCRs), customers perceive value in owning the standard that becomes the most commonly available in the industry. Network externalities refer to whether or not there is a usage pattern that depends on such a complementary product, as well as to how and how much customers use it with the main product.¹⁰

⁸ David J. Teece, "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing, and Public Policy," in *The Competitive Challenge*, ed. David J. Teece (Cambridge, Mass., 1987), 185-219.

⁹ Lieberman and Montgomery, "First-Mover Advantages"; Porter, *Competitive Advantage*; and Richard N. Foster, *Innovation: The Attacker's Advantage* (New York, 1986).

¹⁰ See, for example, M. L. Katz and C. Shapiro, "Technology Adoption in the Presence of Network Externalities," *Journal of Political Economy* 94 (1986): 822-41; J. Far-

While a market is unfolding, both early and later entrants can maneuver to establish a sustainable winning position before the game is decided. Each has particular advantages and disadvantages associated with the timing of decisions and the extent of commitments. Each can affect, at least in part, whether or not support for its standard occurs and how much it continues. In the case of the VCR, the potential global market measured hundreds of millions of units. Its very scale created a window of opportunity lasting a few years, during which firms with comparable engineering and manufacturing capabilities could challenge Sony, the first mover in refining the technology for consumers as well as in making preparations to exploit the mass market. As demand grew at rates outstripping the supply capabilities of Sony or any one producer, rapid followers who were also technological pioneers stimulated the occurrence of a first bandwagon that affected the formation of alliances for production and distribution. The emergence of demand for a complementary product—prerecorded tapes (usually movies)—set off a second bandwagon in the 1980s, as retail outlets for tape rental chose to focus on stocking tapes in the format being adopted by a majority of users, even though Sony's original format still enjoyed substantial acceptance. Of particular interest to historians, economists, and students of management strategy is how the initial moves of the main rivals shaped their long-term competitive positions as well as their eventual success or failure in this market.

Inventors, Pioneers, and Standard-Setters

Magnetic video recording technology was created in the United States, but numerous European and Japanese companies competed and collaborated in the 1960s and 1970s to adapt the technology to the requirements of a mass market. Ampex Corporation, a small California company, invented a video recorder for broadcasting applications in 1956.¹¹ This came after several years of competition with Radio Corporation of America (RCA) to use mag-

rell and G. Saloner, "Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation," *American Economics Review* 76 (1986): 940-55; and W. Brian Arthur, "Positive Feedbacks in the Economy," *Scientific American*, Feb. 1990, 92-99.

¹¹ See Rosenbloom and Cusumano, "Technological Pioneering and Competitive Advantage," and Rosenbloom and Freeze, "Ampex Corporation and Video Innovation."



JVC Through the Years • The illustrations show the evolution of the VCR industry, from JVC's first helical recorder (top), through the bulky mid-1960s model often used by institutions, to the 1970s home VCR with which most consumers are familiar. (Photographs reproduced courtesy of JVC, Public Relations Department.)

netic tape (as earlier used in audio tape recorders) to record television signals, and freed the broadcast industry from a reliance on live performances or on a clumsy system of film recording. In the late 1950s, Sony, JVC, and Matsushita, as well as several other Japanese firms, began studying and improving on the \$50,000-plus Ampex machine, employing novel recording-head mechanisms and solid-state electronic circuits, as well as other product and process innovations, which allowed them to miniaturize the video recorder and to reduce its price dramatically.

Design technology for video recording had been difficult for Ampex to master but proved more difficult to protect from a select handful of companies that had made audio tape recorders and then invested in the development of video recording. Although Ampex retained control of important patents, Japanese firms challenged these in Japanese courts and also explored ways to invent around them. By the mid-1960s, several firms in Japan, along with Ampex in the United States and Philips in Europe, had accumulated considerable expertise in video recording design and manufacture.

Despite a series of products through the 1960s that did not appeal to consumers because of high prices, poor picture quality, bulky housings, and inconvenient reel-to-reel formats, the Japanese pioneers continued to improve their machines until, in 1971, Sony succeeded in designing a cassette model with 3/4 inch-wide tape. This machine, called the U-Matic, was still too large and expensive for regular home use. Nonetheless, it found a market among schools and other institutions, and it embodied the core design concepts that served as the basis for both the Beta and VHS formats.¹² In conjunction with an agreement to adopt Sony's U-Matic as a standard for institutional machines, three Japanese firms that later competed for the home video standard—Sony, Matsushita, and JVC—signed a cross-licensing agreement for video recording patents in 1970.¹³ Philips did not join this group and pursued its own distinctive VCR design.

¹² Useful discussions of the concept of a dominant design as well as "architectural" variations, which seem to describe VHS and Beta as refinements of the U-Matic, can be found in Kim B. Clark, "The Interaction of Design Hierarchies and Market Concepts in Technological Evolution," *Research Policy* 14 (1985): 235–51; and Rebecca M. Henderson and Kim B. Clark, "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms," *Administrative Science Quarterly* 35 (1990): 9–30.

¹³ Nihon Keizai Shimbunsha, ed., *Gekitotsu*; and Rosenbloom and Cusumano, "Technological Pioneering and Competitive Advantage."

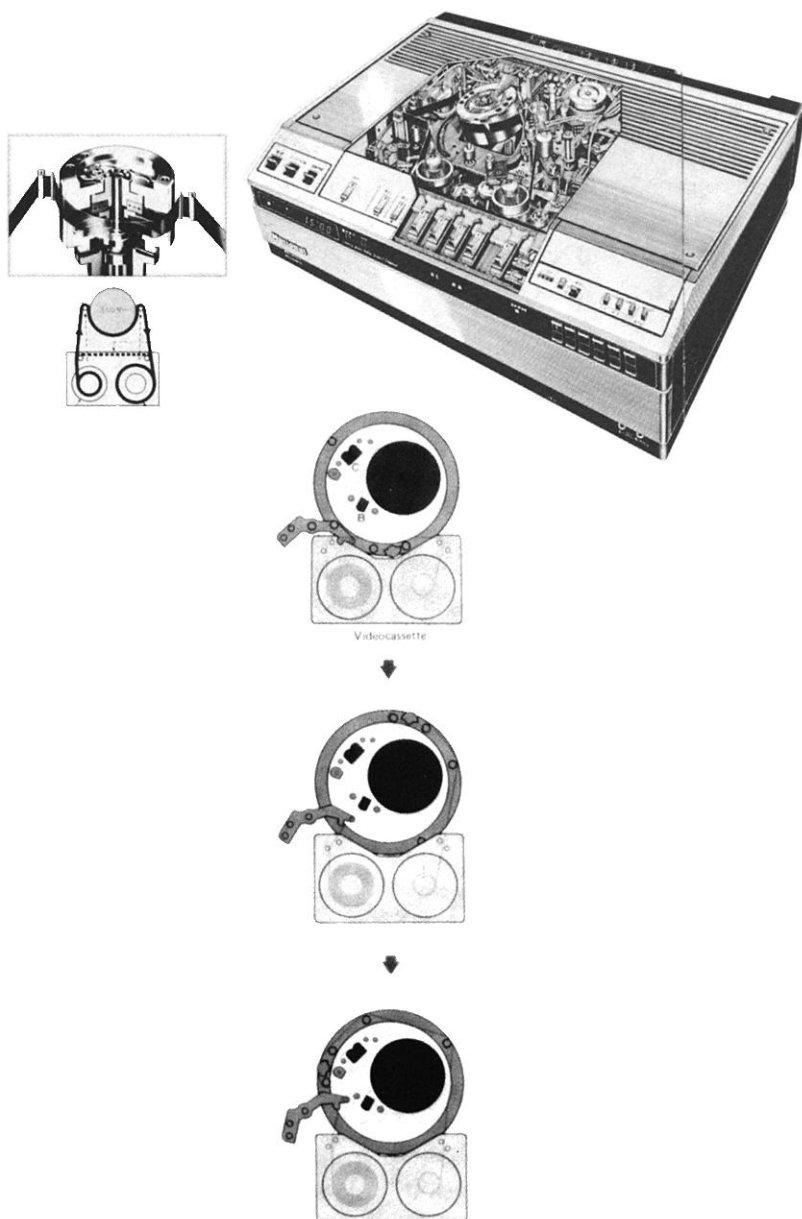
Although engineers and managers recognized that a standard format would be better for consumers and producers (who would benefit from expansion of the market), agreement on a single home video format proved impossible to reach. In fact, Sony's experience with the U-Matic had made its engineers particularly reluctant to cooperate in establishing or refining a new standard. As early as 1970, Sony had appeared ready to introduce a smaller machine that used a more sophisticated (azimuth) recording system and that might have proved popular with consumers. Since Matsushita and JVC were not yet ready to mass produce this type of machine, the U-Matic ended up as a compromise design, requiring a wide tape and a large cassette. The compromise thus forced Sony, by agreeing to support what became the industry standard for institutional machines, to miss a potential opportunity to enter even earlier into the home market.¹⁴

Utilizing nearly two decades of experience with video recorder design, engineering, and manufacturing, Sony and JVC both proceeded to develop 1/2 inch-wide tape VCRs for the home and introduced them in 1975 and 1976. Meanwhile, other companies, including Ampex, RCA, Matsushita, Toshiba, Sanyo, and Philips, introduced or experimented with alternative formats. Unlike the Sony and JVC designs, both of which resembled the effective U-Matic design, the other VCRs were based on distinctive design concepts that proved to be inferior to Beta and VHS.

In addition, just as Sony's Betamax was essentially a miniaturization of the U-Matic but with a more advanced recording technique, the VHS closely resembled the U-Matic (and thus the Betamax), even though the recording format, tape-handling mechanisms, and cassette sizes remained different. Accordingly, it proved difficult for Sony and JVC, and the firms that carried their machines, to differentiate their products through basic features. Hence, neither Beta nor VHS could gain a technological advantage in design or manufacturing that could be sustained long enough to gain a dominant market position. Sony did establish an advantage in reputation if not in actual design and manufacturing skills because of its unique history as an innovator in home video and as primary inventor of the U-Matic. As discussed later in this article,

¹⁴ Nihon Keizai Shimbunsha, ed., *Gekitotsu*; Nomura Management School, "VTR Sangyo noto" [VTR industry note] (Tokyo, 1984); and Richard S. Rosenbloom interviews with Nobutoshi Kihara and Masaaki Morita, Senior Managing Directors, Sony Corporation, July 1980.

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Matsushita NV-6000 and Betamax Tape-Loading Systems • The cut-away diagram of an early Matsushita VHS machine shows its tape-loading mechanism. Compare the inserted diagram of the VHS tape-loading mechanism (left) with the more convoluted tape path of the Sony U-type tape-loading system, illustrated below it. (Photographs reproduced courtesy of Matsushita and Sony corporations, respectively.)

however, Sony's first-mover role and strategic initiatives did not result in a sustainable advantage. Its chief competitors also had superb technical skills, and domination of the huge global market required cooperation with other firms in mass production, licensing, and distribution of both hardware and software. It was by no means certain, however, that the VHS—which came to market after Betamax and was backed by a small firm (JVC) with limited manufacturing and distribution capabilities—would prove superior in the global marketplace.

The Global Mass Market

Demand for a novel consumer-electronics product can rise rapidly as masses of new customers appear each year. In home video, for example, everyone with a television set was a potential customer. In contrast, professional video had been a very limited market. Machines for broadcast use were expensive and complex, and the number of buyers equaled the number of television stations—hundreds, not millions, in the United States, Japan, and Europe combined. As a result, one firm was able to supply most of the new and replacement demand for many years. For example, Ampex had produced approximately 75 percent of all video recorders in use worldwide in 1962, and it was able to dominate the broadcast market for two decades after its invention of the video recorder in 1956.¹⁵

The Beta and VHS models opened up a true mass market, allowing video recorders to parallel and then in the early 1980s to pass color television sets to become Japan's (and the world's) top consumer electronics product in production value.¹⁶ The vast size and worldwide structure of this new demand made it nearly impossible for any one firm to accommodate it. Annual production of home videocassette recorders in Japan exceeded one million as early as 1978, having commenced only in 1975, and continued to double each year until 1981. Japanese firms exported 53 percent of the video recorders they produced in 1977 and approximately 80 percent from 1979 onward. The top export destination was the United States during 1976–79, but European exports consumed a

¹⁵ Rosenbloom and Freeze, "Ampex Corporation and Video Innovation."

¹⁶ Katz and Shapiro, "Technology Adoption in the Presence of Network Externalities."

Table 3
Japanese VCR Exports, 1975–1983
(value in billions of yen, production in thousands of units)

| | <i>Value</i> | <i>Units</i> | <i>Export (%)</i> | <i>Exports by Region/Total Exports (%)</i> | | |
|------|--------------|--------------|-------------------|--|---------------|--------------|
| | | | | <i>N. America</i> | <i>Europe</i> | <i>Other</i> |
| 1976 | 31 | 139 | 48 | 75 | 17 | 8 |
| 1977 | 66 | 402 | 53 | 85 | 8 | 7 |
| 1978 | 126 | 973 | 73 | 60 | 28 | 12 |
| 1979 | 222 | 1,671 | 78 | 46 | 33 | 21 |
| 1980 | 444 | 3,444 | 78 | 32 | 42 | 26 |
| 1981 | 854 | 7,355 | 84 | 34 | 44 | 22 |
| 1982 | 1,080 | 10,661 | 82 | 27 | 52 | 21 |
| 1983 | 1,261 | 15,237 | 80 | 41 | 38 | 21 |

Source: Nomura Management School, "VTR Sangyo noto" [VTR industry note] (Tokyo, 1984), 43.

larger share during 1980–82, as VCR sales boomed with the increasing availability of prerecorded tapes (see Table 3).¹⁷ Europe was probably a more favorable market in which to promote the use of software than the United States because of the smaller number of television stations and available broadcast programs.

Thus, the characteristics of home video—the market's "mass" and global nature, as well as the product's technical complexity—meant that efficient mass production capacity, broad distribution channels, and clear market preferences would require years to emerge. An early mover into the market had no guarantee of a sustainable advantage from simply being first, but needed an effective strategy to capitalize on its position. The need for strategic action was especially strong because other pioneers, after observing customer reactions to the initial product offering, had the option of moving in with a comparable product, lower prices, better features, or superior distribution. In fact, Matsushita was known for competing in that manner: monitoring a broad range of technical developments and gradually building up in-house skills while waiting for Sony, JVC, or other innovative consumer-electronics firms to introduce a new product. Matsushita would then enter the market six months to a year later with a similar but lower-priced version, usually manufactured more efficiently because of Matsushita's mass production skills and willingness to

¹⁷ Arthur, "Positive Feedbacks in the Economy."

invest to achieve scale economies where they proved useful. The scale of Matsushita manufacturing reflected broad distribution guaranteed through an enormous domestic sales network, which marketed products under brand names that included Panasonic, Technics, National, and Quasar. Matsushita also could schedule large production runs because of its willingness to sell finished products to original equipment manufacturers (OEMs) in Japan and abroad for sale under their labels.¹⁸

The Argument

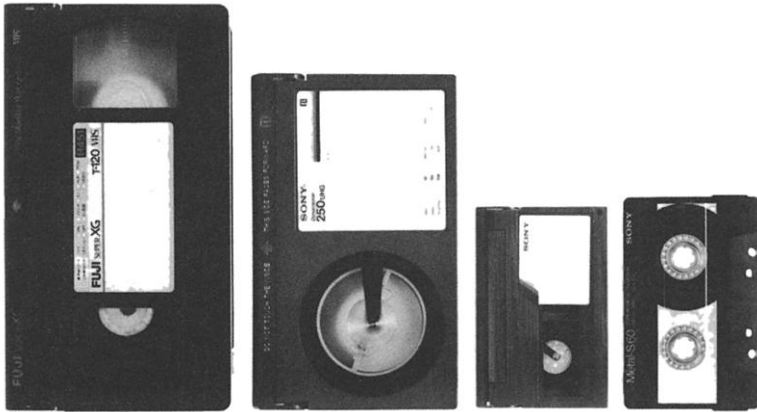
A VCR by itself is worthless. Users can employ it only in conjunction with a complementary product, the videotape cassette, that is designed to conform to the interface specification of the VCR. This is a common characteristic of contemporary information technologies, such as the personal computer (PC) and its software programs, compact disc (CD) players and discs, or TV receivers and broadcast signals. Interface standards for innovative products of this sort can be established by various means: government regulation (the Federal Communications Commission for television), formal agreement among a large number of producers of the primary product (CD players), or implicit acceptance by producers reflecting the market power of a sponsor (IBM PC).

In the case of the VCR, since no single producer or coalition was strong enough to impose a worldwide standard, and since repeated efforts to bring producers to an agreement failed, the marketplace set the standard. Furthermore, the existence of a "network externality" had two important consequences. First, given rival products of approximately equal cost and capabilities, buyers will tend to choose the one that has been chosen, or appears likely to be chosen, by a greater number of other buyers. Second, this creates a dynamic system with a "positive feedback": the perceived benefit of choosing a given standard increases as more buyers choose it, thus increasing the probability of purchase by others not yet in the marketplace. An early lead in this sort of contest, however achieved, may become self-reinforcing.

In the drama of the VCR standardization battle, there were three sets of principal players: 1) the main protagonists, Sony,

¹⁸ Nihon Keizai Shimbunsha, ed., *Gekitotsu*, 151-54.

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Cassette Size Comparison • Tape sizes shown are, from left, VHS, Beta, 8mm, and audio. The smaller Beta tape size made it more difficult for Sony to increase the recording time of its VCRs. (Photograph reproduced courtesy of the Sony Corporation.)

JVC, and Philips, sponsors of the three principal rival formats and major producers of the core product, the VCR; 2) the remaining consumer electronics producers, each of whom would adopt one of the standard formats for production and/or distribution; and 3) the producers and distributors of an important complementary product, prerecorded software.

As it played out, the crucial battle was between Beta and VHS, Sony and JVC. (Although Philips held on to a different standard in Europe for a decade, it never posed a serious challenge to the other two.) The facts are simple: Beta reached the market first, took 58 percent of the market in 1975–77, and fell behind VHS in 1978. For the next six years, sales of Beta-format VCRs increased every year, even as its share of the worldwide market fell every year. After being outsold four-to-one by VHS in 1984, Beta began a rapid decline to extinction (see Tables 1 and 2).

The figures show how quickly the VHS format turned a slight early lead in sales into a dominant position. Chance events might have produced that early lead, and, as the theory suggests, that might be enough to explain the outcome. The thesis of this article, however, is that the early lead and the eventual outcome reflect the deliberate actions of the main players. Strategic maneuvering by the principal protagonists in 1975–77 led to an alignment of producers of the core product and to the exploitation of mass production and distribution capabilities sufficient to account for the early dominance of VHS sales. In a second phase of rivalry, in the

1980s, the strategic alignment of producers of complementary products reinforced the VHS advantage and hastened the demise of Beta, which might otherwise have survived as a second format.

Emergence of the VCR Standard

A three-year period, from mid-1974 to 1977, proved decisive in determining the outcome of the standardization battle that would rage on for another decade. At the start of this period, diversity characterized the positions of the world's largest consumer electronics companies with respect to home video, a market that remained wholly speculative in 1974. VCR designs based on six different incompatible formats were in late stages of development at rival companies, and three of the majors, Hitachi, Sharp, and Zenith, had no commitments at all to home video development. By mid-1977, the pattern had changed sharply, as all ten of the biggest firms were marketing home VCRs, and the industry had divided into three "families," supporting either Sony's Beta, JVC's VHS, or the Philips format. The line-ups, and data about each firm's color TV sales and prior VCR commitments, are identified in Table 4.

Table 4
Home-Video Families and World Color TV Shares, 1976-1977

| <i>Company</i> | <i>Format</i> | <i>1974 VCR Commitments</i> | <i>1976 World Color TV Sales</i> | |
|----------------|---------------|-----------------------------|----------------------------------|------------------|
| | | | <i>Rank</i> | <i>Share (%)</i> |
| Sony | Beta | Betamax prototype | 3 | 7.4 |
| Sanyo | " | V-Code in Japan | 5 | 6.2 |
| Toshiba | " | V-Code in Japan | 6 | 5.8 |
| Zenith | " | none | 4 | 6.4 |
| Total Beta | | | | 25.8 |
| Matsushita | VHS | VX-100 prototype | 1 | 12.7 |
| Hitachi | " | none | 7 | 5.6 |
| RCA | " | Selectavision prototype | 8 | 5.2 |
| Sharp | " | none | 10 | 3.1 |
| Total VHS | | | | 26.6 |
| Philips | Philips | N-1500 in Europe | 2 | 11.5 |
| Grundig | " | N-1500 in Europe | 9 | 3.8 |
| Total Philips | | | | 15.3 |

Source: For color TV sales: Harvard Business School, "The Television Set Industry in 1979" (Boston, Mass., Case no. 9380-191, 1980).



The Philips VCR • The machine shown is an early model in the Philips VR-2000 series. Although it was technically well designed, the Philips VCR, incompatible with both the VHS and the Beta systems, lost out in the marketplace. (Photograph reproduced courtesy of the Philips Company.)

The decisive factors in the standards battle were few. First, of the six designs being developed around the world in 1974, four were significantly flawed and destined to fail. The Philips N-1500, Sanyo-Toshiba V-Code, and Matsushita VX designs were marketed vigorously yet fell short, despite the introduction of improved second-generation models in each case. RCA's VCR design never got past the prototype stage, since management abandoned the project after seeing the Betamax. Although a later Philips model, the V-2000, had many fine technical features, it proved complex and costly to manufacture and was introduced too late to capture a viable market share. Like RCA, Philips also had a video disc system under development, which distracted management attention away from the VCR; JVC and other Japanese firms also had disc systems under development but concentrated on refining and marketing their VCR machines.

Because of the common technical heritage in the U-Matic, the Beta and VHS designs were closely comparable in cost and performance. Sony had a clear lead primarily in timing; it would take JVC roughly two more years to match the stage that Sony had achieved by late 1974. But moving first was not sufficient, in itself, to win the prize in this market; how Sony moved and what its principal rivals did also mattered. In retrospect, as Akio Morita,

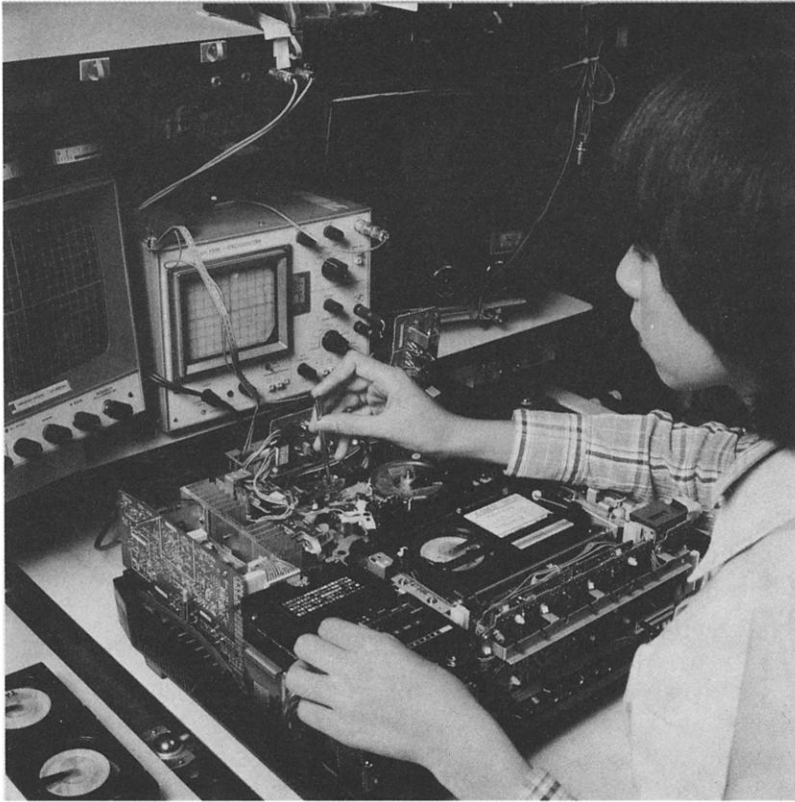
then Sony's president, later acknowledged, he and Masaru Ibuka, then chairman, made a "mistake" and "should have worked harder to get more companies together in a 'family' to support the Beta-max format."¹⁹ JVC, in the number two position, did "try harder" and was more effective at forming alliances in support of VHS.

JVC's more effective campaign to form an alliance behind VHS produced a coalition that matched the Beta family in global market power. JVC and its principal ally (and parent), Matsushita, followed that with strategic commitments that gained a decisive edge in market share for VHS, beginning in 1978. Matsushita exploited its generic skills in mass production and substantial previous experience in VCR manufacture by establishing production capacity for the VHS that exceeded the combined capacities of all other Japanese VCR producers. JVC, meanwhile, moved aggressively to bring leading European consumer electronics firms into the VHS family, almost preempting that market from Beta.

Strategic Alignment of Primary Producers

A set of assumptions that proved to be in conflict shaped Sony's strategy for commercializing the Betamax. Sony's leaders believed that the Beta design was good enough to be a winner, and they knew that they were ahead of their rivals in VCR development. But they also understood that no producer, on its own, could establish a VCR format, however good the design, as a recognized global standard. Thus, Sony set out to interest other VCR pioneers in adopting the Beta format, concentrating especially on winning the allegiance of Matsushita, its most formidable rival. But two premises hampered their ability to recruit allies. As Japan's leading developer of video technology, Sony believed that it should not have to delay commercialization of the Betamax in order to cooperate, and probably compromise, on the development of an industry standard with other firms. Sony managers and engineers felt that their earlier willingness to compromise on the U-Matic had been a competitive error. Consequently, Sony went ahead and began manufacturing preparations for the Betamax in the fall

¹⁹ Akio Morita, *Made in Japan* (New York, 1986).



Betamax in Production • This photograph shows an early Sony Betamax VCR on the assembly line at the company's Kohda factory. (Reproduced courtesy of the Sony Corporation.)

of 1974, before approaching other firms to discuss the prospect of their adopting the Sony machine as an industry standard (see Appendix A).

Furthermore, Sony was reluctant to build VCRs for its licensees. Sony had always been uniquely innovative with consumer products that incorporated advanced electronics. Its management had never before agreed to ship Sony products to other companies for distribution under their labels, preferring to build up the Sony name and reputation and to avoid sharing the benefits of Sony innovations with too many levels of distributors. For example, Sony developed and marketed Japan's first audio-tape recorder (1950), stereo audio system for broadcasting (1952), transistorized radio (1955), transistorized video-tape recorder (1958), and transis-

torized micro-television (1959), as well as unique products such as the Trinitron television, whose picture-tube technology did not follow the industry standard established by RCA.²⁰ Thus, although Sony managers realized that they would have to license the Beta format to ensure its widest distribution, they were unwilling to compromise on their standard or to help potential licensees with OEM shipments.

Sony first demonstrated the Betamax to representatives of RCA, an American video pioneer, in September 1974. At the same time, Sony began talking to JVC and Matsushita, its U-Matic partners, about "joint development" of a home video format. But Sony did not manage these relationships well. When it approached the other firms, Sony had already begun tooling up for the Betamax, signaling to prospective partners a commitment to proceed with mass production irrespective of their support. Sony thus acted as a true first mover, perhaps believing that its lead in the market would convince other firms to follow. At the same time, having begun manufacturing preparations also made Sony less flexible, because altering the design of its machine would require expensive changes in manufacturing equipment.

The 1974 discussions with RCA accomplished one of Sony's objectives by persuading RCA to kill its own VCR development program, but they also brought to light the most vulnerable aspect of the initial Beta design, its limited playing time. RCA had given two hundred of its own VCRs to U.S. customers in a market test during early 1974 and concluded that a minimum two-hour playing time was necessary for commercial success.²¹ RCA executives knew from the Betamax demonstration that their efforts to develop VCR technology had been far surpassed by the innovative Japanese, and they terminated their own program. But they decided to wait for further progress in the technology, especially for longer playing times, before making a commitment to market a particular VCR.

When Sony demonstrated the Betamax to Matsushita and JVC in December 1974, Matsushita also questioned the adequacy of a one-hour playing time.²² These negative reactions to the Betamax then convinced managers at JVC that a successful machine would have to offer at least two hours of playing time and strengthened

²⁰ Nick Lyons, *The Sony Vision* (New York, 1976).

²¹ Lardner, *Fast Forward*, 84; and *TV Digest*, 21 April 1975.

²² Nihon Keizai Shimbunsha, ed., *Gekitotsu*, 13-17.

their commitment to the VHS, whose development had always proceeded on that assumption. JVC now joined RCA and Matsushita in declining to adopt the Beta format.²³

Sony managers eventually realized that they were not in a strong bargaining position and decided to modify the Betamax for two-hour recordings. Sony postponed further licensing negotiations, losing valuable time and opportunities to continue attempts at enlisting licensees. In particular, when Hitachi, another major producer of consumer electronics products, showed an interest in July 1975 in licensing the Betamax, Sony managers refused, insisting that the Betamax was not yet perfected and thus not available for licensing.²⁴ It seems that Sony managers were still primarily interested in persuading Matsushita to adopt the Beta standard, rather than Hitachi; they knew by this time that JVC was working on a competing format, which, because of JVC's position as a Matsushita subsidiary, Matsushita was likely to support if Sony did not make a special effort to persuade them to adopt the Beta format.

Moreover, Sony sought partners who could quickly manufacture VCRs on their own rather than requiring Sony to provide complete machines. Sony chairman Akio Morita was unequivocal about this strategy, declaring early in 1976 that "Sony is not an OEM manufacturer."²⁵ In this regard, Matsushita, which had a large manufacturing capability for VCRs based on previous unsuccessful products, was a better fit than Hitachi, which had made only a few broadcast-use VCRs through a subsidiary and needed an OEM relationship before it could establish in-house production.²⁶

Sony resumed seeking partners as soon as it revised the Betamax to play for two hours. Top executives from Sony and Matsushita met again in March 1976 to discuss adopting Beta as the common standard. In July, Sony demonstrated the latest machine to Matsushita, JVC, Hitachi, Sharp, Mitsubishi, Toshiba, and Sanyo and also appealed to Japan's Ministry of International Trade and Industry (MITI) for support. MITI officials tried to negotiate a settlement and favored Sony in these discussions, since it already had a machine in the market. Toshiba and Sanyo eventually agreed

²³ Nayak and Ketteringham, *Breakthroughs!* 37–38.

²⁴ Nihon Keizai Shimbunsha, ed., *Gekitotsu*, 33–34; Lardner, *Fast Forward*, 156.

²⁵ Quoted in *TV Digest*, 16 Feb. 1976.

²⁶ Yoichi Yokomizo, "VCR Industry and Sony" (MS Thesis, MIT, Sloan School of Management, 1986), 79–80.

to back Beta, but the other firms decided to wait for the VHS, which JVC announced publicly in September 1976.²⁷

In contrast to Sony, JVC followed a strategy aimed at forming as large a group as possible, aggressively pursuing both licensing and OEM agreements, including exports.²⁸ Management first established a group of adherents in Japan who could boost JVC's manufacturing and marketing capabilities—before completing the design and its own preparations for manufacture. JVC initiated this process in the spring of 1975, shortly after Sony's initial demonstration of the Betamax, and by the end of 1976 had lined up Hitachi, Mitsubishi, and Sharp, in addition to Matsushita. JVC also proposed an OEM relationship to Matsushita, which turned it down because JVC did not have enough capacity to supply Matsushita's huge distribution network and also because Matsushita was capable of producing the VHS machine on its own within a few months.²⁹ In addition, JVC agreed to provide machines to Hitachi, whereas Sony would not; JVC began shipments to Hitachi in December 1976. In January and February 1977, JVC also began supplying VCRs to Sharp and Mitsubishi, which Hitachi had helped to recruit.³⁰

As a second step, toward the end of 1976, JVC moved to establish a footing in the U.S. market by negotiating with RCA. The U.S. company rejected this offer for an OEM relationship because of JVC's small production capacity.³¹ Yet, rather than giving up on OEM agreements outside Japan, JVC turned toward European firms, which would be satisfied with smaller quantities than RCA needed. JVC pursued these European alliances far more actively and effectively than any other VHS or Beta producer, even after establishing a large production base and gaining worldwide recognition for its brand name (see Table 5).

In addition, to entice other firms to support VHS, JVC was

²⁷ Nihon Keizai Shimbunsha, ed., *Gekitotsu*, 59–72.

²⁸ See Appendix A and Tables 5, 6, and 3; Nayak and Ketteringham, *Breakthroughs!* 42; Nomura Management School, "VTR Sangyo noto"; and "Innovations Spur Boom in VCR Sales," *The New York Times*, 11 Dec. 1984, D1.

²⁹ Nihon Keizai Shimbunsha, ed., *Gekitotsu*, 54.

³⁰ JVC committed to supplying Hitachi on an OEM basis although this entailed that a large portion of its production capacity of about 2,000–3,000 units per month would be diverted to that end. This portion would have been significantly smaller for Sony, which, at the time, had a production capacity of more than 7,000 units per month. See Nomura Management School, "VTR Sangyo noto"; and *TV Digest*, 21 April 1975 and 13 Dec. 1976.

³¹ Nayak and Ketteringham, *Breakthroughs!* 46.

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Table 5
Group Alignments (1983–1984)

Note: Suppliers indicated by initials (J = JVC, Ma = Matsushita, H = Hitachi, Mi = Mitsubishi, T = Tokyo Sanyo, S = Sony, To = Toshiba, Sa = Sanyo, P = Philips, G = Grundig)

| <i>Japan</i> | <i>U.S.</i> | <i>Europe</i> |
|--------------------|--------------------|--------------------|
| | VHS GROUP (40) | |
| JVC | Magnavox (Ma) | Blaupunkt (Ma) |
| Matsushita | Sylvania (Ma) | Zaba (J) |
| Hitachi | Curtis Mathes (Ma) | Nordmende (J) |
| Mitsubishi | J.C.Penny (Ma) | Telefunken (J) |
| Sharp | GE (Ma) | SEL (J) |
| Tokyo Sanyo | RCA (H) | Thorn-EMI (J) |
| Brother (Mi) | Sears (H) | Thomson-Brandt (J) |
| Ricoh (H) | Zenith (J)* | Granada (H) |
| Tokyo Juki (H) | | Hangard (H) |
| Canon (Ma) | | Sarolla (H) |
| Asahi Optical (H) | | Fisher (T) |
| Olympus (Ma) | | Luxer (Mi) |
| Nikon (Ma) | | |
| Akai Trio (J) | | |
| Sansui (J) | | |
| Clarion (J) | | |
| Teac (J) | | |
| Japan Columbia (H) | | |
| Funai | | |
| | BETA GROUP (12) | |
| Sony | Zenith (S)* | Kneckerman (Sa) |
| Sanyo | Sears (Sa) | Fisher (Sa) |
| Toshiba | | Rank (To) |
| NEC | | |
| General (To) | | |
| Aiwa | | |
| Pioneer (S) | | |
| | V-2000 (7) | |
| | | Philips |
| | | Grundig |
| | | Siemens (G) |
| | | ITT (G) |
| | | Loewe Opta (G) |
| | | Korting (P) |
| | | B&O (P) |

*In spring 1984, Zenith switched from the Beta group to VHS.

Source: Nomura Management School, "VTR Sangyo noto"; and JVC, Public Relations Dept.

willing to let other companies participate in refining the standard, such as moving from two hours to longer recording times or adding new features. JVC also provided considerable assistance in manufacturing and marketing.³² Yet another important difference from Sony proved to be style: JVC managers approached prospective partners in an exceedingly “polite and gentle” manner, and encouraged them to adopt as the common VCR standard “the best system we are all working on,” rather than the VHS per se.³³ One outcome of JVC’s approach was that prospective manufacturing partners truly believed they would have some stake in the future evolution of VHS features.³⁴ Allowing partners to share in development also improved the VHS in ways that JVC might not have pursued itself. For example, after JVC exhibited the VHS prototype to Matsushita in spring 1975, Matsushita provided technical feedback that sped the completion of the new VCR.³⁵ Matsushita also took the lead in increasing recording and playback time after consulting with RCA.

JVC also strengthened the position of the VHS family by moving aggressively to line up European distribution. Philips, the leader in the consumer electronics market in Europe, still commanded less than 25 percent of the market for color television in the region. With its German ally, Grundig, the number two producer, Philips was producing home VCRs based on its 1972 technology, now outmoded by the Beta and VHS innovations. Most of the other European consumer electronics firms had earlier marketed VCRs produced by Philips and Grundig, but by 1975 all of them had dropped the product. In contrast to RCA’s reaction to the Japanese innovations, Philips determined to surpass the new designs with an innovative machine, for which they launched development in 1975. Meanwhile, Philips and Grundig persisted with the old design, upgraded in 1977 to provide two-hour recordings. The Philips V-2000 reached the market in 1980 but, despite impressive technical features, it was too expensive and too late (see Table 6).

³² Michael A. Cusumano interview with Susumu Gozu, Manager, Domestic Sales Dept., Video Products Division, Victor Company of Japan, July 1989.

³³ Kokichi Matsuno, message to employees in taking over as JVC President in 1975, and Shizuo Takano, JVC’s Video Department manager, both quoted in Nayak and Ketteringham, *Breakthroughs!* 41. Susumu Gozu, in his interview with Cusumano, gave a similar account of JVC’s approach.

³⁴ Nayak and Ketteringham, *Breakthroughs!* 32–33; also, Gozu interview.

³⁵ Lardner, *Fast Forward*, 148–49.

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Table 6
VCR Sales by Country and Format (1983)

| | <i>Unit Sales (millions)</i> | <i>VHS %</i> | <i>Beta %</i> | <i>V-2000 %</i> |
|--------------|----------------------------------|------------------|-------------------|---------------------|
| USA | 4.1 | 75 | 25 | 0 |
| Japan | 3.4 | 70 | 30 | 0 |
| Britain | 2.3 | 74 | 24 | 2 |
| W. Germany | 1.5 | 60 | 20 | 20 |
| France | 0.4 | 70 | 20 | 10 |
| Italy | 0.2 | 60 | 20 | 20 |
| Above Totals | 11.9 | 72 | 25 | 3 |

Source: Nomura Management School, "VTR Sangyo noto," 5.

JVC exploited this opportunity to recruit Telefunken, Thomson, Thorn, Nordmende, and other strong European brands into the VHS family. Moving quickly with its Japanese partners, JVC had defined the technical standards for a PAL (the European color standard) VCR in 1977. JVC's readiness to supply machines on an OEM basis as well as to help firms prepare for manufacturing in Europe, plus the evident superiority of VHS over the current Philips offering, won commitments in rapid order from the remaining major European firms.³⁶

The marketing clout wielded by the rival families is worth close analysis, because all the participants understood that VCRs would be sold as adjuncts to television and audio equipment. A rough proxy for market power in that industry in the mid-1970s was a company's share of the color television receiver market. At one level, the rivals appear evenly balanced. Among the world's top ten consumer electronics companies, the VHS and Beta groups were evenly matched, each selling slightly more than one-quarter of the color sets sold in 1976 (see Table 4), whereas Philips and Grundig together accounted for less than one-sixth. But the VHS family was more successful in gaining the allegiance of smaller brands. Hence, within each of the three major geographic markets, VHS started out with a market share advantage. The VHS family—Matsushita, JVC, Hitachi, Sharp, and Mitsubishi—accounted for nearly 60 percent of color TV sales in Japan in 1976,

³⁶ Alan Cawson et al., *Hostile Brothers: Competition and Closure in the European Electronics Industry* (New York, 1990).

compared to only 37 percent for Sony, Toshiba, and Sanyo. In the U.S. market, the VHS brands, led by RCA, had a 49 percent share of color TV sales in 1976, compared to only 41 percent for Zenith, Sony, Sears, and the rest of the Beta family. And by 1978, almost all the European brands not committed to the Philips format adopted VHS, leaving Beta in a minority position.

In 1975 and 1976, all the world's leading consumer electronics producers entered the home video market. Those that had bet wrong on video development, choosing an inferior design approach, or electing not to invest at all, reversed their positions and adopted one of the three contending formats. In the course of these two years, JVC, by adroit maneuvering (and with a major boost from Matsushita), transformed the structure of the rivalry to establish a standard format for home VCRs. In mid-1975, Sony had stood out in a field of diverse contenders, including rival VCRs as well as potential alternatives such as videodisc. Its Beta design was the only format both ready for market and capable of performing at the level required for a mass market. By mid-1977, VHS could challenge it from a position of parity, both in product cost and functionality and in the market power of the VHS family.

Product Differentiation

Did the market performance of VHS result from differentiating features, price, or quality? A comparison of models introduced during 1975–85 by Sony, JVC, and Matsushita, the major home VCR producers, indicates some differences in all three dimensions (see Appendixes B, C, and D). In general, however, at no time did either format establish more than a transient advantage in features, prices, or picture quality.

For example, although Sony's initial models played for one hour and VHS machines two hours, Sony increased its machine's capacity to two hours merely five months after JVC entered the market and several months before Matsushita appeared (see Table 7). Sony offered more low-priced models until 1980, when Sanyo introduced inexpensive Beta models. Nevertheless, Matsushita quickly surpassed Sony in share once it entered the VHS market in 1977, and the VHS standard was dominant worldwide by the end of 1978. Beta and VHS offered basic models at similar prices; the VHS group included more brand names, yet Sony led in the

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Table 7
Recording-Playing Time Comparison

| <i>Year/Month</i> | <i>BETA</i> | <i>VHS</i> |
|-------------------|----------------|--------------------|
| 1975/5 | 1 hr. (Sony) | |
| 1976/10 | | 2 hr. (JVC) |
| 1977/3 | 2 hr. (Sony) | |
| 1977/10 | | 4 hr. (Matsushita) |
| 1978/10 | 3 hr. (Sony) | |
| 1979/3 | 4.5 hr. (Sony) | |
| 1979/8 | | 6 hr. (Matsushita) |
| 1979/8 | | 4 hr. (JVC) |
| 1979/12 | | 6 hr. (JVC) |
| 1982/3 | 8 hr. (Sony) | |
| 1982/9 | 5 hr. (Sony) | |

Source: Itami Hiroyuki, *Nihon no VTR sangyo: naze sekai o seiha dekita no ka* [Japan's VTR industry: why it was able to dominate the world] (Tokyo, 1989), 208; JVC, Public Relations Dept. (See Appendix C).

Note: Some of the longer playing times for Beta were achieved with thinner tape, not new machine models.

introduction of most new features even as it was losing market share to the VHS group. Between 1977 and 1983, Sony was the first company to offer wireless remote control, half-speed and one-third speed machines, multi-function machines (scan, slow, and still), high fidelity (hi-fi) sound, and a one-unit movie camera (camcorder). But, as can be seen in Table 8, Matsushita or JVC usually matched Sony's new features within a few months, and sometimes more quickly. JVC also was first with several innovations, such as slow/still functions, a portable VCR, and stereo recording (which Matsushita marketed at the same time).

Differences in picture quality are more difficult to assess, but VHS did not have a reputation as being superior to Beta, and the truth may indeed have been the opposite.³⁷ In addition, physical differences existed in the machine weights and cassette sizes, but it remains unclear how these affected the course of events, except that the smaller Beta cassette made it more difficult for Sony to increase recording or playing time simply by putting more tape into its cassettes.³⁸

³⁷ "VCRs: Coming on Strong," *Time*, 24 Dec. 1984, 48; "Selecting the First VCR—Some Questions to Keep in Mind," *The New York Times*, 18 Dec. 1983, H38; Tony Hoffman, "How to Buy a VCR," *Home Video*, April 1981, 48–55.

³⁸ Nihon Keizai Shimbunsha, ed., *Gekitotsu*; Yanagida Kunio, "VHS kaihatsu dokyumento" [Documentation of VHS development], *Shukan gendo*, May 1980; Rich-

Table 8
Special Effects Comparison (Sony and Matsushita)

| | <i>Introduction Date (Year/Month)</i> | | |
|--------------------------|---------------------------------------|-------------------|------------|
| | <i>Sony</i> | <i>Matsushita</i> | <i>JVC</i> |
| Wireless Remote | 1977/3* | 1977/6 | 1979/6 |
| 1/2-Speed Machine | 1977/3* | 1977/6 | 1979/8 |
| Slow/Still | 1979/3 | 1978/7 | 1977/12* |
| Portable VCR | 1978/9 | 1980/2 | 1978/2* |
| 1/3-Speed Machine | 1979/3* | 1979/8 | 1979/12 |
| Scan/Slow/Still | 1979/3* | 1980/6 | 1979/8 |
| Stereo Recording | 1980/7 | 1979/8* | 1979/8* |
| Hi-Fi | 1983/4* | 1983/5 | 1983/11 |
| One-Unit Camera-Recorder | 1983/7* | 1985/1 | 1984/3 |

*marks the first to introduce the feature.

Source: Yokomizo, "VCR Industry and Sony"; and Appendixes B, C, and D.

The key issue here is that Beta machines still might have survived as an alternative format used for high-quality recording of broadcast programs off the air or for home movies (the market niche Sony has exploited with 8mm camcorders). To have achieved this with Beta, Sony would have had to distinguish its VCR through special effects or features that made it especially convenient or superior to VHS in performance. Yet, as with basic features and prices, Sony was unable to differentiate Beta models for a significant length of time because of the technical skills and initiatives of JVC and Matsushita, as well as those of their partners in the VHS group.

It also seems that Matsushita was able to counter Sony in the Japanese and U.S. markets by utilizing its huge engineering and manufacturing resources to offer a product line with more combinations of features and prices. Compared to Sony, Matsushita introduced both less and more expensive VCRs between 1978 and 1981 and manufactured about twice the number of model types Sony produced during the same time period (see Appendixes B and D). Other marketing measures helped VHS firms overcome Sony's image for high quality and reliability; for example, RCA and

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Sony Camcorder • Shown above is Sony's 8mm Video CCD-V8 model, with an 8mm videocassette tape. Sony was able to exploit the market for home movies more successfully than that for VCRs. (Photograph reproduced courtesy of the Sony Corporation.)

Matsushita (which marketed Panasonic and Quasar brands in the United States) both offered an extended labor warranty for their machines.

Mass Production and Mass Distribution

By 1978, the VHS family had gained a significant edge in manufacturing capability, as well as in market power. Both the Beta and VHS machines were complex to manufacture, compared to other consumer electronics products such as radios, televisions, or audio equipment, in particular because they required high precision for machining the heads and sophisticated assembly skills for building the tape-handling mechanism and other components. The difficulty of designing and then mass-producing an inexpensive VCR kept Ampex and RCA from entering this segment of the market in the 1970s, even though both designed home VCR prototypes in

their laboratories.³⁹ Philips, in addition to difficulties with product reliability, also had to price its VCRs 20 to 30 percent higher than VHS and Beta machines.⁴⁰

Both Sony and JVC mastered the problems of mass production engineering and manufacturing, benefiting from experiences gained through earlier video recorder production. They also relied on integrated development teams for the Beta and VHS projects that brought together members with both design and operations backgrounds. JVC, which had less experience making VCRs than Sony, paid special attention to making its VCR easy to manufacture and service by creating a relatively simple, low-cost design with fewer components and assembly steps than the Betamax—characteristics that also appealed to companies wishing to license a VCR for in-house manufacturing. In contrast, although Sony had the manufacturing expertise to produce the Betamax economically, potential licensees appeared concerned over their ability to mass produce the Beta design.⁴¹

Matsushita also made low-cost production a major priority as it modified the VHS design and prepared its own plants. The company spent at least fourteen months studying manufacturing issues before formally adopting the VHS standard in January 1977. Matsushita engineers knew what problems to expect, because they had accumulated invaluable experience producing earlier VCR machines, including a cartridge model once made in a plant with 1,200 workers and a monthly capacity of 10,000 units, as well as the VX cassette model, which Matsushita had made in 1976 before switching to the VHS.⁴² Matsushita not only emphasized a reduction in parts but also invested in manufacturing automation and scheduled large production runs, anticipating that its vast distribution system would enable it to sell a great number of VCRs.⁴³ Matsushita's ability to deliver low-priced VCRs with an increasing

³⁹ Rosenbloom and Cusumano, "Technological Pioneering and Competitive Advantage"; Rosenbloom and Freeze, "Ampex Corporation and Video Innovation"; and Margaret B. W. Graham, *RCA & the VideoDisc: The Business of Research* (New York, 1986).

⁴⁰ Nomura Management School, "VTR Sangyo noto," 4.

⁴¹ Rosenbloom and Cusumano, "Technological Pioneering and Competitive Advantage"; Yanagida Kunio, "VHS kaihatsu dokyumento"; Michael A. Cusumano interview with Gozu of JVC as well as with Tak Matsumura, Assistant Director, Video Recorder Division, Matsushita Electric, July 1989.

⁴² Nihon Keizai Shimbunsha, ed., *Gekitotsu*, 21–24, 54; Lardner, *Fast Forward*, 159.

⁴³ Yokomizo, "VCR Industry and Sony," 39–40.

variety of features also helped it undercut Sony prices and win contracts to supply machines to overseas distributors—arrangements that further increased Matsushita's scale of operations and ability to justify additional investments in product development and automation.⁴⁴

Managers at Matsushita believed that the manufacturer who would dominate the world market would be the company that captured the largest share of the U.S. market, where the major VCR distributors were likely to be RCA and Zenith, the leaders in color television sales.⁴⁵ Sony moved first after developing a two-hour model by establishing a relationship with Zenith, after having been rebuffed by RCA. RCA intended to lead in the market for home video players but wanted lower-priced machines as well as a longer recording time. Meanwhile, Matsushita took a strong interest in RCA's distribution resources. These mutual interests brought RCA and Matsushita together in negotiations for an OEM agreement after discussions broke down between RCA and JVC, which did not have the manufacturing capacity to supply RCA with the volume of machines it wanted.

As RCA managers pondered which Japanese producer with which to link up, they reconsidered the issue of tape length. In February 1977, apparently to the astonishment of Matsushita executives, RCA requested a VCR that "could record a football game." This meant a recording time of at least three hours. Rather than ending the negotiations, Matsushita launched an intensive effort to double playing time from two to four hours by using the approach Sony had taken to double the playing time of its one-hour machine: halving the width of each recording track (called the track pitch) as well as slowing the recording speed. Matsushita put seventy engineers on this project alone and achieved the increase in playing time in merely two months; it then set up production capacity for 10,000 units per month within six months. By the end of March 1977, Matsushita had an agreement to supply RCA with approximately 50,000 four-hour VCRs by year's end.⁴⁶

A large part of the VHS advantage came from the sheer ability to deliver more VHS machines than Beta producers could make early on in the competition. Even in 1978, because of Matsushita's massive capacity, the VHS group accounted for approximately 66

⁴⁴ *TV Digest*, 4 April 1977.

⁴⁵ Itami, *Nihon no VTR sangyo*.

⁴⁶ Lardner, *Fast Forward*, 161–63; Nayak and Ketteringham, *Breakthroughs!* 47.

Table 9
VCR Monthly Production Capacity (1978)
(thousands of machines, average monthly capacity)

| <i>VHS Group</i> | | <i>Beta Group</i> | |
|------------------|------------|-------------------|------------|
| 100 | Matsushita | 45 | Sony |
| 20 | JVC | 10 | Toshiba |
| 6 | Hitachi | 10 | Sanyo |
| 126 | VHS Total | 65 | Beta Total |

Source: Itami, *Nihon no VTR sangyo*, 220.

percent of the total Japanese VCR production capacity of 191,000 units per month (see Table 9). Matsushita—not JVC—thus proved instrumental in winning over RCA and pushing the VCR competition toward the areas where Sony was weakest: low prices and mass distribution, as well as longer playing and recording times. JVC personnel opposed a doubling of the playing time, arguing that this constituted a “bastardization” of the VHS (that is, a compromise in picture quality), and they refrained from collaborating with Matsushita in pursuing this feature. JVC eventually built a two-speed (two- and four-hour) machine in August 1977, primarily to satisfy its OEM partners, but not until July 1979 did it introduce such a machine commercially under the JVC brand name.⁴⁷ JVC, which had about one-tenth the sales volume of Matsushita, also took six months to build a machine with four-hour play and twelve months to achieve a monthly capacity of 10,000 units.⁴⁸

Most important, the nature of competition changed as a result of Matsushita’s alliance with RCA. First, momentum clearly built up for VHS in the U.S. market, as General Electric, Sylvania, Magnavox, and Curtis Mathes scrambled to join this group in 1977, under the rationale that the format RCA supported would probably become the dominant machine in the American market.⁴⁹ U.S. distributors initially had been indifferent to the choice of standards and appeared to be waiting for clearer market signals before selecting a format. Second, because of the longer playing time, Matsushita and its distributors, and later other firms in the VHS group, were able to establish an image of the Beta machine as deficient with respect to this basic feature. Sony increased the

⁴⁷ *TV Digest*, 11 July 1979.

⁴⁸ *Ibid.*, 29 Aug. 1977.

⁴⁹ *Ibid.*, 30 May, 27 June, 7 Nov. 1977.

Betamax's playing time to three hours in October 1978, but not until March 1979, a year and a half after Matsushita introduced the four-hour VHS, did Sony introduce a 4.5-hour machine (see Table 7).

Thus, by spring 1977 Matsushita was able to plan a large-scale entry into the worldwide VCR market and to begin exploiting its skills and investments in low-cost manufacturing and mass distribution. These assets, in turn, helped RCA, which had brand recognition as well as extensive distribution channels, to offer reliable products at low prices. The effective Matsushita-RCA combination then damaged Sony's competitive position in both the U.S. and Japanese markets, not only because Sony's market share and distinctiveness declined. Shortly after RCA's announcement of a reduction in prices to undercut Sony in August 1977, Zenith demanded a renegotiation of its OEM agreement with Sony, to whom it was paying \$100 more for Beta machines than RCA paid Matsushita for VHS machines.⁵⁰ After a lag of more than two months, Sony and Zenith responded by matching RCA's prices.⁵¹ Yet these moves portended a difficult future: Sony would now play the game on terms that Matsushita and RCA had set, and play it poorly. In fact, Sony had trouble matching the prices of both Matsushita and JVC in the low end of the VCR market between 1979 and 1981 (see Fig. 1). Sanyo took over as the primary supplier of the lowest-priced Beta machines, but it did not have the range of alliances or the distribution channels to which Matsushita had access.

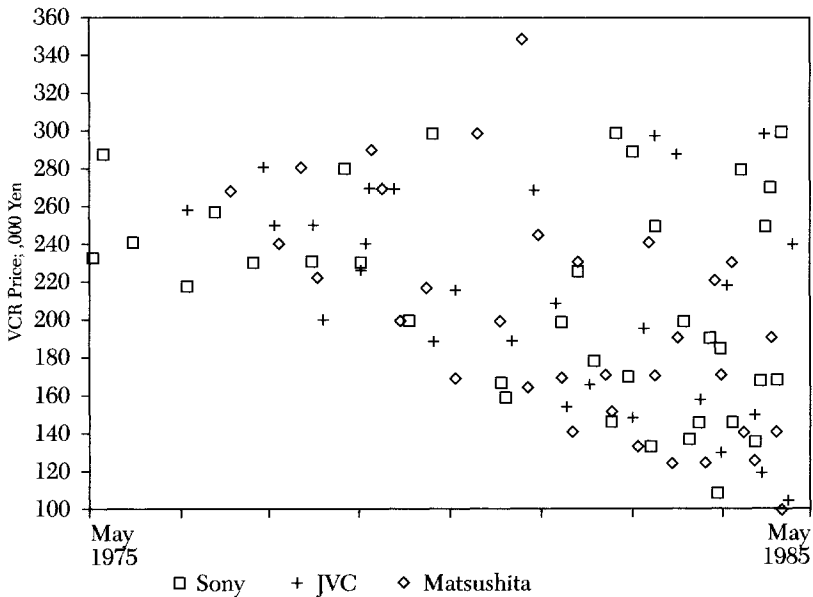
Strategic Alignment for Complementary Products

Of the three principal functions of the VCR—namely, “time-shifting” (recording broadcast programs for later viewing), making and viewing home movies, and playing prerecorded cassette programs—only in the last one did the greater availability of VHS prove to be a significant factor for consumers. Blank cassettes used for time-shifting and movies were readily available for both machines. The format did represent a potential constraint on the sharing of these tapes among households, once recorded, but such use remained small. On the other hand, users quickly perceived

⁵⁰ Ibid., 4 April 1977.

⁵¹ Ibid., 29 Aug., 3, 31 Oct., 7 Nov. 1977.

Figure 1
VCR Price Summary Comparison



Source: Appendixes B, C, D.

that prerecorded tapes were more available in VHS than in Beta, and that difference appeared very salient to users intending to rent or buy programs.

Until the early 1980s, that difference did not matter much in the marketplace. The VCR was broadly perceived to be a niche product, appealing primarily to certain demographic segments. In 1980 and 1981, with VCR ownership in only 5 to 10 percent of television households in most advanced countries, forecasts typically projected a leveling of demand at penetration levels of 15 to 30 percent in the late 1980s.⁵² Users gave little evidence of interest in prerecorded tapes. In the United States in the late 1970s, three-quarters of all VCR owners bought no prerecorded tapes.⁵³ In 1983, several years after the beginning of the tape-rental business, 40 percent of VCR owners never used such tapes and only 8

⁵² Bruce C. Klopfenstein, "Forecasting the Market for Home Video Players: A Retrospective Analysis" (Ph.D. diss., Ohio State University, 1985).

⁵³ *TV Digest*, 9 Sept., 16 Oct. 1978, 12 April 1979.

percent identified them as "important."⁵⁴ With a small installed base of players and low consumer interest, producers and distributors of programs had little incentive to invest heavily in prerecorded tapes and video rental stores.

All that changed in the mid-1980s. Confounding the forecasts, the VCR turned into a mass-market product, reaching 30 percent of American homes by 1985, five years ahead of most forecasts, and still climbing. Sales and rentals of prerecorded cassettes began to grow exponentially, doubling each year from 1982 to 1986. Although at least one leading U.S. firm concluded in 1982 that tape rentals would not be accepted by U.S. consumers and that the economics of the rental business would not support a large industry, entrepreneurs flocked to open rental stores in every neighborhood.⁵⁵

Europe stood at the leading edge of this change. VCRs began to achieve mass-market penetration in Europe earlier than elsewhere, apparently due to the availability of fewer broadcast channels there. In 1983, when penetration had reached 10 percent in the United States and 12 percent in Japan, it was 29 percent in the United Kingdom and still growing. Because TV set rental was a common practice in Britain, extended readily to VCRs, the practice of renting programs on tape was a natural adjunct. The linkages formed by JVC and Hitachi with Thorn and Granada, the leading British TV-rental operations, led those distributors to emphasize the VHS format in tape rental as well. Program producers and distributors, observing the preponderance of European brands adopting VHS, tended to emphasize it over Beta and Philips formats. One pioneer in tape production, Magnetic Video, in 1980 had three times as much capacity in Europe for VHS production as for either Beta or V-2000.⁵⁶

In the United States, aggressive steps by RCA in the late 1970s contributed significantly to the momentum behind the VHS standard, which still did not overtake Beta decisively until the mid-1980s. Because of its ambitious videodisc venture, RCA had well-developed ideas about the consumer market for recorded video programming. To promote its VCR in 1978, RCA developed an important alliance with Magnetic Video Corporation of America (MV). MV was a leader in prerecorded video (primarily used

⁵⁴ Klopfenstein, "Forecasting the Market for Home Video Players," 141.

⁵⁵ Richard S. Rosenbloom, personal interviews at RCA, 1982.

⁵⁶ *TV Digest*, 6 Oct. 1980.

then for education and training) and was the first to offer feature films on cassette. RCA supplied two MV program cassettes free with each VCR in 1978, along with a membership in the MV "club." MV, which soon found most of its growth coming in the VHS format, expanded capacity to enable it to duplicate 2.4 VHS tapes for every Beta tape. Matsushita facilitated this by developing equipment for high-speed duplication and by rapidly making low-cost decks available to MV and others. When the British firm, Granada, began opening rental shops in the United States in 1980, it offered only VHS players and cassettes.

Sony matched most of these moves, but with a lag and with less effect. In 1979 Sony linked up with Video Corporation of America (VCA), but this firm continued to promote VHS as well. Sony also proved less effective than Matsushita in supplying equipment for duplication of tapes in the Beta format. As a consequence of these and other moves, by 1980 the VHS format clearly dominated Beta in the channels for prerecorded tapes. According to one estimate, VHS then accounted for 70 to 90 percent of the revenues of cassette dealers in the United States.⁵⁷

As the mass market began to grow in subsequent years, VHS sustained and multiplied this initial advantage. The greater abundance of VHS program material gave buyers greater incentive to choose VHS players, which then led tape distributors to stock more VHS tapes, in a reinforcing pattern. By 1984, contrary to most forecasts made as recently as 1980 or 1981, the sale and rental of prerecorded tapes was a billion-dollar business in the United States, dominated by the VHS format.⁵⁸ When Zenith, the leading U.S. color TV brand, switched from Beta to VHS in 1984, the end was in sight for the Beta format.

Conclusions

The VCR story provides a classic example of the dynamics possible in a standardization contest affected by bandwagons and complementary products. The evidence cited here also shows this case to be an important illustration of how strategic maneuvering can harness the dynamic power of a special marketplace—the mass-consumer market—to make a winner out of a second mover with

⁵⁷ *Ibid.*, 8 Dec. 1980.

⁵⁸ *The Wall Street Journal*, 21 April 1986, 20D.

extensive technological skills but a weak starting position in manufacturing and distribution capabilities.

In April 1975, Sony enjoyed what looked like an insurmountable lead. Its Betamax, already on the market in Japan, was clearly superior to VCRs being offered by major rivals—Matsushita, Sanyo, Toshiba, and Philips. The company had a lustrous reputation globally as an innovator and leader in consumer electronics. JVC, a minor factor in the industry, was still struggling to perfect VHS prototypes that seemed to offer few evident technological advantages. Matsushita was struggling with its poorly received VX product. Two years later, though Beta still enjoyed a lead, JVC, supported by Matsushita, set in motion the fundamental forces that would continually erode, and then extinguish, Beta's share of a massive global market.

In retrospect, it is possible to identify the key events and to "explain" the outcome in terms of a few factors. But as events were unfolding, the implications of each strategic move must have been more difficult to discern. Each of the key protagonists acted in a way that made sense in context. Sony's behavior followed patterns that had brought it great success over two decades. JVC, the underdog, could not reasonably have been less humble or flexible in its relationships. Matsushita, along with Toshiba, Sanyo, and Philips, were actually failed first movers, since they introduced unsuccessful VCRs at nearly the same time as the Betamax. Matsushita, however, exhibited its usual mixture of caution and flexibility. Had the market grown more slowly, as nearly all observers expected, Sony might have been able to respond more effectively to its early mistakes and to the actions of its key competitors.

A few important moves made the difference. JVC created a winning alignment of VCR producers in Japan by the way its managers conducted the formation of alliances, showing versatility and humility, whereas Sony pressed commitment and reputation. The alliance with the giant Matsushita brought huge added benefits. Matsushita's management waited until VHS seemed likely to be a viable alternative to Betamax before abandoning its own VX model and then quickly switched over to the new machines, investing massively in capacity in advance of demand while pushing the product technology to meet RCA's requirements of a longer recording time. JVC completed the sweep by moving ahead of Sony to enlist a huge number of European partners behind VHS.

JVC's early success in aligning itself with Matsushita and other

Japanese producers allowed the company to gain a decisive edge in the race for distribution rights. Sony's reluctance to be an OEM supplier, and its underestimation of the threat from VHS, left Beta in a minority position for potential market power in North America and Western Europe as well as in Japan. As the theories discussed in this article suggest, once VHS took the lead, it became more and more likely that it would continue to gain share year after year. The final contest, among producers and distributors of video software, accelerated this process. Even without the growing importance of software, the outcome probably would have been the same in the long run. Nonetheless, the dominance of VHS in tape-rental channels hastened the demise of Beta and made certain it would not survive even as a second format.

Louis Pasteur said that "chance favors the prepared mind." Chance no doubt played a role in the dynamic growth of the VCR industry and the eventual success of VHS. But the alliances that JVC formed for production and distribution and the timely strategic commitments of its ally, Matsushita, proved to be the decisive factors in the triumph of VHS over Beta.

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Appendix A: VCR Industry Chronology, 1974–1978

Year/Month

- 1974/9 Sony proposes to Matsushita and JVC that they jointly adopt the Sony VCR under development, although development was largely completed and Sony already had begun setting its manufacturing dies and making other production preparations.
- Sony also shows the Betamax prototype to RCA, in the hope of persuading the U.S. firm to adopt it. (RCA subsequently abandons an attempt to develop its own VCR but rejects the Betamax because of its short 1-hour recording and playing time.)
- Toshiba and Sanyo introduce their own VCR, the V-Code I, with 30-minute and 1-hour tapes.
- /12 Sony shows the Betamax prototype to Matsushita and JVC, but still receives no commitment from them.
- 1975/4 Sony introduces the Betamax SL-6300 in Japan, priced at 229,800 yen (ca. \$800); 1-hour recording time.
- JVC announces to Matsushita that it has a competing VCR under development, the VHS.
- /7 Hitachi approaches Sony as a potential licensee of the Betamax, but is rebuffed as Sony prefers to wait for Matsushita and modify the Betamax for 2 hours.
- /9 Matsushita introduces its own VCR model, the VX-100, with 1-hour tape. JVC also completes a VHS prototype and demonstrates this to Matsushita and later to other firms.
- /12 Hitachi adopts the VHS format.
- 1976/1 JVC asks Sharp and Mitsubishi Electric to adopt the VHS format; they agree by fall 1976.
- /2 Sony introduces the Betamax (SL-7200) in the U.S.
- /3 Hitachi, acting on behalf of JVC, asks Toshiba and Sanyo to join the VHS group.
- Sony again approaches Matsushita and asks that it adopt the Betamax and Matsushita shows the VHS prototype to Sony for the first time.
- /4 Toshiba and Sanyo introduce the V-Code II with a 2-hour tape.

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- /5 Matsushita introduces the VX-2000, with a 100-minute tape.
 JVC begins manufacturing preparations for the VHS.
- /6 Sony and JVC each ask the Ministry of International
- /7 Trade and Industry (MITI) to back their standards. MITI proposes that
- /8 JVC adopt the Betamax, or that the two firms negotiate on a standard, adopt one or the other or a combination, but these suggestions fail to be accepted.
- /10 JVC introduces the VHS for commercial sale in Japan with a 2-hour tape.
- /12 Hitachi begins marketing VHS machines supplied by JVC.
- 1977/1 Sharp begins marketing VHS machines supplied by JVC.
 Matsushita publicly adopts the VHS format.
- /2 Sanyo, Toshiba, and Zenith adopt the Betamax format.
- /3 Sony introduces a 2-hour color version of the Betamax (SL-8100), although it is not compatible with the 1-hour Betamax.
 Matsushita introduces a 4-hour version of the VHS for export to RCA, Magnavox, Sylvania, GE, and Curtis.
- /4 Pioneer and Aiwa adopt the Betamax format.
- /8 Sanyo reaches an agreement with Sears-Roebuck to supply it with Betamax machines.
- /10 The VHS group settles on a European standard, followed by export agreements to several European distributors.
- /11 NEC adopts the Betamax format.
- 1978/1 Hitachi begins in-house production of the VHS
- /5 Mitsubishi begins in-house production of the VHS for export

Sources: Primarily Nihon Keizai Shimbunsha, ed., *Gekitotsu: Soni tai Matsushita: bideo ni kakeru soryokusen* [Crash! Sony versus Matsushita: the all-out war waged on video] (Tokyo, 1978) and Sony Corporation, "Table of Sony VTR History," unpublished memorandum, 16 Aug. 1977.

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Appendix B: Sony Product Schedule, 1975–1985

| <i>Name</i> | <i>Date</i> | <i>Yen Price</i> | <i>Comments</i> |
|-------------|-------------|------------------|------------------------------------|
| SL-6300 | May-75 | 229,800 | First Betamax |
| SL-7300 | Jul-75 | 285,000 | |
| SL-6301 | Feb-76 | 238,000 | |
| SL-7100 | Oct-76 | 215,000 | Price-Down/Simple Operation |
| SL-8100 | Mar-77 | 255,000 | 2-hr Recording (Both Beta I&II) |
| SL-8300 | Mar-77 | 258,000 | 2-hr Recording Only (Beta II) |
| SL-8500 | Oct-77 | 228,000 | |
| SL-3100 | Sep-78 | 229,000 | Portable |
| SL-J7 | Mar-79 | 279,000 | Multi-Function/Beta-Scan/Beta III |
| SL-J5 | Jun-79 | 229,000 | |
| SL-J1 | Mar-80 | 198,000 | Portable |
| SL-J9 | Jul-80 | 298,000 | Stereo |
| SL-F1 | Jul-81 | 165,000 | Portable |
| SL-F11 | Jul-81 | 278,000 | Wireless Remote Control/Stereo |
| SL-J10 | Aug-81 | 158,000 | Price-Down |
| SL-J30 | Jun-82 | 198,000 | Price-Down with Stereo |
| SL-J20 | Jun-82 | 137,000 | |
| SL-F7 | Sep-82 | 225,000 | Swing Search |
| SL-J25 | Dec-82 | 178,000 | |
| SL-F3 | Mar-83 | 145,000 | |
| SL-B5 | Mar-83 | 199,000 | Portable |
| SL-HF77 | Apr-83 | 299,000 | Hi-Fi |
| SL-F5 | Jun-83 | 169,000 | Micon Voice |
| BMC-100 | Jul-83 | 289,000 | Beta-Movie |
| BL-F17 | Oct-83 | 132,000 | |
| SL-HF66 | Nov-83 | 249,800 | Hi-Fi |
| SL-HF55 | Apr-84 | 198,000 | Hi-Fi |
| SL-HFR30 | May-84 | 137,000 | BetaPlus (Expandability for Hi-Fi) |
| BMC-200 | May-84 | 289,000 | Beta-Movie Auto Focus |
| SL-HFR60 | Jul-84 | 145,000 | BetaPlus |
| SL-HF300 | Sep-84 | 189,000 | Hi-Fi |
| FL-F33 | Oct-84 | 108,000 | |
| SL-HF500 | Nov-84 | 185,000 | Hi-Fi |
| SL-HF355 | Nov-84 | 198,000 | Hi-Fi |
| EV-A300 | Jan-85 | 145,000 | 8mm |
| BMC-500 | Jan-85 | 268,000 | Beta-Movie Auto Focus |
| SL-HF900 | Feb-85 | 239,800 | Pro/Hi-Band |

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| | | | |
|----------|--------|---------|-------------------------------|
| CCD-V8 | Mar-85 | 280,000 | 8mm Movie |
| SL-HFR70 | May-85 | 135,000 | Hi-Band |
| SL-HF505 | Jun-85 | 168,000 | Hi-Band |
| EV-A300 | Jun-85 | 145,000 | 8mm |
| EV-S700 | Jun-85 | 249,800 | 8mm Digital |
| BMC-600 | Jul-85 | 270,000 | Hi-Band/Beta-Movie/Auto-Focus |
| SL-HF505 | Sep-85 | 168,000 | Hi-Band |
| CCD-M8 | Sep-85 | 198,000 | 8mm Movie |
| EV-C8 | Sep-85 | 148,000 | 8mm Portable |
| CCD-V8AF | Oct-85 | 299,800 | 8mm Movie/Auto Focus |

Source: Sony Corporation, cited in Yokomizo, "VCR Industry and Sony," 83.

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Appendix C: JVC's Product Schedule, 1976–1985

| <i>Name</i> | <i>Date</i> | <i>Yen Price</i> | <i>Comments</i> |
|-------------|-------------|------------------|-------------------------------------|
| HR-3300 | Oct-76 | 256,000 | First VHS; 2-hr, 2-head |
| HR-3600 | Dec-77 | 279,000 | Slow/Still; Wired Remote |
| HR-4100 | Feb-78 | 248,000 | Portable |
| HR-3310 | Sep-78 | 248,000 | Microphone Mixing |
| HR-4000 | Nov-78 | 198,000 | VHS Player |
| HR-4110 | Jun-79 | 225,000 | Portable, Slow, Wireless Remote |
| HR-3500 | Jul-79 | 238,000 | Slow Function |
| HR-3750 | Aug-79 | 268,000 | Multi-Function/Speed, 4-head Stereo |
| HR-6700 | Dec-79 | 268,000 | Multi-Speed, 6-hrs., 2-head |
| HR-2200 | Jul-80 | 188,000 | Portable, 2-head |
| HR-6500 | Nov-80 | 215,000 | 4-head, Timer & Counter* |
| HR-7300 | Sep-81 | 188,000 | " |
| HR-7650 | Jan-82 | 268,000 | Front-Loading, Wireless Remote |
| HR-2650 | May-82 | 208,000 | |
| HR-C3 | Jul-82 | 153,000 | Compact (VHS-C) |
| HR-7500 | Nov-82 | 165,000 | Random Search Function |
| HR-7100 | Nov-82 | 139,800 | |
| HR-D120 | Jul-83 | 148,000 | |
| HR-D225 | Sep-83 | 195,000 | |
| HR-D725 | Nov-83 | 298,000 | Hi-Fi |
| HR-D220 | Nov-83 | 158,000 | One-Touch Timer |
| GR-C1 | Mar-84 | 288,000 | Compact Camcorder |
| HR-S10 | Jul-84 | 158,000 | |
| HR-D130 | Jul-84 | 138,000 | Simplified Timer |
| HR-D150 | Nov-84 | 129,800 | |
| HR-D555 | Dec-84 | 218,000 | Hi-Fi/Stereo |
| HR-D250 | May-85 | 149,800 | |
| HR-D140 | Jun-85 | 119,800 | |
| GR-C2 | Jul-85 | 299,000 | Compact Camcorder |
| HR-D565 | Aug-85 | 189,800 | Hi-Fi |
| HR-D160 | Nov-85 | 104,800 | |
| HR-D755 | Dec-85 | 239,800 | Hi-Fi, Programming Remote Control |

*Note: All subsequent models are 4-head
Source: JVC, Public Relations Dept.

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Appendix D: Matsushita Product Schedule, 1977–1985

| <i>Name</i> | <i>Date</i> | <i>Yen Price</i> | <i>Comments</i> |
|-------------|-------------|------------------|-----------------------------------|
| NV-8800 | Jun-77 | 266,000 | 2-hr/4-hr Recording |
| NV-5500 | Mar-78 | 238,000 | |
| NV-6600 | Jul-78 | 279,000 | Slow/Still |
| NV-5000 | ct-78 | 220,000 | Portable |
| NV-6000 | Aug-79 | 289,000 | 6-hr Rec/Slow/Still/Stereo |
| NV-6200 | Oct-79 | 268,000 | Stereo |
| NV-3000 | Feb-80 | 198,000 | Portable |
| NV-3500 | Jun-80 | 215,000 | Multifunction (Scan/Slow/Still) |
| NV-3300 | Nov-80 | 168,000 | |
| NV-3700 | Mar-81 | 298,000 | Wireless Remote Control/Stereo |
| NV-3200 | Jul-81 | 198,000 | Portable |
| NV-1000 | Nov-81 | 350,000 | 4-head/Clean Still/Reverse/Stereo |
| NV-700 | Nov-81 | 229,000 | 4-head/Clean Still |
| NV-310 | Dec-81 | 163,000 | |
| NV-710 | Feb-82 | 244,000 | 4-head |
| NV-100 | Feb-82 | 178,000 | Portable |
| NV-350 | Jun-82 | 169,000 | |
| NV-300 | Aug-82 | 139,800 | |
| NV-200 | Aug-82 | 163,000 | Portable |
| NV-750 | Sep-82 | 229,800 | 4-head |
| NV-600 | Feb-83 | 169,800 | 3-head |
| NV-150 | Feb-83 | 189,800 | Portable |
| NV-330 | Mar-83 | 149,800 | 3-head |
| NV-800 | May-83 | 289,800 | Hi-Fi/4-head |
| NV-370 | Aug-83 | 132,800 | 3-head |
| NV-850HD | Oct-83 | 239,800 | Hi-Fi/4-head |
| NV-630 | Nov-83 | 169,800 | |
| NV-360 | Feb-84 | 123,800 | |
| NV-180 | Mar-84 | 189,800 | Portable/4-head |
| NV-7700 | Mar-84 | 189,800 | 4-head |
| NV-270 | Aug-84 | 125,000 | 3-head |
| NV-870HD | Oct-84 | 219,800 | Hi-Fi/4-head |
| NV-650 | Nov-84 | 169,800 | 4-head |
| NV-900HD | Jan-85 | 229,800 | Hi-Fi/4-head |
| NV-M1 | Jan-85 | 298,000 | VHS-Movie |
| NV-550 | Mar-85 | 139,800 | |
| NV-260 | May-85 | 125,000 | |
| NV-880HD | Jul-85 | 189,800 | Hi-Fi/4-head |
| NV-660 | Sep-85 | 139,800 | |
| NV-U1 | Oct-85 | 100,000 | |
| NV-M3 | Oct-85 | 298,000 | VHS-Movie |

Source: Matsushita Electric, cited in Yokomizo, "VCR Industry and Sony," 84.