

MiniDisc: Successful Innovation or Just Cool Technology?

An Analysis of Sony's Decade-Long Quest for Success

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Executive Summary

The result of a successful innovation process is a commercially successful product that pays back investments in development and marketing, and eventually yields a profit for the original innovator.¹ The development and subsequent marketing of the Sony MiniDisc (MD) system provides an excellent framework in which to study this process and the factors contributing to its outcome. This report begins with a background that describes the market, industry, and technological contexts in which the MD concept was born. MD's key performance characteristics are identified and compared to a rival technology that was simultaneously introduced into the market. This is followed by a chronological tracing of Sony's effort to commercialize the MD – an effort which began in 1992 and continues to this day. The case is then analyzed in the following three contexts: 1) integration of technology and strategy, 2) design, enactment, and evolution of technology strategy, and 3) innovation challenges. The main conclusion of the analysis is that Sony's technological competencies, complementary assets, identification of emerging markets, and product reinvention efforts all contributed, over a lengthy period of time, to the eventual success of the MD format.

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Introduction

Researchers dream of making those once-in-a-lifetime breakthrough inventions that change the world and provide vast economic benefits. However, great inventions frequently do not result in great success in the marketplace. Kodak's disc cameras,² AT&T's Picturephone,³ and Sun's Voyager "nomadic workstation"⁴ are just a few of the many examples of impressive technological creations that were met with utter failure in the commercial marketplace.

Sometimes, this initial failure is followed by successful commercialization by an imitator.

Innovations such as the Computer Aided Tomography (CAT) scanner, computer mouse, cola soft drink, and pocket calculator are all examples where commercial successes were enjoyed by an imitator rather than the inventor.⁵ These cases illustrate an important difference between invention and innovation.

In contrast to *invention*, for which success is measured in *technical* terms, the degree of success in *innovation* is derived from *commercial* factors.⁶ The strength of relevant appropriability regimes, emergence of a dominant design, a firm's innovative capability, market dynamics, industry context, and the status of complementary assets all factor into the outcome of the innovation process.⁷

The development and subsequent marketing of the Sony MiniDisc (MD) system provides an excellent framework in which to study these factors and how they interact to affect the innovation process. This report begins with a background that describes the market, industry, and technological contexts in which the MD concept was born. MD's key performance

characteristics are identified and compared to a rival technology that was simultaneously introduced into the market. This is followed by a chronological tracing of Sony's effort to commercialize the MD – an effort which began in 1992 and continues to this day. With these historical facts and events established, the case is then analyzed in the following three contexts: 1) integration of technology and strategy, 2) design, enactment, and evolution of technology strategy, and 3) innovation challenges. Conclusions are drawn from this analysis, and recommendations for future strategy are made.

Background

One of Sony's best known and most successful innovations is the cassette Walkman. Launched in 1979, this innovation defined a new product category, set industry standards, and quickly became the dominant design for personal audio devices worldwide. Even during the rise of the higher-fidelity digital Compact Disc (CD), the cassette tape Walkman was still successful because it addressed a new market, and was marketed as a complement to the CD – portable, durable, and recordable. Thus, the innovation opened up crucial new markets for both Sony and its competitors,⁸ and the design was soon imitated by legions of followers.

While Sony enjoyed a huge market share for several years after the Walkman's introduction, by the mid-1980s, the leader was losing ground to low-price imitators who were beginning to add new features of their own. Sony's solution was to proliferate the Walkman by increasing the flow of model variations and prevent competitors from occupying segments exclusively.⁹ It worked: by 1990, Sony had a commanding lead in the portable cassette audio market with close to 200 model variations built around just three internal platforms.¹⁰ This

“platform approach” provided significant cost savings and maintained the Walkman’s status as an industry standard well into the 1990s.¹¹ At the same time, the market continued to grow; in 1991, when CD unit sales finally overtook cassettes,¹² over 100 million personal stereos were purchased worldwide.¹³

However, Sony realized that this “bull market” for tape-based personal audio devices would only last so long. Tape was cumbersome and in many ways already obsolete in the new world of disc technology. Furthermore, the production volume of prerecorded audio cassettes had already peaked in 1988 at 76 million units.¹⁴ What was needed were some good ideas and a willing company to market them. Sony was the perfect “guinea pig.”

Corporate Guinea Pigs

Sony Corporation’s roots lie in war-torn Japan of October 1945. Originally known as *Tsushin Kogyo Kabushiki Kaisha* (Tokyo Telecommunications Engineering Corporation), the founders’ core values emphasized innovation and “...development of dynamic technologies.”¹⁵ Even the name Sony, used first as a brand name and adopted in 1958 as the company name, was innovative. It is a blend of the Latin word *Sonus* or sound, and “Sonny,” a Japanese slang term for energetic, passionate, inventive young men.¹⁶ Although at the time it was highly unusual for a Japanese company to have a roman-letter name, it was chosen this way specifically for its value in marketing products internationally, in order to allow the company to expand globally.¹⁷

Right from the start, the leaders of the fledgling company knew the future lie in a strong corporate identity. In April 1955 for example, the company courageously refused a huge order

of 100,000 of its TR-52 “UN Building” transistor radio sets because the customer, Bulova, wanted to sell them under their own name rather than Sony’s.¹⁸

Examples of Sony’s commitment to innovation also go back to the early days. In 1960, Sony’s then-President Masaru Ibuka was awarded the Medal of Honor from the Emperor of Japan, and Sony employees honored him with a guinea pig statue. Strange as it sounds, it was an inside joke that Ibuka was actually quite proud of. Originally, “corporate guinea pig” appeared in the Japanese press as describing how Sony had pioneered transistor production but then lost the lead to imitators like Toshiba. Offended at first, Ibuka eventually used the label to Sony’s advantage, proclaiming “...those who simply do the same work over and over in the same way will gradually fall behind the times...There are countless industries that can be built up from scratch...by taking the guinea pig approach to products...”¹⁹

This commitment to rapid, aggressive innovation and brand identity has paid off for Sony. Today, Sony is a corporate giant, with annual sales and operating revenue of \$72.1 billion. Its commitment to innovation is demonstrated by healthy, rising levels of R&D, shown as a percentage of sales in Figure 1, as well as its almost routine ranking among top R&D spenders²⁰ and high on “innovation indexes.”²¹ Sony’s corporate identity is aptly described by its theme phrase “Like No Other.” In the 1990 Landor Associates’ Global ImagePower® survey, Sony ranked first in terms of esteem, fourth in name recognition, and second overall, impressively beating out seasoned contenders such as Mercedes-Benz (ranked 3rd overall), Disney (5th), IBM (9th), Rolls Royce (11th), and Porsche (19th).²² Subsequent Landor surveys have consistently ranked Sony at the top of the brand world.²³

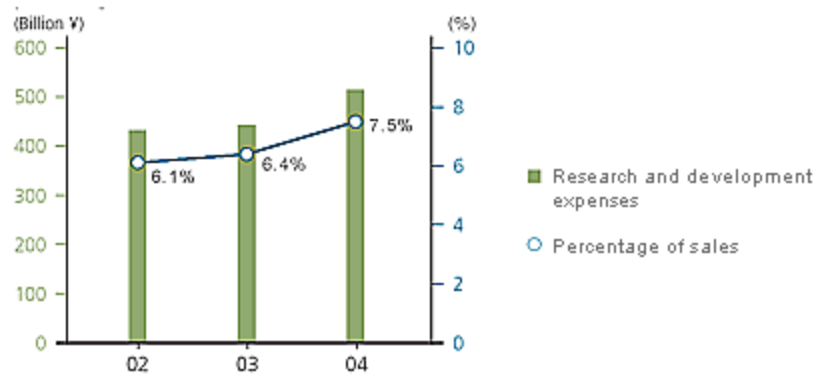


Figure 1. Sony Research and Development Expenses as a Percentage of Sales, 2002-2004.²⁴

The Age of Recordable Digital Media

This commitment to continuous innovation had Sony working on improvements to the CD even before the format had fully taken hold. In the early 1980s, the Audio Development Group (ADG) of Sony began working on recordable media technologies. The goal of this work was to find alternatives to the read-only CD. By 1986, numerous competing technologies were being developed in parallel by four separate groups within ADG. Along the way, these groups generated numerous important advances in the field of digital audio, including Digital Audio Tape (DAT) and a prototype recordable CD player,²⁵ which was demonstrated to Sony President Norio Ohga at the 1989 Audio Fair.²⁶

With ADG's successes in the field, it was apparent to Ohga that practical, affordable digital audio recording products would soon become a reality. Impressed with the 1989 recordable CD demonstration, and worried about the peaking of cassette technology, Ohga tasked ADG with "...developing a recording and playback device that uses a disc smaller than

the CD to replace the audio compact cassette.”²⁷ He imposed an extremely ambitious deadline of November 1992, the ten year anniversary of the CD.²⁸

Going It Alone

Sony and Philips Electronics, having cooperated ten years earlier to launch the CD as a replacement for vinyl long play (LP) albums, immediately began discussing strategy and technology options. While this earlier alliance had been very successful and eventually led to the demise of the LP, each company now had very different ideas about how to eliminate the analog cassette. Philips’ solution was tape-based, while Sony had been energized by Ohga’s vision of a small disc and saw an opportunity to use their established magneto-optical (MO) disc technology. While both approaches offered digital-quality sound, the technologies involved – in fact the very medium and their operating characteristics – were vastly different. Perhaps even more contrasting than the technologies involved were the firms’ basic strategies and conclusions about the market: Philips saw only opportunities for evolution, while Sony was hoping to start a revolution.^{29,30}

In defending its evolutionary approach, Philips argued that analog cassettes were too pervasive for an outright replacement technology to be successful. By 1992, over 2.5 billion prerecorded and blank tapes were being sold each year,³¹ and one billion cassette players were in use worldwide.³² With this level of market acceptance for analog tape, they reasoned that the consumer, entrenched in tape and suspicious of new formats as a result of the 8-track and Betamax flops, would not accept anything that wasn’t backwards compatible. In disagreement, Sony insisted that consumers, now becoming familiar with CDs and the many advantages of

disc-based technology, were beginning to tire of the inherent limitations and linear access of tape and were ready for a change. Sony cited the CD's incompatibility with LPs as an example of how consumers will change formats when there is a clear advantage and an assurance of industry support.

Agreeing to Disagree

While both firms readily agreed it was time to replace the analog cassette tape, they were far apart on exactly how to do so. Although this fundamental difference led to an impasse, neither side was solidly confident about its analysis of the market. Each company went its own way, but only after establishing reciprocal licenses to manufacture each other's hardware – just in case.^{33,34} Philips went on to develop the magnetic tape-based Digital Compact Cassette (DCC) system that was backwards compatible with analog cassettes. The system was capable of playing prerecorded analog and digital cassettes, as well as recording from analog or digital sources onto digital cassettes. Philips used a well-understood compression scheme based on MPEG-1 layer 1 (Precision Adaptive Subband Coding – PASC) that resulted in unperceivable differences in sound quality compared to CDs.³⁵

Sony created the MiniDisc system based on re-recordable MO discs one-fourth the size of conventional CDs. As with DCC, the system could record from both digital and analog sources, and play back pre-recorded discs. However, no backwards compatibility was possible with the new format, and the playback fidelity was termed “near-CD quality.” This was mostly due to the relative immaturity of the proprietary compression algorithm chosen for MD (Adaptive Transform Acoustic Coding – ATRAC).³⁶

A more complete description/comparison of the DCC and MiniDisc systems is found in

Table 1.

Table 1. Comparison of DCC and MD Formats, circa 1992.

	Digital Compact Cassette	MiniDisc
Introduced	November 1992	December 1992
Inventor	Philips Electronics	Sony Corporation
Hardware Licensees	Matsushita (Technics/Panasonic), Tandy, Sony	Sharp, Sanyo, Kenwood, Matsushita, JVC, Philips, Aiwa, Pioneer, Onkyo, Denon, Clarion
Technology	Magnetic Tape	Magneto-Optical Disc
Recording Media Length	90 minutes	74 minutes
Media Size	2.5"x4" cassette	2.5"x2.5" sheathed disc
Random Access to Tracks?	No	Yes
Recordings Editable?	No	Yes
Software Industry Backing?	Extensive	Limited (one record company)
Backwards Compatibility?	Yes, analog cassette playback	None
Compression?	Yes; lossy 4:1 Precision Adaptive Sub-band Coding (PASC) compression technique.	Yes; lossy 5:1 Adaptive Transform Acoustic Coding (ATRAC) compression technique.
Quality relative to CD	Excellent; inaudible differences	Fair; significant audible degradation ⁺
Hardware Cost at Debut	\$850 (home deck)	\$650 (portable unit)
Media Cost at Debut	\$10 blank; \$16 pre-recorded	\$15 blank; \$15 pre-recorded

The Development Race

In order to meet Ohga's November 1992 deadline for release of the MD, Sony immediately created an MD group that would bring together the necessary complementary assets. Since it was already 1990, there was no time for acquisition or lengthy development of

⁺ Since ATRAC was an entirely new compression scheme that Sony had no experience with, the initial version caused significant audible degradation in sound quality, even in a first generation recording. Subsequent improvements greatly improved sound quality, to the point where differences between the source and recording were inaudible.

new technologies.³⁷ Not only was Ohga going to push the group hard to meet his deadline, but Philips was also racing to beat Sony to market with the DCC. Sony's channel strategy thus was one whereby all complementary assets were internalized for innovation as depicted in Figure 2.³⁸



Figure 2. Sony Internalized Complementary Assets for MD Innovation.

President Ohga bestowed “corporate status” on the MD project, at the time something which had only been done for Betamax, 8mm cameras, and the CD player. This high level support enabled Sony to quickly bring together existing complementary assets and technologies for rapid innovation. For example, while improvements were needed in order to adapt Sony’s existing CD-MO technology to MD, the basic technology foundation, including the necessary complementary assets such as manufacturing, testing, and materials were all present. Pure optical pickup and disc technology, necessary for the planned pre-recorded MD catalog, was taken straight from Sony’s CD player experience. Shock resistance was achieved by using a memory buffer technique already in development for portable CD players. Core performance and miniaturization requirements were readily met by using monolithic microwave integrated circuit (MMIC) and heterointerface field effect transistor (HIFET) technology from a Car Navigation System project. Finally, production line capability was accelerated by bypassing the prototyping phase, a move possible only because of the tight integration between Sony’s development and manufacturing complementary assets.³⁹

Throughout the innovation process, Sony’s patent office worked closely with the MD group in order to achieve a tight appropriability regime for MD. This allowed the promotion department to safely begin licensing negotiations with potential hardware and software manufactures early on. By the time MD hit the market, there were already 64 licensing agreements in place, 32 for hardware, 18 for software (pre-recorded music), and 14 for blank media.⁴⁰ The promotion department also conducted extensive market surveys in order to understand consumer perception, attitudes toward MD with respect to CD, and importantly, the

awareness of MD versus DCC. This information was used to fine tune the initial marketing messages that would accompany the launch of MD.

The MiniDisc Marketing Saga

Both DCC and MD units began to appear in stores in late 1992. DCC was launched worldwide with a massive advertising campaign⁴¹ in November, slightly ahead of Sony's MD. At its debut, only full-size home recording deck units were available, with portable DCC units launched several months later.⁴² Philips-manufactured DCC decks, as well as those manufactured by its licensee Matsushita, initially cost about \$850. All but one record company backed the format (the one owned by Sony of course – CBS), and over 500 DCC titles were available by year's end.^{43,44} Philips' advertising message was confident and clear: a CD-quality replacement for analog cassette recorders that can also play old analog tapes.⁴⁵

MD equipment appeared in stores in Japan in November 1992, and began to slowly filter into retailers in the US and Europe in December. In contrast with DCC, MD arrived slowly and with less fanfare. In fact, most of Sony's 1992 Christmas season advertising focused on its portable "Discman" CD players rather than the MD. Still, 200 prerecorded titles were available in the US in early December,⁴⁶ expanding to over 300 by the start of the New Year.⁴⁷ All of these pre-recorded titles were produced by the Sony-owned label CBS, the sole record company supporter of MD. Only portable units, priced at around \$650, were available initially. Home decks were not planned in the initial Sony strategy, but did eventually appear.

A War of Words

Once both formats were available to consumers, the much-anticipated digital format war ended up being mostly a war of words. Initial press coverage and industry outlooks favored DCC due to its superior quality, backwards compatibility, and support from the record industry. Consumers however, adopted a wait-and-see attitude, taking the sidelines to wait for a victor to emerge.^{48,49} Because of this, both companies experienced sluggish sales, especially in the US. Nonetheless, Sony aggressively touted its optimism with public statements claiming to have shipped over three million players in the first nine months, expectations of reaching ten million by 1995, and the increased availability of pre-recorded titles. Not surprisingly, Philips downplayed Sony's optimism. Curiously however, Philips also downplayed DCC, stating in late 1993 that both formats had only begun to be accepted by "hi-fi and gadget freaks."⁵⁰

A Victor Emerges?

In reality, Philips' conservative announcements were probably closer to reality. Nevertheless, it was the MiniDisc system that began to gain momentum, especially in Japan and Europe. Whether real or as a result of Sony propaganda, by the third quarter of 1993 press coverage of the two formats had begun to favor MD.^{51,52} In the first twelve months, about 50,000 MD units were sold in the U.S. compared with an estimated 30,000 DCCs.⁵³ MD also gained record company support as it picked up momentum. In September 1993, there were 1,200 pre-recorded MD titles, of which about 450 were offered by record companies independent of Sony. Also, Sony introduced a new model lineup in September 1993 that was 40% smaller

and 45% lighter than the first generation models, and included an improved audio compression algorithm.⁵⁴

Consumers however remained languid. Sony, anxious to tout the format's acceptance by the record industry, emphasized the availability of a growing pre-recorded catalog. In April 1994, a US "re-launch" was undertaken. This advertising campaign was squarely aimed at DCC, and marked the debut of home recording decks as well as a new round of portable and auto units. Prices dropped as Sony began to reduce the costs and accelerate new model releases using the platform approach it had pioneered with the Walkman.

Meanwhile, Philips was struggling to keep DCC afloat. With the popular press beginning to predict its demise, consumers became wary. Prices remained high and Philips was unable to achieve economies of scale. Furthermore, Philips was having trouble with the manufacture of the dual-mode heads necessary for backward compatibility with analog tape. While the MD's radical new form, fit and function prevented it from being directly compared to cheap, commodity cassette players, Philips was up against "competition" from analog cassette units costing 10 to 20 times less.⁵⁵ DCC never became profitable for Philips and in 1996, the company officially discontinued the format.

A Rocky Road

Even with DCC out of the way, Sony had a tough sell with consumers. Separate marketing pushes in 1995,⁵⁶ 1996,⁵⁷ 1997,⁵⁸ and 1998⁵⁹ resulted in only a frustrating continuation of lumbering sales activity. Over this period, Sony continued to innovate, making significant

improvements in the areas of battery life, miniaturization, recording capacity, and sound quality. Unfortunately, as a result of the limitations of the first generation units, especially in the area of sound quality, MD still carried a stigma of having noticeably lower quality than the CD. After seven years in the market, analysts described MD's growth as "slow" with a mere one million cumulative units sold in the US during that time.⁶⁰ In addition, competition from new solid state "MP3" players was beginning to be felt. To make matters worse, Sony was publicly talking about introducing their own line of MP3 players based on their solid state "MemoryStick" technology, and continued to proliferate the Discman portable CD player to nearly commodity levels. To many consumers and analysts, it appeared as though Sony had lost its focus in digital music and might be positioning to abandon the MD format. By 2000, industry analysts were calling the format a failure, equating it to Betamax, 8-track, and (ironically) DCC. The general opinion was that MD, like the tape it was designed to supplant, was part of an antiquated "home stereo" paradigm. Digital music on the other hand was converging with the computer.⁶¹ Therefore, the thinking went, viable digital audio devices must be part of the "home computer" paradigm. It looked as though the only advantage of MD was the cost of media; blank discs now cost only about \$2 while comparably sized solid state media cost over \$100.

A Positive Side?

In spite of the industry's negative attitudes toward MD, there were some positive signs that the format might catch on. First, with each successive marketing push, Sony moved closer to positioning the format purely as a blank medium. By 1998, pre-recorded titles were vanishing from stores but sales of blank discs were rising. Hardware costs were dropping significantly as

Sony further exploited the platform approach and matured its manufacturing capability for key components. Meanwhile, MD was already an unqualified success in Japan where it represented a whopping 50% of all blank audio media sales revenues.⁶² In the US, MD had developed a growing devoted “techie” following that maintained active Internet support portals,^{63,64} and several profitable MD importers appeared.^{65,66}

An Unlikely Savior

In 1998, an obscure Australian company, Xitel, was selling sound cards with digital optical outputs for high-end PC gamers who wanted 3-D surround sound. But the firm noticed that as MP3 popularity picked up in the US, they were selling more of their cards to MD devotees. What MD fans had discovered was that the optical output on Xitel’s sound card could be easily connected to the optical input on all MD recorders, allowing for real-time all-digital transfer of MP3s to MD. The company responded in 1999 by selling “MD-Port,” a simplified and lower cost product specifically designed for MD.⁶⁷ Amazingly, this accidental innovation was credited with tripling MD sales in North America during the first half of 2000, compared with the same period in 1999.⁶⁸ By February 2001, MD had become the number one top selling portable digital music player on the market.⁶⁹ Sony quickly realized the opportunity and worked out a deal with Xitel to immediately add the connector to its retail packages. By July 2001, MD units accounted for about 40% of the portable digital audio players sold in the US and Xitel was selling 100,000 MD-Ports per month. The rise of computer-centric MP3 music formats, at first seen as a mortal threat, had actually saved MD from extinction.

MD Comes of Age (Finally!)

With the new computer-based hope for MD, Sony quickly and fully embraced compatibility with PC standards and on-line formats. Sony changed its marketing pitch and targeted the “Gen Y” students who were responsible for the Napster and MP3 craze.⁷⁰ A new generation of MD hardware, known as “NetMD” was on the shelves in December 2001. NetMD added a Universal Serial Bus (USB) interface to the recorder, and included software for fast direct transfer of MP3, Windows Media Audio (WMA), and WAV format audio files from the PC to MD. Because of copyright issues, NetMD imposed several restrictions on PC-to-MD transfers and disallowed MD-to-PC transfers entirely.⁷¹ Market reception was warm and NetMD was suddenly a late contender in the latest music format war between small-but-pricey MP3 players and portable CD players.

In 2004, Sony completely reinvented MD with the launch of the Hi-MD system. Hi-MD quintupled the storage capacity of standard MD media to 1GB by reducing the size of the disc’s magnetic domains. Backward playback compatibility with older media is maintained through the use of Domain Wall Displacement Detection (DWDD), an innovative technique patented by Sony. DWDD allows longer-wavelength playback lasers, like those used in earlier units, to also play the new higher-density media.⁷² In addition to added storage capacity, Sony further enhanced PC connectivity with new transfer software, bi-directional transfer capabilities, high-speed (up to 100X) transfer rates, advanced track management software, and an on-line store that sells music downloads for MD in ATRAC format. Using its 12 years of experience with the MD

platform, Sony has evolved MD to the point where it is now positioned as a low-cost alternative to Apple's iPod.

Analysis

The story of the MD, from President Ohga's initial vision to Sony's latest Hi-MD strategy, includes a number of interesting and unique aspects. When analyzed using today's tools and understanding of global strategic management of technology and innovation, the result is a number of valuable insights into the science of managing technological innovation, new product development, and evolution of technology products in a dynamic global environment.

In this section, the MD case is analyzed within the following high level contexts: 1) integration of technology and strategy, 2) design, enactment, and evolution of technology strategy, and 3) innovation challenges. For each, a number of assertions are made followed by a brief supporting discussion.

Integrating Technology and Strategy

- *A "Porterian" Strategy Allowed Sony to Leap from Cassette to MD*

According to Porter, "competitive strategy is about being different," not about operational effectiveness.⁷³ It's clear that Sony understood this difference when it decided to develop the MD even while it was the market leader in the cassette Walkman market. Ohga realized that merely positioning and further proliferating the Walkman line would only be viable for a limited time. In Porter's framework for technology and competitive strategy, this would lead to a no-win race to achieve overall or focused differentiation by applying incremental

product technological change.⁷⁴ Unfortunately, when the next big technological innovation came along, the entire market could suddenly be eliminated and Sony would be relegated to imitator status at best.

It's rare for Japanese companies to have strategy as defined by Porter. Sony is an exception, and the reasons go all the way back to the company's origins. As explained in this report, Sony was founded on innovation and its unique attitude and values enabled it to grow and expand globally at fantastic rates using the "guinea pig" approach. These core values have thrived over the years and are clearly evident in this case.

- *Sony Used the Walkman Dominant Design to Make MD Players Seem Immediately Familiar*

Sony is responsible for creating the portable audio market in 1979 with the introduction of its Walkman player. Using this well-established industry standard, Sony Engineering created an MD player that leveraged the familiarity of this dominant design. This approach allowed Sony to accelerate past the pre-paradigmatic stage of product development as defined in the Abernathy-Utterback framework.⁷⁵ By hastening the emergence of a dominant design for the MD player, Sony was able to quickly shift its focus from design to cost, while continuing to innovate at lower levels in the design hierarchy.

- *Aggressive Patenting Helped Sony Control Imitators and Refine its MD Hardware Design*

As explained by Teece, in a tight appropriability regime every imitator has an ongoing dependence on the innovator. Since the MD Group was created with a close coupling to Sony's Patent Office, by the time MD was announced, enough patents were in place to thwart imitation.

In addition, the tight appropriability regime created by the Patent Office allowed Sony to refine the MD hardware design at least once before licensees' products appeared.⁷⁶ This enabled Sony to establish its reputation as "the MD Company" early on in the format's rollout. This image is strong even 12 years later with more than ten other manufacturers of MD equipment. Recent surveys have confirmed this.⁷⁷

- *Having all Complementary Assets Under Common Ownership Allowed Sony to "Out-Innovate" Philips and Still Match DCC's Launch Date*

Bringing together Sony's vast capabilities in R&D, manufacturing, marketing, software (record company), and technology was paramount to meeting Ohga's launch deadline and competing with Philips. Not only was the MD Group able to accomplish this, but the resulting product was far more advanced than anything else available at the time. By selecting existing technologies and capabilities, and combining them in innovative ways, Sony was able to rapidly develop the MD platform. Development costs were also greatly reduced, giving Sony a much stronger platform at launch time than Philips. Having all complementary assets available internally enabled this unique technology fusion. A few years later, Sony repeated this feat with the 1995 PlayStation, resulting in immediate and profitable success as a newcomer in the home video game market.⁷⁸

- *The MD Group's Role as an Integrator Rather than a Business Unit Enabled Innovative Technology Integration*

When President Ohga defined the MD project as a corporate endeavor, he was pioneering a shift in corporate thinking only later articulated in the literature by Prahalad and Hamel: the change from a Strategic Business Unit (SBU) organization to a collection of core

competencies.⁷⁹ In particular, Ohga realized that Sony could use its collection of core competencies for growth beyond what was possible if he simply made the MD project a part of the portable audio group. Critical pieces of the MD design, such as the MMICs from the Car Navigation System, might not have been considered during the initial development process if this had been the case. Although Sony did have SBUs, the MD Group was set up externally to these allowing it to cross boundaries. This would have lengthened development time and reduced the performance of initial MD units, resulting in consumers' lasting first impressions being negative.

- *Sony Achieved Real Growth By Supplanting its Own Cassette Technology*

As Porter asserts, technology companies that chase growth by simply adding features to existing products do so at the expense of strategy.⁸⁰ Sony avoided this pitfall by recognizing that it could grow more profitably in the long term by engaging in “creative destruction,” a concept first defined by Schumpeter in 1951.⁸¹ This refers to the strategy of creating new products that compete directly with one's own existing products. Many times this strategy is difficult for certain company interests to accept. In the case of Sony however, it is ingrained throughout. In addition, because of Ohga's direct involvement in the MD corporate project, any resistance from the portable audio group for example, would be immediately squelched.

In the case of MD, it not only competed with Sony's successful Walkman line, but it made the entire family of cassette tape products obsolete. In addition, the radical MD innovation threw the portable recorder market out of equilibrium, spurring years of new innovations throughout the industry in areas such as MP3 players, convergence technology, and encoding formats. Schumpeter calls this phenomenon “dynamic disequilibrium.” Sony has in turn been

able to benefit from several of these new markets, including multi-format MD players, MP3 Walkmans, and its successful “VAIO” computer series that emphasizes convergence.⁸²

Design, Enactment, and Evolution of Technology Strategy

- *Sony Correctly Predicted the Peaking of the Technology S-Curve for Tape and Proactively Avoided Losing Industry Dominance*

Sony created the first home use tape recorder in 1950.⁸³ Since then it had built immense technological competencies in the field of tape and had pioneered countless improvements. With this expertise, Sony knew better than almost any other firm how and why tape was reaching its limits in terms of performance. This limit can be modeled by Technology S-Curve theory, as

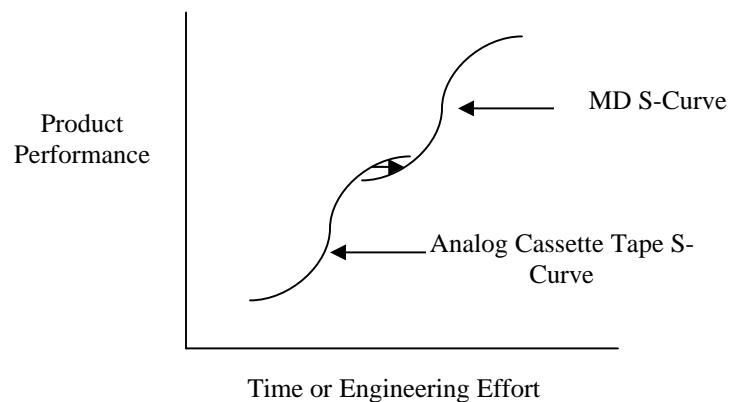


Figure 3. Technology S-Curves and their Relationship for Cassette and MD

shown in Figure 3. When more and more engineering effort is required to make only incremental improvements in performance, a peaking of the S-curve is likely occurring. At this point, the incumbent is in danger of focusing too much on these improvements and failing to predict the emergence of a follow-on technology. In the case of Sony however, President Ohga

saw this peaking and took action with his charge to replace the cassette tape. Sony “jumped” to a new S-Curve that it created and wholly owned.

- *Sony Used its Distinctive Technological Competencies to Develop Competitive Advantage Over Philips*

Sony had a number of distinctive competitive advantages that made it unique in the portable audio industry. Optical pickups, magneto-optics, precision motors, audio compression, media technology, magnetic tape, and miniaturization⁸⁴ are all examples. None of these can be easily copied by other companies and their combination is required for innovation of MD-like products. By combining these, Sony was able to increase differentiation and reduce costs with respect to its competitors that were developing DCC.

- *Sony Failed to Fully Understand and Exploit Industry Context at MD's Launch*

When MD was launched, it was up against DCC immediately. The record industry perceived DCC favorably as a logical evolution of its profitable cassette market, while it viewed MD as an adversary to its rapidly expanding CD market. Thus, record industry support formed mostly around DCC and a large prerecorded DCC catalog was available at launch. This threat from DCC caused Sony to go on the defensive and add unnecessary emphasis to the existence of a pre-recorded catalog. This confused consumers and for a while, further alienated record companies that didn't want MD sales cutting into CD sales. In reality, there was no need for a prerecorded MD catalog, as the very nature of MD made it extremely easy to make quality recordings of CD. It took Sony nearly six years and numerous failed marketing campaigns to realize this. Had Sony studied the industry context more carefully and followed Ohga's original MD vision of simply replacing the cassette tape, it may have avoided getting dragged down into

a pre-recorded catalog size battle with Philips. This would have also helped differentiate MD from DCC.

- *Sony Failed to Recognize the Impact of Computer-Based Music on MD Strategy and Leverage Lead User Knowledge*

Even though MD was successful in Japan, it lumbered along in the US for years after its introduction. During the rise of MP3s, in the mid-1990s, Sony failed to recognize opportunities to align its MD strategy with this huge trend. Although a large “cult” following of MD “techie” had emerged in the US, Sony failed to follow these groups’ own innovations and adaptations of MD. It was purely by accident that Sony became aware of the Xitel connection to MD, but this innovation turned out to be critical to the longevity of MD in an MP3 world. Had Sony been in closer touch with MD’s lead users it might have capitalized on this trend earlier. Once Sony realized the ramifications of this environmental factor, it was fortunately able to quickly adapt the format and its strategy.

Innovation Challenges

- *With the MD, Sony was Successful in Generating New Opportunities – This Must Continue*

Having been saved by accident, Sony should now use this lesson and apply formal techniques for lead user research, such as those described by Hippel, et. al.,⁸⁵ to ensure the continuing evolution of MD, NetMD and Hi-MD. But it should also continue the same type of thinking that was responsible for MD in the first place – what is the next replacement technology? In other words, Sony should continue the practice of “creative destruction” whenever a technology reaches its peak on the S-curve. This balance between improving

existing technology and looking for new opportunities is a challenge to find. Sony seems to perhaps found this balance, as evidenced by the rapid evolution of all of its leading edge products. In fact, Sony's success in this area is the subject of wide recognition. Apple's strategy for instance is "...to be the Sony of the computer business..."⁸⁶ referring to its desire to serve multiple market segments with innovation integrated into all complementary assets.

Conclusions

The MD case is a good example of a successful technological innovation that got to where it is because of the innovator's capabilities and strategy. Sony's technological competencies, complementary assets, identification of emerging markets, and product reinvention all contributed to the eventual success of MD in the marketplace. Because of Sony's commitment to the format, continual efforts to reduce media and hardware costs, and the accidental integration with the PC, MD seems to have crossed "The Chasm"⁸⁷ sometime around 2001. It was at this point that MD was adopted by the pragmatists, since it had become more of an *evolutionary* convergence of the PC with an established, inexpensive digital music device. Having made this jump, MD is sure to be a part of the digital music world for some time to come and can be considered cool technology *and* a successful innovation.

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