

## DISCUSSION PAPER SERIES

No. 3935

**SURVIVING A STANDARDS  
WAR: LESSONS LEARNED FROM  
THE LIFE AND DEATH OF DIVX**

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Discussion Paper No. 3935  
June 2003

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CEPR Discussion Paper No. 3935

June 2003

## **ABSTRACT**

### **Surviving a Standards War: Lessons Learned from the Life and Death of DIVX**

In April 1997, a consortium of hardware manufacturers and movie studios launched the DVD format. By that fall, electronics retailing giant Circuit City announced its intentions to launch a partially incompatible format known as DIVX. This Paper assesses Circuit City's strategy to establish the dominant standard for digital video technology. We identify several key principles that any firm must consider when deciding how to compete in a market with evolving standards. We argue that virtually all of these factors weighed in against Circuit City, so that its effort was destined to fail.

JEL Classification: K21 and L82

Keywords: network effects and standards war

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Submitted 27 May 2003

## **Surviving a Standards War: Lessons Learned from The Life and Death of DIVX**

Standards are a common feature of many technology-driven industries, from telecommunications to computers, from compact discs to VCRs. During the infancy of these industries, there are often several competing standards. Most of the time, firms and consumers coalesce around a common standard. As an industry evolves towards that standard, each firm has to make a choice: Should it adhere to the same standard used by most other firms, thereby attempting to “compete in the market”? Or should it attempt to impose its own standard, hoping that standard will come to dominate, thereby competing “for the market.”

This paper discusses a recent standards battle in the DVD market. In the context of that battle, we discuss several key principles that managers must consider if they are to make an informed decision about competing over standards. Shapiro and Varian (1999) discuss in detail the assets that assist a firm fighting a standards war, as well as the strategies and tactics to be employed in standards wars. Our paper in contrast provides a fresh look at some key principles in the context of the DVD vs DIVX standards war.

Despite the fact that Circuit City ended up losing a standards war that it initiated, there are valuable lessons to be learned from the case. Firms that carefully consider and balance the principles we discuss are likely to improve their chances of surviving and winning standards wars.

Literally billions of dollars may rest on whether firms make the right decisions. Sony banked on its Beta format VCR and lost out to JVC’s VHS format. But Sony scored a huge success when it partnered with Philips to set the standard in the compact disc market. Nintendo secured a near monopoly in the video gaming market when it’s 8-

bit gaming system drove Atari from the market. Microsoft hit the biggest jackpot of them all when its DOS operating system won out over Apple's windows-driven operating system.

Visions of such past successes must surely have weighed on the mind of Richard Sharp, CEO of Circuit City, as he contemplated the future of the fledgling market for Digital Versatile Discs (DVD). In April 1997, a consortium of hardware makers and motion picture studios introduced DVD as an affordable, yet markedly superior, replacement for videotapes. Wary of starting a standards war, the DVD consortium had agreed to a common standard. If the format succeeded, all firms throughout the industry would prosper.

As the nation's largest electronics retailer, Circuit City was a critical member of the DVD value chain. But Circuit City was not content to compete in the market. In September 1997, it introduced a competing format called Digital Video Express, or DIVX. In theory, DIVX could do everything that DVD could do, and more. If successful, DIVX could replace DVD as the industry standard, and Circuit City would profit from every unit of hardware and software sold throughout the world.

Less than two years after Circuit City made its bold gamble, DIVX was dead. (According to a July 1999 online article appearing in Tape Disc Business, Circuit City invested \$330 million in DIVX. See "Divx, R.I.P., Circuit City pulls plug on pay-per-use DVD," by Tom Reilly, July, 1999, available at <http://www.tapediscbusiness.com/issues/1999/0799/>.) Circuit City failed because the conditions required for it to win a standards war were not present. Had Circuit City assessed the situation correctly, it might have avoided the costly debacle.

## **A Detailed History of DVD and DIVX**

In the mid-1990s, the worldwide video industry was moribund. The basic technology had not changed since the mid-1970s, and penetration and sales of VCR hardware and software were flat. To lift the industry out of its doldrums, the DVD consortium shepherded the development of the new digital format.

By now, most consumers are familiar with DVD. Video and audio information are encoded on a disc that looks exactly like a compact disc. DVDs contain ten times more information than CDs, however. As a result, DVDs boast video resolution that is more than twice that of the videocassette, and five-channel surround sound capability that rivals or exceeds the sound quality of CDs. The DVD consortium had every reason to believe that its superior quality and reasonable cost would enable DVD to revive the video industry.

Seeking to avoid the VHS-Betamax “format war” that delayed the growth of the videocassette market, the DVD consortium saw to it that DVD would be an “open format,” meaning that all machines would play all DVD discs. At the same time, all DVD discs would be encoded with the Dolby Digital sound process, so they would be compatible with virtually all home-theater electronics.

Early adopters responded enthusiastically to the DVD launch. Through August 1997, over 140,000 players had been shipped to dealers in the U.S. with an estimated 100,000 sold to consumers. This compares very favorably to the initial sales of compact discs, VCRs, and other home entertainment technologies. Studios found eager consumers for their software. Titles such as *Batman*, *Blade Runner*, and *Das Boot* found their way into ten percent or more of all DVD households.

While some studios, notably Warner and Columbia, enthusiastically supported DVD, others held back. Paramount, Fox, Disney's animated motion picture division, and movies directed by Steven Spielberg and George Lucas were the most obvious missing in action. Some of these studios were concerned about the potential for piracy. Studios may also have been waiting for a larger installed base to assure a bigger sales "bounce" when they finally did enter the market.

Early adopters otherwise appeared to be quite optimistic about the new format. It was possible to get a good read on the attitudes of early adopters by reading various Internet DVD forums that emerged during the summer of 1997. Just a few months after the introduction of DVD, the most popular DVD chat sites were receiving more than 2000 posts weekly. Many posts predicted that the upcoming Christmas season would see the mass-market breakthrough of DVD. This would be unprecedented -- no similar technology (e.g. VCR, compact disc) had succeeded so quickly.

There were other indications that DVD might be a hit. During the summer of 1997, Internet vendors emerged offering discounted prices on DVD hardware and software. At the same time, Best Buy (the nation's second largest electronics retailer at the time) threw its full support behind DVD, with special in-store displays, wide selections of hardware and software at discounted prices, and heavy advertising. Perhaps the forecasts of a big DVD Christmas might come true.

Tempering the early enthusiasm for DVD were occasional rumors about a competing technology known only as "zoom," which was supposed to be a pay-per-view alternative to open DVD. The rumors came true on September 8, 1997, when Circuit City announced its intention to introduce Digital Video Express (DIVX). DIVX was a

joint venture between Circuit City and the law firm of Ziffren, Brittenham, Branca & Fischer.

DIVX would be partially compatible with DVD. Specifically, DIVX players would play all DVD discs, but DVD players could not play DIVX discs. DIVX discs were “locked” by an encryption technology that would be unlocked when the user started playing them, and remain unlocked for 48 hours. Circuit City announced that one time viewing (OTV) of a DIVX disc would cost \$4 to \$5. However, users could permanently unlock the discs for an additional fee, so that the total price of an unlocked disc (i.e., rental fee plus unlocking fee) would roughly equal the price of a DVD disc. In this way, consumers seemingly had nothing to lose from DIVX.

The DIVX announcement shocked DVD enthusiasts, raising concerns about standards and the spectre of monopoly. Unlike open-DVD, any hardware or software maker wishing to adhere to the DIVX standard would likely have to pay a licensing fee to Circuit City. Thus, Circuit City would have some measure of control over the video industry, and stood to profit handsomely if DIVX became the dominant standard.

Early adopters did not know it, but at the time of the DIVX announcement, Circuit City was far away from actually bringing the product to the market. It had neither hardware nor software to demonstrate, and was struggling to recruit other retailers to sell DIVX.

As the 1997 Christmas season came and went without any sign of DIVX products, suspicions mounted about the difficulties facing the DIVX launch. On January 17, 1998, Circuit City CEO Richard Sharp made an announcement that seemed to settle the DVD market. He announced that test marketing of DIVX would not begin until the summer.

He also indicated that all DIVX players would be initially manufactured by Zenith, which was not a significant force in the audio/video hardware market and was on the verge of bankruptcy. Lastly, he indicated that DIVX would be marketed as an advanced feature of DVD, rather than as an alternative standard.

When Circuit City finally launched DIVX in the fall of 1998, it faced an uphill battle. Studio support for DIVX had weakened. At the same time, Circuit City had convinced only one major competitor – The Good Guys – to carry the product. Although Circuit City reported that it sold as many as 80,000 DIVX players in the crucial Christmas 1998 shopping season, this represented less than 25 percent of the sales of open DVD players during the same period. At best, DIVX was destined to be a niche format.

By the spring of 1999, things were looking even bleaker for DIVX. As of May 1999, nearly two million DVD players had been shipped to retailers. The DIVX share through that time was at most 165,000. At the same time, there were 3317 software titles available on the DVD format and only 471 titles available on DIVX. (This included many titles available in both formats.) On June 16, 1999, Circuit City pulled the plug on DIVX.

### **Evaluating Circuit City's Decision**

As the 1997 Christmas selling season approached, Circuit City had to nail down its DVD strategy. If it wanted to compete for control over the entire market, it would have to announce the introduction of DIVX as soon as possible. At a minimum, this would slow DVD sales. Otherwise, holiday sales of DVD might push the installed base

of open DVD beyond the “point of no return,” and at best, Circuit City would compete in the retail market.

We can use economic principles to examine Circuit City’s strategy. These principles pertain to markets in which there are **network effects**. Network effects are present when consumers place a higher value on a product when the number of other users of that product or a compatible product increases. In “actual” networks, users are physically linked. Examples of actual networks include telephone and email networks. In “virtual” networks, users are not physically linked and the network effect arises from positive feedback from complementary goods. Examples of virtual networks include computer operating systems, VCRs, CD-players, and DVD-players.

When there are strong network effects and little functional difference between two incompatible standards, one of the standards typically takes over the entire market, while the other is orphaned. (This clearly was the case in the Betamax vs. VHS standards battle.) Incompatible standards can coexist, but only if the standards are highly differentiated and network effects are not strong.

In early 1997, Circuit City chose to compete *for the market* rather than *in the market*. There was one clear factor in favor of this choice. Given the size of the home video market, Circuit City needed only a modest probability of success to justify going it alone. This reflects a general economic principle that goes as follows: *A monopoly in the bush is often worth more than an oligopoly in hand*. In the simplest version of this principle, economic theories show that a monopolist earns more than twice as much as do individual duopolists, all else equal. This implies that the expected profits to a firm that

takes a “50 percent chance of monopoly power/50 percent chance of zero profits” gamble exceed the profits to a firm that settles for sharing the market as a duopolist.

In the case of digital video technology, the numbers must have seemed even more attractive to Circuit City. If DIVX became the dominant standard, Circuit City could extract a licensing fee from every unit of hardware and software. Circuit City could extract profits from all phases of the industry, much as Nintendo had enjoyed enormous profits when it maintained a stranglehold over video gaming technology in the 1980s and extracted profits that might have otherwise gone to upstream game developers and downstream retailers. In contrast, if it accepted the DVD standard, Circuit City might expect to capture perhaps 20 percent of the profits from the U.S. retail hardware business, a somewhat lesser share of profits from selling software, and none of the profits from the hardware manufacturing business. As these businesses were fairly competitive, the profits were unlikely to be very large to begin with.

Despite its late start, Circuit City had reason to be optimistic that DIVX could achieve dominance. While early adopters had embraced the new DVD technology, there were still fewer than 150,000 DVD units in U.S. households. It seemed reasonable to expect that the next batch of adopters might prefer DIVX. After all, DIVX could do anything that DVD could do, as well as provide the OTV option. If the OTV option proved to be popular, DIVX could quickly make up lost ground to DVD, and eventually win the battle for installed base.

Unfortunately for Circuit City, other economic principles weighed against its decision. Circuit City chose to make DIVX compatible with DVD (in the sense that DIVX players would play all DVD discs) in order to convince potential adopters that

there would be sufficient software available for the DIVX format. This is sometimes referred to as one-way compatibility.

Compatibility is likely a good idea when there is already a significant amount of complementary software available for an established standard. But *one-way compatibility between competing standards may backfire when both standards are still in their infancy and there is relatively little software available for either standard.*

WINDOWS succeeded in part because it was backwards compatible with applications software written for DOS. This is because vendors of complementary products – in this case the movie studios -- will likely choose to release their software in a form that is compatible with the incumbent technology since it reaches BOTH audiences. This will mean that very little software will be written specifically for the entrant's technology. In such a case, few consumers will have heightened demand for the entrant's product.

This is indeed what happened. The studios were unwilling to release DIVX-only discs, as the incremental cost of releasing the film in DVD format was nil. Circuit City apparently ended up paying as much as \$100 million to get a few studios to release a handful of films exclusively on DIVX. (See <http://www.fightdivx.com/blockbuster.htm>.) The DVD consortium included several film studios, so Sony, Toshiba and the other hardware makers were able to avoid this kind of expense to assure a steady flow of DVD software.

Perhaps Circuit City's biggest mistake was failing to recognize that *developing an installed base requires appealing to early adopters*. Early adopters shunned DIVX. Many were videophiles who worried about DIVX quality. They feared that Zenith technology would not match that of other hardware leaders. They also doubted that

studios producing DIVX videos primarily for OTV would incur the expenses needed to produce the sharpest images or make “special edition” productions. Circuit City did little to dispel these doubts, announcing that DIVX videos would be released in standard 4:3 format (as opposed to widescreen) with no special editions.

Since early adopters tended to be frequent Internet users, a DVD culture developed on the Internet. Hence, it was no surprise when several on-line hardware and software vendors participated heavily in DVD-related sites. By the middle of 1997, the most popular DVD chat sites were receiving more than 2,000 posts weekly, many from potential early adopters who did not own a DVD player. The concerns about DIVX circulated quickly via the Internet and likely hampered Circuit City’s efforts to get the format off the ground.

Circuit City might have overcome the resistance of early adopters had it not ignored another economic principle: *Do not forget the value net*. The Value Net emphasizes the importance of relationships with trading partners. As Brandenberger and Nalebuff point out in their book *Coopetition*, no firm can succeed in winning the market without willing trading partners.

The value net consists of suppliers, competitors, and producers of complementary products and services. The DVD value net included manufacturers, studios, and retailers and their fortunes were clearly intertwined. Circuit City found that willing partners for a potential DIVX value net were few and far between.

Most major hardware makers were part of the DVD consortium and had no desire to hand over control to a retailer owning full technology licensing rights. Circuit City could be certain that Sony, Toshiba, Philips, and Matsushita would stay the course with

DVD. That left Zenith and, eventually, Thompson (which manufactures the RCA brand) as the only major manufacturers willing to supply DIVX hardware.

On the software (studio) side, Circuit City could count out Columbia (owned by Sony). Warner President Warren Liebenluft had been a vocal proponent of DVD, so Circuit City could count them out as well. The remaining studios expressed no public preference for either format, leaving Circuit City with no allies.

Circuit City also needed the support of retailers. It could rule out its major competitor, Best Buy, which had enthusiastically embraced DVD. Even The Good Guys backed off from supporting DIVX, often relegating “display units” to a back room.

Circuit City was not able to build an alliance prior to rollout. Hence, for all intents and purposes, Circuit City had to go it alone.

Another issue facing Circuit City was whether their effort to win the market outright might backfire, so that the market would fail to materialize altogether. This reflects the principle that firms should *make sure at least one format survives*. Format wars may cause consumers to sit on the fence, rather than make a commitment to a format that might lose. This occurred in the DVD market, when Circuit City’s preannouncement caused sales of all forms of DVD/DIVX hardware to fall by as much as 20 percent. (See Dranove and Gandall (2003).) This could have been a crippling blow to the fledgling technology. Many early adopters were awaiting the possibility of digital video streaming over the Internet. A two or three year delay in the acceptance of DVD might have discouraged the fence sitters from ever adopting the technology.

Given its inability to build up a value net, it might have been a better strategy for Circuit City to abandon DIVX prior to the rollout and to join the DVD value net. Not

only would this have guaranteed the survival of one of the technologies, Circuit City would likely have faced less hostility from early adopters of DVD. (See below.)

The confusion caused by the preannouncement angered early adopters, who denounced Circuit City at various Internet sites. Some apparently even visited Circuit City stores to dissuade customers from buying DIVX. This active effort by early adopters to promote a unified standard seems unprecedented.

We know of no other example where consumers communicated in such massive numbers and coordinated activities in behalf of an emerging standard. Hence, a final lesson is that *communications and coordination among consumers via the Internet will likely play a big role in future standards battles.*

Chat groups helped consumers communicate information and coordinate actions. Since many of the early adopters were also Internet users, the large number of active DVD and DIVX web sites conveyed very useful information to potential adopters in real time. The information spread across the Internet turned out to be remarkably accurate. Internet chat sites correctly anticipated the nature of the Circuit City's new technology, the difficulties that Circuit City would have in enlisting partners, and the dip in sales that would result from market confusion. The ability of the Internet to convey information quickly and inexpensively may reduce market failures associated with competition between incompatible technologies.

Managers need to take this into account when formulating their strategy. Had Circuit City taken into account the strong preferences of early adopters for widescreen format and the ability of early adopters to communicate and coordinate via the Internet, it might have adopted a different strategy.

## **Post Mortem**

Circuit City needed to garner the support of early adopters, hardware and software makers, and at least some retailers. But early adopters shunned DIVX, as did hardware and software makers and retailers.

It was probably not a wise decision to choose compatibility with DVD. While this assured purchasers of DIVX that they would not be orphaned, it likely encouraged movie studios to release primarily in DVD format, since they could reach all consumers in this fashion. But if Circuit City had issued a fully incompatible standard, they may have been no better off. Users probably would not have had sufficiently strong preferences for the OTV feature to insure that DIVX could survive, even as a niche player.

Circuit City may have also erred when it priced its DIVX players at a 10-15 percent premium above comparable DVD players. This may have been enough to convince some purchasers to stick with open DVD. Circuit City could have subsidized the purchase of the DIVX player in order to create a large installed base. But this may have triggered a fierce price war, as evidenced by the price cuts that DVD manufacturers implemented when DIVX hit the market.

For all the reasons discussed, Circuit City's odds of winning the market were low. But what if it had elected to compete within the market? Circuit City was the nation's number one electronics retailer overall. If the DVD market took off, could it expect to reap its fair share of profits? To answer this question, it is important to examine events that had unfolded prior to the DIVX announcement date.

By the fall of 1997, Best Buy had already made a major commitment to DVD. Best Buy stores had extensive selections of hardware and software and aggressively promoted DVD both through advertising and in-store promotional displays. Best Buy was rapidly establishing an identity as the place to go for DVD.

The growth of e-commerce was also threatening Circuit City's dominance. By fall of 1997, there were already several online DVD retailers, including mass merchandisers Amazon and Buy.com. Even if Circuit City had competed in the market, it seems unlikely that it could expect to be the only dominant retailer.

Nevertheless, it probably would have been a better choice than going alone. Indeed, if Circuit City had elected to embrace DVD in its earliest stages, rather than introduce DIVX, it could easily have matched Best Buy's retailing strategy. This would have secured its position as the U.S.'s number one bricks and mortar retailer, while accelerating the success of DVD.

### **Summary of Principles**

We now summarize the six principles we believe that a firm must consider when deciding how to compete in a market with evolving standards:

- **Principle 1:** A monopoly in the bush is often worth more than an oligopoly in hand, that is, under certain conditions it will be worthwhile to compete "for the market," rather than "compete within the market."
- **Principle 2:** One-way compatibility between competing standards may backfire when both standards are still in their infancy and there is relatively little software available for either standard. The reason is that vendors of complementary products will likely choose to release their software in a form that is compatible with the technology that reaches BOTH audiences.
- **Principle 3:** Firms competing in markets with network effects must insure that their technology appeals to early adopters. Otherwise, a bandwagon of support can build an insurmountable lead for another technology.
- **Principle 4:** Firms should insure that they have a formidable value net, which consists of suppliers, competitors, and producers of complementary

products and services. This is especially important in industries with network effects.

- **Principle 5:** Make sure at least one format survives. If complementary product providers support different incompatible standards, demand may be very low for each of the incompatible standards and both might fail.
- **Principle 6:** Communications among consumers via the Internet will likely play a big role in future standards battles. While the DVD vs. DIVX battle was likely the first key standards war where coordination among consumers via the Internet had a major impact, the Internet will surely play a key role in future standards' competition.

### **The Principles in Action: Another Standards War is Brewing**

In closing, we take a look at the principles in action in the context of a new, yet related standards battle. The early adopters of DVD are carefully watching the emerging competition between two incompatible formats, Super Audio CD (SACD) and DVD-Audio. These technologies offer surround sound coupled with music quality that audiophiles claim is superior to standard compact discs. Sony owns the SACD format, and includes SACD decoding on many of its high-end DVD players. The open DVD-Audio format is often included on high-end DVD players made by other manufacturers, as well as Sony. As of this writing, there are nearly 1000 titles available in SACD, and a few hundred in DVD-Audio, with little overlap. While this sounds like a large selection, remember that the number of music recordings vastly exceeds the number of movies. (For example, Amazon.com currently lists over 1000 recordings containing at least one work by composer Gustav Mahler.) At any time, perhaps 5 percent of the top 100 selling music titles is available in one of the high resolution formats. (Of the 1000+ Mahler titles, only 6 are available in SACD.)

It is not clear if either format can thrive, even if the format war is resolved. One deterrent is the cost of upgrading. Hardware makers currently charge \$50-\$500 to

upgrade a traditional DVD player to the high resolution audio formats. Proper playback of either format also requires additional cables and, potentially, additional hardware to handle the surround sound. Most consumers already believe that compact discs sound “perfect”, and lack the kind of expensive audio equipment that brings out fully the benefits of the new formats. Moreover, they have been assaulted by new formats for other technologies (especially DVD) and may be unprepared for another spending spree. Thus, the demand for these audio formats may be limited (**Principle 5**).

At the same time, electronics retailers are not very enthusiastic about the new formats (**Principle 4**). Best Buy and Circuit City are still educating consumers about DVD, and hope that the new video technology spurs demand for big screen televisions and surround sound home theatres. Most early adopters of high resolution audio already have the necessary cables and hardware, so there is little additional profit from these items. At best, electronics retailers could hope to sell additional software, but the current titles are often obscure (mainly classical and jazz), and do not fit in with current music title selections at most retailers. Indeed, it is difficult to find SACD and DVD-Audio at most electronics retailers, and the selection is very limited. (Best Buy carries some recordings in the DVD section, while others are in the music department.) This contrasts sharply with Best Buy’s early promotions of DVD, which featured dedicated displays and shelf space.

The format war is only making matters worse. Most audiophiles remain on the fence. Posters to audiophile web sites bemoan the lack of major studio support (most of the software comes from independent studios) (**Principle 3**). Many high-end retailers advise their customers to hold off making any purchase until the format war is decided.

Which format has the best chance of surviving? Many classical and jazz labels are releasing in SACD format. Although these represent just a few percent of total CD sales, they are especially popular among audiophiles who frequent web sites devoted to the new technologies. For example, the vast majority of posters to the Audio Asylum chat group on high resolution audio prefer the SACD format (**Principle 3**). On the other hand, DVD-Audio is currently included in more hardware. Even so, Sony is the only major hardware maker that stands to gain much from sales of either format, due to sales of its Sony Music label recordings. Other hardware makers are content to sell DVD-only players, realizing scant additional profits from the DVD-Audio feature. This suggests that Sony has greater incentive to make the investments necessary to win over more recording studios and retailers.

Thus far, Sony has scored one coup by convincing ABKCO/London Records to release the Rolling Stones catalog in SACD. The buzz on the Internet is that many potential early adopters are waiting to see what will happen to the Beatles catalog (**Principle 6**). If Sony plays its cards right, through aggressive licensing arrangements with software and hardware makers, joint ventures with Best Buy and other retailers, and a few more high profile releases like the Rolling Stones, it stands a good chance of winning the market for high-end surround sound audio (**Principle 4**).

### **References:**

Dranove, D., and N. Gandal (forthcoming 2003), "The DVD vs. DIVX Standard War: Empirical Evidence of Network Effects and Preannouncement Effects," *Journal of Economics and Management Strategy*.

Shapiro, C., and H. Varian (1999), "The Art of Standards Wars," *California Management Review*, 41(2), 8-32.