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Markets characterized by multiple competing digital standards have room for more than one winner, unlike traditional analog markets.

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Strategies for Tomorrow's 'Winners-Take-Some' Digital Goods Markets

MOST MANAGERS (AND CONSUMERS) understand the key patterns of market evolution from earlier standards wars.¹⁰ History provides a number of examples that begin with two or more similar, but incompatible, information technologies introduced to address consumer market needs. Incompatibilities between the technologies mean users of one cannot enjoy the benefits of the other, in terms of either users to communicate with or of content to consume.

Vendors of both technologies, recognizing the network effects associated with adoption, start a “standards war,”

given their expectation that only one will win, and thus that firms must compete *for* the market before they compete *in* the market. This result is common in markets with networks of complementary goods (such as software for hardware, media for players, and games for game consoles), where the market desires a single, dominant standard, and consumers prefer to adopt the market leader, and may even withhold purchases until a dominant technology emerges.¹⁵

In order to win a standards war vendors may engage in competitive behavior, (such as subsidizing early adopters to increase network size and offsetting the lack of network benefits to early adopters), thereby causing the market to “tip” to their technology platform.^a When tipping occurs, the winning firm can extract economic rents from its dominant position in the market, and future-generation technologies must then offer significant improvements

^a “Platform” is used here as defined by Eisenmann, et al.: “...products and services that bring together two distinct groups of user in a two-sided network.” Platforms tend to become standards, though not all standards are platforms. Our analysis here is of technology standards broadly, though some examples are platforms. Markets that tip to a single, dominant standard are commonly called winner-takes-all, despite the fact that the dominant market share may be less than 100%.

» key insights

- **Winner-takes-all markets, where products tend to “tip” toward a single standard, have been common in IT, as in VHS over Betamax, Blu-ray over HD-DVD, and Microsoft Windows and Office over multiple competitors.**
- **Changes in development and delivery of digital goods may portend a winners-take-some outcome that demands a switch from yesterday’s subsidization of early adopters and later reliance on network effects to drive the market toward tipping.**
- **Digital formats conversion across platforms increasingly allows coexistence of multiple winners, as with hardware devices, like flash memory cards, and with multiple digital audio, video, and image formats, allowing conversion across multiple standards.**



to overcome the network advantages of the incumbent platform. Examples of such standards wars include VHS over Betamax VCRs, DVD over Divx, Blu-ray over HD-DVD, and the XM-Sirius satellite merger;^{1,4,5} see the sidebar “Digital Winner-Takes-All Standards.”

These examples share a number of characteristics: Competing technologies were effectively substitutes; competitors’ formats were incompatible; complements (media, software, and content) were critical for consumer value; and, most important, technologies were not easily converted from one standard to another due to factors including the time and effort involved

in conversion, quality degradation inherent to conversion, technological restrictions or limitations, and digital rights management (DRM) restrictions.

Emerging Winners-Take-Some Market

Managers should note this established pattern of strategic interaction might become less relevant in the context of digital standards, where cheap and perfect conversion from one format to another is possible. In this setting our research suggests managers are more likely to face a winners-take-some outcome where multiple different standards can coexist.

Examples of this new competitive environment are appearing in a variety of contexts; for example, while the content-platform characteristic of flash memory cards and card converters may look similar to the competition between VHS and Betamax, flash memory cards have not yet seen a strong winner-takes-all outcome, where one dominant standard emerges. Instead, the flash memory card market has seen multiple formats—Compact Flash, Memory Stick, Secure Digital, Smart Media, xD Picture, and MultiMedia Card—with no obvious trend toward market consolidation (see Figure 1).

Figure 1. Flash memory card market share, January 2003–August 2006; data source: NPD Group¹¹

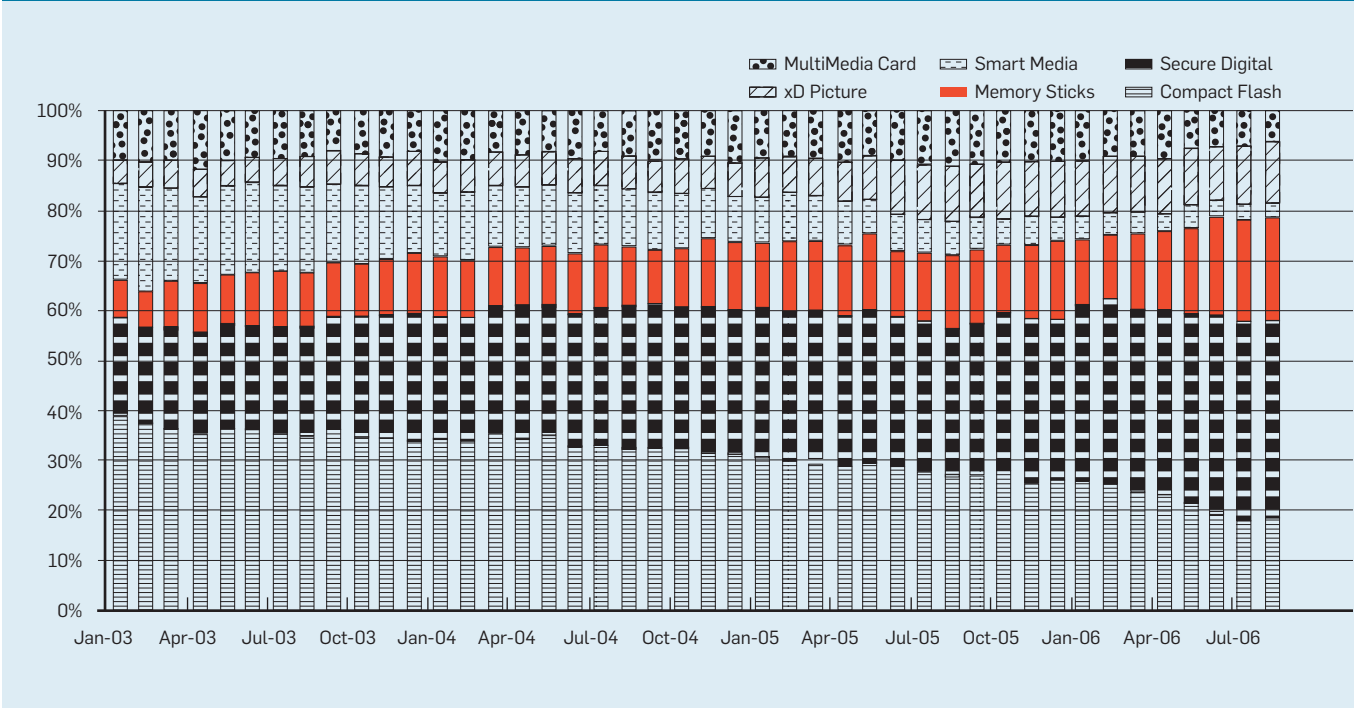
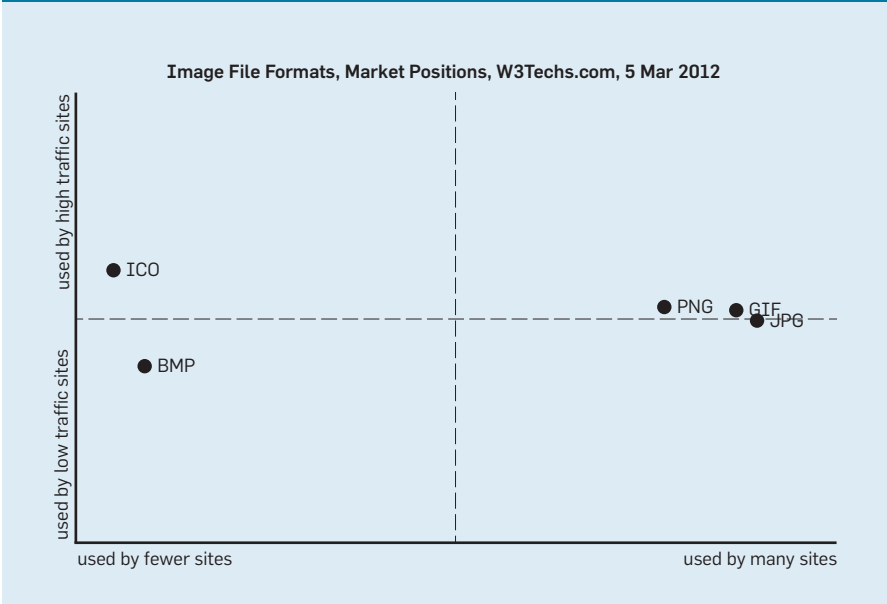


Figure 2. Adoption of digital image formats by market position and Web traffic; data source: http://w3techs.com/technologies/market/image_format



Digital-image formats use, November 2011–April 2012, top one million websites; data source: http://w3techs.com/technologies/history_overview/image_format/all

Digital Image Format Used	November 2011	April 2012
JPG	71.8%	72.4%
GIF	69.9%	67.3%
PNG	50.9%	55.6%
BMP	0.8%	0.7%
ICO	0.2%	0.2%
None	9.9%	9.4%

In the case of digital image formats several competing standards, including .jpg, .gif, .png, .bmp, and .tiff, have coexisted for years. Although some formats tend to be more popular than others, there is little tendency toward a winner-takes-all outcome, perhaps best illustrated in the adoption of various digital image formats by websites worldwide (see the table here).

It is clear that the majority of these websites adopt multiple formats to display images, but a dominant position has not led to a self-reinforcing growth path. The market shares of the three leading formats have been relatively stable over time, and, in fact, the market share of the third leading image format—.png—has shown some growth, a phenomenon that does not support what might be predicted by the classic theory of network effects. Moreover, the popularity of the leading formats is not driven by Web traffic, hence not by visitors’ preference, suggesting compatibility among these formats is not a major factor in adopting a particular digital image format (see Figure 2).

Similar situations are seen in other digital media formats, as in audio (such as .wav, .aac, .mp3, .wav, .aac, .mp3, .wma, .flac, and Apple Lossless), video (such as .wmv, .mpg, .avi, .flv, and .mov), and file compression

(such as .arj, WinRAR, and WinZip). These examples suggest that first-mover advantage does not always translate into the persistent market power to be expected of a winner-takes-all outcome.^b

Several factors drive this trend: First, in a digital environment, a large number of essentially equivalent designs is possible, making an increased variety of independently produced formats more likely. In contrast, in an analog environment, natural laws tend to limit the design space. Additionally, digital forms are relatively easy to copy, encrypt, compress, and communicate than their analog counterparts, all of which reduce the overall cost of diversity.

However, this environment suggests only how multiple standards come into existence, not why they survive. One critical factor enabling the coexistence of competing digital standards is the presence of hardware- or software-based digital converters; for example, hardware-based flash memory converters allow users of one standard to easily transfer their content onto other devices through the ubiquitous USB interface. For digital file conversion, a computer with appropriate software can serve as a flexible universal converter, allowing for, say, straightforward conversion of a .jpg image file to a .gif image file. Likewise, video editors on a Macintosh platform easily convert .wma audio files created on Windows PCs to an iTunes-compatible .aac format, with little discernible loss in media quality.

In contrast, prior to the digital revolution, analog media “readers” were typically fixed in hardware and relatively inflexible. Conversion between two incompatible standards in this context was slow, and led to significant signal loss; for example, conversion from vinyl record albums to analog tape is costly in terms of both time and lost audio quality. Likewise, providing the ability to play two incompatible formats (such as VHS and Betamax videotapes) and write in at least one of them would nearly double the cost of the hardware.⁴ These significant costs

^b Not all analog markets become winner-takes-all, and not all digital markets become winners-take-some; however, when conversion is essentially lossless and costless, the likelihood of a multiple-winners outcome increases substantially.

Digital Winner-Takes-All Standards

But wait, aren't Blu-ray discs digital? And isn't satellite radio a digital signal? Why do these markets have a single winner?

Blu-ray/HD-DVD. It is important to note that while Blu-ray content is digital, it is encoded onto a fixed medium not easily converted between standards due to intellectual-property protections. Moreover, differences in the lasers used to encode Blu-ray and HD-DVD content mean “dual players” would cost nearly twice as much as a single player (similar to a dual VHS/Betamax player). As a consequence, the Blu-ray vs. HD-DVD “standards war” had a single winner, as with Beta-VHS.

XM and Sirius. XM and Sirius were established by the U.S. Federal Communications Commission as separate licenses to promote competition. However, bidding for content and subsidization of early adopters threatened to bankrupt both sides. Their merger was the solution to the failed regulatory enforcement of multi-vendor competition. A converter, in the form of a dual receiver, would still be required to receive both signals. For these reasons a single provider has survived.

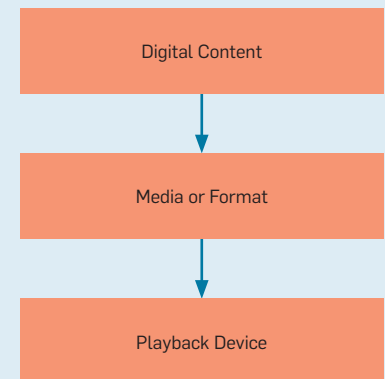
of multi-homing led consumers to choose a single standard, and a single winner generally emerged.^c

Digital Products Delivery Chain

A model is helpful for observing similarities among what otherwise might be seen as disparate products. Figure 3 highlights three essential elements in the digital-products delivery chain, starting with Digital Content. These information goods represent anything that can be encoded digitally, including data, images, music, and video. Producers of information goods must decide how they deliver these goods, represented as the second step—Media or Format—in the delivery chain. In the analog era, goods were delivered in fixed media (such as videocassette tapes and vinyl records). The first move toward full digitalization was digital information communicated on physical media (such as audio CDs and video DVDs); see the sidebar “Digital Winner-Takes-All Standards.” Digital goods today are increasingly delivered as a stream of bits following a standard format (such as one of the audio, image, and video formats outlined earlier). Formats can be seen as “contain-

^c Consistent with Eisenmann et al.,⁸ “multi-homing” is used here as “affiliating with multiple platforms”; for example, in the context of video games, demand-side multi-homing would involve a consumer with more than one video-game console, while supply-side multi-homing would involve a video-game creator developing versions for more than one console platform.

Figure 3. Digital-products delivery chain.



ers” that fulfill the role once filled by physical media.

Finally, the end consumer needs a playback device, or reader, to allow consumption of the information good. In the analog era these were single-purpose devices (such as VCRs and players), a model that persists today in single-purpose e-book readers. Increasingly, however, general-purpose devices with built-in converters serve the playback role for multiple media types; for example, e-books may be read on multipurpose devices (such as a PC, a smartphone, or tablets like Apple’s iPad⁶), reducing what would otherwise be multi-homing costs.

Future Standards Wars

How might these trends evolve in the future when even more products are digital? It seems likely that media quality will continue to be an impor-

tant aspect of consumer adoption decisions. The cost of digital conversion will continue to fall, given the prevalence of general-purpose computers and increasing reliance on media consumption through software-based devices and the Internet (such as Google Docs and other cloud-based services). It also seems likely that important technology markets will continue to have strong complementary goods relationships due to lower compatibility barriers. As a result, consumers will increasingly value product features over mere platform compatibility, and design features and functionality will be key dimensions of competition; see, for example, Apple's history with the iPhone and iPad.³

If these predictions hold we can expect an environment where technology vendors benefit from coordinating with other firms through cross-licensing agreements to increase their total effective market size.¹¹ In response, consumers will be more aggressive about early adoption of technologies, since the risk of being "stranded" on the wrong technology is reduced. This early consumer adoption should lead to a larger and more competitive market, more rapid technology innovation, and potentially more entrants in standards- and platform-based markets. Finally, we can expect more incremental technological changes relative to prior analog markets because there will be fewer installed-base barriers of the kind that might cause discontinuous, step-function technology

changes during platform-change windows (such as from analog tapes and records to compact discs, and from floppy drives to CD-ROMs) and the attendant rush to upgrade to the latest media format.

From Here to There

The Digital Markets Evolution Diamond (see Figure 4) outlines three potential paths that might be taken by technology vendors, as well as consumers, in the evolution from an analog winner-takes-all outcome to a digital winners-take-some market. The simplest, most direct path would be from Figure 4's Stage 1 to 3 via 2—Direct Digital Transition—where products move directly to a digital format (such as from analog TV signals to digital TV signals). However, such direct evolution may turn out to be a special case, and, perhaps more likely in the short run we will see two "detours" to the same end result. In the first—the left-hand path from Stage 1 to 2a to 3—the market evolves by undergoing a transition stage through fixed media. Products move to a digital future in two steps, the first a digitally based transitional form (such as from analog vinyl records to digital CDs), then a second (such as from digital CDs to pure digital downloads, or from analog video tapes through digital DVDs to digital downloads); see the sidebar "Netflix: A Missing Link."

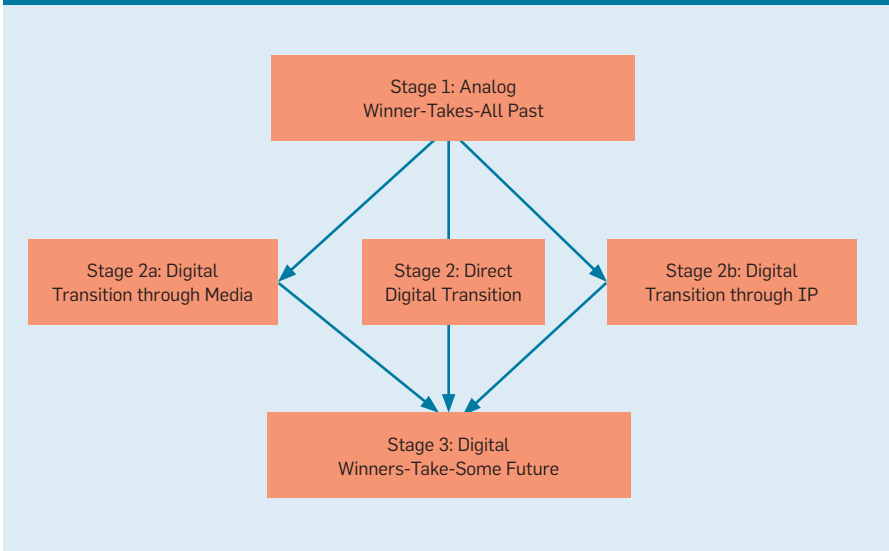
A second detour on the evolution to Stage 3 is a right-hand path from Stage 1 to 2b to 3 in Figure 4. The

product's first step is a set of multiple digital formats vendors guard with traditional intellectual property protections (such as patents and copyrights) while still imposing a winner-takes-all outcome supporting their technology. The earlier Stage 1 analog formats typically provided rational explanations for single winner-takes-all outcomes (such as the physical incompatibility between VHS and Betamax tapes). Similarly, the installed base of software may have created disincentives for multi-formats due to learning costs and the incentives for winner-takes-all outcomes through network effects due to platform creation and the benefit of a large number of complementary products. In Stage 2b vendors attempt to replicate winner-takes-all outcomes by creating proprietary digital formats protected by intellectual-property controls.

One example of Stage 2b intermediate migration is digital music from Apple's iTunes DRM to DRM-free downloads. As noted earlier, while inter-standards conversion is easy for most digital goods, products with DRM typically cannot be converted between formats. The record industry's mandated use of Apple-controlled DRM may have created a virtuous cycle for Apple, where customers who purchased content on the iTunes store were locked into using iPod media devices, and, out of convenience, most iPod users used the iTunes store to purchase music. This may have contributed to the early market dominance of the iTunes Music Store and the resulting market power Apple was able to exercise over music labels in pricing and marketing negotiations.¹³ Other observers have made similar comments about the market for e-books.¹⁴ In order to avoid such outcomes in the future producers of complementary content goods may have a strategic incentive to support multiple competing standards to reduce the likelihood of having to deal with a monopolist partner.⁹ With digital goods it may also be less costly for such a producer to convert its content to multiple formats.

However, such Stage 2B approaches may be short-lived, as the ease and quality of digital conversion makes it difficult to create advantages for pro-

Figure 4. Digital-markets evolution diamond.



proprietary formats (such as Sony's unsuccessful attempt to establish its Memory Stick format as the dominant flash memory standard) and given users' ability to defeat proprietary schemes to create constrained environments (such as so-called "jailbreaking" of iPhones and the defeat of copy-protection schemes in general).²

Moreover, in winner-takes-all markets vendors of digital technology have sought to establish their formats as a dominant standard and protect it from being copied. Sometimes, this took the form of not licensing their innovations to other firms, so as to retain sole manufacturing rights (such as Sony with Betamax and Apple with the Macintosh operating system). As these products could maintain higher margins they tended to command only niche markets. Therefore, these vendors moved to partner with other firms to co-produce devices or their complementary goods while still aiming to establish a single standard. In 1979 Sony successfully teamed with Philips to produce the audio CD standard, and video-game console manufacturers have contracted with video-game software producers to create entertainment systems that tend to produce generational, winner-takes-all results in video games (such as Nintendo's NES and Sony's PlayStation).⁷ However, the approach has seen notable failures as well; Sony, in particular, has created or backed a variety of unsuccessful efforts to standardize devices; see the sidebar "Sony Lessons Learned, Lessons Missed."

The market for digital technology may be seeing the emergence of an alternative strategy; for example, in flash memory, instead of attempting to promote a proprietary single standard, as Sony did with the Memory Stick, SanDisk sells a variety of flash memory formats. Likewise, Amazon provides converters allowing its users to read its Kindle DRM-protected titles on Kindle devices, as well as on other portable devices, including the iPad and iPhone.⁶ Finally, recent versions of Microsoft's Office productivity suite allow users to save their output in non-Microsoft formats (such as .pdf) and have made the file-format standard more accessible through .xml; see the sidebar "Microsoft Word and Adobe .pdf."

Netflix: A Missing Link

Netflix, Inc. is a subscription service that began as a "DVD rental by mail" service and has since begun offering streaming content over the Internet. At the end of 2011 Netflix had 23 million streaming subscribers and prior to that was mailing approximately two million DVDs on an average day. Netflix represents a classic transition path through fixed media. While it may ultimately provide only a direct digital download service, it began life by offering an alternative to making a trip to the video store. Sources: http://online.wsj.com/quotes/key_facts.html?mod=2_0470&symbol=NFLX&news-symbol=NFLX and <http://www.Netflix.com>

Sony Lessons Learned, Lessons Missed

Sony has been extremely successful in the consumer electronics market, including with its Walkman cassette player, audio CD standard (jointly with Philips), and PlayStation video-game system. However, less visible are a number of product attempts that have been relatively unsuccessful. Beyond Betamax, which, despite losing the standards war, went on to be successful as a commercial videotape standard, a variety of other Sony products failed to establish themselves in the marketplace. According to business author Steve Knopper, these include the Minidisc audio format, PressPlay music store, MusicClip (an SDMI-compliant digital music player based on the ATRAC DRM-protected standard), Connect music store (also ATRAC-based), and eXtended Copy Protection placed on music CDs via a software rootkit. See Knopper, *S. Appetite for Self-Destruction: The Spectacular Crash of the Record Industry in the Digital Age*. Free Press, New York, 2009.

Microsoft Word and Adobe .pdf

Two digital formats with significant worldwide installed bases are Microsoft Word (.doc and .docx) and Adobe Portable Document Format (.pdf). How do they fit within the trends described here? In the specific example of Word, high switching costs and complementary investment in learning or training played an important role in its early dominant market position. Further, converters (such as OpenOffice Writer) were introduced so late in the process that most potential users likely already invested in Word and its related learning and training. Moreover, converters to other formats are often imperfect, and, therefore, conversion is not lossless in the example of Word, meaning a winners-take-some outcome was less likely from the start.

The Adobe example involves similar technical "costs" to conversion but in this case through patents and proprietary standards. It is important to note that Adobe's initial strategy with .pdf was to exploit the two-sided nature of the reader/writer markets by giving away its reader software to consumers as a way to increase the utility of its .pdf writer software to publishers.⁷ However, to execute this strategy, Adobe needed to maintain its monopoly position in the writer market, through a combination of DRM (.pdf documents encoded with Adobe DRM can be read only by Adobe's reader software) and intellectual-property protections by holding patents that prevent other companies from developing competing ".pdf writer" software. This protection strategy was successful for Adobe for many years, though it was abandoned in 2008 when Adobe allowed its patents to be licensed royalty free and applied for ISO standardization of the .pdf standards.

These examples may reflect the first wave of a new strategy where platform rights holders choose to allow conversion in many cases. In the context of digital products a new equilibrium can emerge with technology vendors agreeing to provide converters at a suf-

ficiently low price to all consumers.¹¹ In this approach both the incumbent firm and potential new entrants are better off, since the possibility of conversion between formats provides multiple benefits: it helps adoption of both existing and new products, as consum-

ers need not wait on the sidelines for fear of being stranded by choosing the wrong standard; it reduces the need for price competition and subsidies to try to create a single winning standard; and it may even generate revenue through the sale of devices or software that perform the conversion. Moreover, users may benefit from being part of a larger network and generally having more opportunity to consume the new product.¹²

Our research in the market for flash memory shows that a variety of formats coexist in a winners-take-some outcome, rather than the traditional winner-takes-all outcome.¹² We find the existing network effects in flash memory use are moderated by the adoption of digital converters; specifically, digital converters provide a measurable reduction in the price premium of leading flash-card formats relative to that of formats with smaller market shares. These market dynamics imply that the provision of conversion technology increases the ability of new entrants to survive the standards competition, as converters tend to neutralize the impact of network effects. Our further analysis shows that market concentration in the flash memory market decreases as converters become more widely available, implying that adoption of converters fosters a more competitive market.

A variety of new and emerging products may fit this model; for example, there is intense competition in the e-book market among Amazon's Kindle, Apple's iPad, Barnes and Noble's Nook, and others.⁶ Given the digital nature of the content it seems probable that a winners-take-some result will emerge, with the ability for potential consumers to consume e-book content on multiple platforms, rather than a classic winner-takes-all outcome. This winners-take-some outcome is made possible by, in part, the fact that the cost for vendors of stocking multiple formats is much lower for digital goods than it was in, say, the Beta and VHS videocassette tape era, when significant quantities of physical inventory had to be kept in each supported format. With digitization and cheap, perfect copying a single master digital copy in each format is sufficient.

Caveat Manager

Predicting the future is, of course, a tricky business. While we expect to see the winner-takes-all phenomena replaced by the winners-take-some phenomena in many markets for digital goods, we also expect exceptions to emerge. What signs should a manager look for as advance warning that the market being pursued is unlikely to proceed to a winners-take-some outcome? We imagine three important conditions: First, especially early on, traditional market power may still prevail, with big vendors with deep pockets and strong distribution links in the marketplace choosing to follow the old rules and survive for an initial period of time. Eventually, though, as more examples of winners-take-some outcomes emerge, fewer technology vendors will take the risk. In addition, vendors that elect to try to follow the traditional path will be subject to increasing governmental antitrust oversight, as has been the case with many IT firms, including Google, Intel, and Microsoft.

A second exception may occur when a few collaborators in a consortium emerge to share in the financial returns, but also work to keep out others so as to keep sharing to a minimum. This is another market-power exception, but with an oligopoly instead of a monopoly outcome. These results are likely to be an initial transition point for market leaders that increasingly perceive the risks of a go-it-alone strategy.

Finally, we may still see winner-takes-all outcomes when governments dictate or otherwise greatly reward them. In some circumstances it may be appropriate, as when there are significant social and private costs of nonstandardization (such as HDTV and telecommunication standards) or when scale makes conversion a relatively expensive option. However, other circumstances will see less benign government intervention as when, say, regulators, under the influence of organizations with market power, or through a "fighting the last war" analysis of winner-takes-all markets, issue regulations that favor single winners. Managers are well advised to closely monitor emerging government policies in this regard.

Looking Ahead

The movement toward greater digitization will bring about an overall better marketplace for vendors and consumers alike, marked by quicker technology innovation, fewer consumer "dead-weight" losses due to technological stranding, more product choices, less vendor risk, and more interoperability. Managers should prepare to seize the related opportunities rather than fight the last war. **C**

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