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HDTV Standards Setting: Politics, Technology, and Industry

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Over the course of the past several decades, we have witnessed a tremendous surge in the number of communication and information technologies. These technologies have spread throughout various facets of our society and have influenced the way we live our lives in many ways. As they have become increasingly integral to our day-to-day existence, our need to understand the phenomenon of technological innovation has become more critical.

The early stages of technological innovation are extremely important, though often overlooked. One particularly important aspect of the early development of an innovation involves the establishment of appropriate technical standards which govern the operation of the innovation. This lack of attention is both surprising and problematic given the:

- Critical role standards can play in the timing of the introduction of an innovation.
- Effect they have on the capabilities and nature of the technology.

- Influence they exert in determining the eventual degree of success experienced by the innovation.

Typically viewed as an inconsequential part of the comparatively unimportant technical prehistory of an innovation, the standards-setting process is not merely a technological issue. It is, in fact, a complex and fascinating amalgam of public and private concerns, a nexus of economic, sociological, and political forces. An examination and analysis of the standards-setting process yields important information concerning the origins of a technology, and helps to provide a fuller, richer understanding of the entire technological innovation process. This article explores this neglected dimension of technological development by examining the standards-setting process connected with high definition television (HDTV).

Standards

Standards can be defined as “technical parameters that govern the operation of a piece of equipment or an entire industry.”¹ The establishment of uniform standards is particularly critical when complementary products are required (for example, hardware and software configurations) and when interconnections between products are desired. Standardization can help to accelerate the diffusion of technological products, and also help reduce risks for both market entrants as well as consumers. On the other hand, the establishment of standards tends to remove the incentives for further development and can stifle technological innovation. Moreover, there is always the possibility that an obsolete standard can become so ingrained that it is difficult to phase in a new one. Standards can therefore serve to prompt or inhibit adoption of a new technology.

The standards-setting process is an intricate activity. Standards can be established through government actions, via industry coalitions, or through

free market competition. Rosen, Schnaars, and Shani have devised an analytical framework comparing these various approaches to standards setting and have drawn the following conclusions: “managing standards is preferred to letting the marketplace decide..., coalitions generally offer the greater advantages with the fewest negative effects..., active government intervention in standard setting is preferable in some situations.”²

Within the communication industry, standards are an especially important element in the acceptance and diffusion of a new technology. Several communication technologies have floundered or failed for want of coherent, uniform standards. In the United States, quadraphonic sound, videotex, and AM stereo are classic examples. Given their inherent complexity, technical uniformity is particularly critical in television systems. The production, distribution, and reception of programming involves numerous sectors of the industry, and relies upon a complex chain of machinery. Such interconnections necessitate standardization within the television industry.

HDTV Standards

In the late 1960s, Japanese researchers for NHK began research on an advanced system of producing and displaying video images that utilized projected 35mm film as a technical benchmark. This research produced what became known as high definition television or HDTV. When compared with the existing world television systems, HDTV offers a wider aspect ratio, provides a significant increase in the number of scanning lines resulting in improved picture clarity and definition, and enables “CD-quality” audio. The technology was promoted by its early advocates as a potential basis for a new and unified world television standard. In the early 1980s, HDTV was demonstrated in the United States, and, as the decade progressed, the technology became a topic of increased discussion and interest.

Broadcasters, aware that alternative distribution systems like cable and direct broadcast satellites had fewer spectrum constraints and could adopt HDTV fairly quickly if they so decided, and cognizant of the increased competition at the Federal Communications Commission (FCC) for spectrum for non-broadcast applications, asked the FCC to act on HDTV. A coalition of 58 broadcasting organizations petitioned the FCC on February 21, 1987 to initiate a proceeding to explore the issues surrounding the introduction and

impact of advanced television services. The FCC concurred that the subject merited attention and, on August 20, 1987, opened a Notice of Inquiry to consider the technical and public policy issues of advanced television.

THE FCC STRATEGY

To assist them in the process, the FCC chartered the Advisory Committee on Advanced Television Service (ACATS) on September 30, 1987. The formation of the Advisory Committee differed from the traditional FCC approach of hearings and demonstrations. By making the FCC “dependent upon the private sector for assistance,” this action was a reflection of the prevalent deregulatory governmental philosophy.³ The ACATS charter states that the committee is to advise the commission regarding the facts and circumstances concerning advanced television, and should the commission decide that it would be in the public interest to adopt some form of advanced television service, the committee would also “recommend policies, standards, and regulations that would facilitate the orderly and timely introduction of advanced television services in the United States.”

Drawing upon the input of the Advisory Committee and the contributions offered through the public comment process by other affected parties, the commission issued a series of significant decisions over the next several years. While some of these decisions have been issued more tentatively than others, they comprise a coherent strategy on HDTV and have had a major influence on the shape and direction of advanced television within the United States. On September 1, 1988, the commission stated that “providing for terrestrial broadcast use of ATV techniques would benefit the public,” but HDTV systems must be compatible with existing NTSC service, and no spectrum space outside of the VHF and UHF bands would be allocated for such service.⁴ In September 1990, the commission refined its introduction strategy by announcing its intention to endorse a simulcast HDTV system.⁵

The transmission of conventional NTSC on existing channels and HDTV transmission of the same programming on a separate channel, it was felt, would enable a comparatively smooth and spectrum-efficient transition to the new standard. Such a strategy would also encourage the further development of new HDTV systems by freeing the technology from the inherent limitations of the existing NTSC system.⁶ In May 1992, the commission released several tentative decisions

concerning a timetable for industry conversion to advanced television service. These decisions were modified slightly, and the commission issued the following ATV implementation strategy on October 16, 1992.⁷ Broadcasters would have three years from after the time that an ATV allotment table was released or an ATV standard was set to apply for an ATV channel, and six years to complete construction of an ATV facility. The commission adopted a deadline of 15 years from the effective date of the new system selection or the allotment table, whichever was later, for final conversion. Also, the commission adopted a 50% simulcasting requirement, to be imposed one year after the six-year application and construction period ended and a 100% simulcasting deadline three years from that date. The commission defined simulcasting as “the broadcast on the NTSC channel of the same basic material broadcast on the ATV channel, excluding commercials and promotions.”⁸ Noting that the “adoption of specific dates and periods will lend a degree of certainty to the conversion plans,” the commission also released a timetable for review of the schedule, but cautioned that changes in the established existing timetable would not be made without substantial justification. In discussing the release of this implementation strategy and the pending standards selection, Commissioner Duggan rather succinctly stated that, “We are, in essence, decreeing the creation of a whole new broadcast television industry and the shutting down of an old one. We do not do so lightly.”⁹

TESTING AND EVALUATION

While the FCC began to articulate its strategy for the introduction of this new technology, testing and evaluation of the various proposed systems proceeded. Testing was conducted at the Advanced Television Test Center (ATTC), a non-profit organization funded by private industry, under the aegis of the Advisory Committee. By the time the actual testing had begun, the initial field of proposed systems vying for selection had narrowed dramatically from 23 systems to five. Another dramatic shift had occurred by the time testing commenced. While all of the various proposed systems were originally analog-based, four of the five remaining systems to be tested were exclusively digital.

The Advisory Committee compiled a test plan “of considerable depth and breadth with the advice of industry, and input of the systems competitors who

could be counted on to seek out flaws in each other’s designs.”¹⁰

System selection criteria fell into three categories. The category of spectrum utilization included a consideration of the anticipated service area for broadcasters, as well as a determination of the number of existing NTSC stations which could be accommodated by an additional ATV channel. Economic criteria included a consideration of the cost of ATV implementation for broadcasters and alternative service providers like cable system operators, as well as the cost of manufacturing ATV receivers. The third category, technology criteria, focused “directly on the benefits to the consumer that would accrue from adopting an advanced television system.”¹¹ This category included improvements in audio and video quality, transmission robustness, increased capability and flexibility in providing for a fuller range of services and functions, and the systems’ extensibility and interoperability. Extensibility is defined as “the ability of a transmission system to support and incorporate extended functions and future technology advances.” Interoperability is defined as “the suitability of the transmission system for operation on a variety of media, in addition to terrestrial broadcasting.”¹²

THE GRAND ALLIANCE

In February 1993, the Advisory Committee released their recommendations following the testing and evaluation of the five systems. While the committee recommended that no further consideration be given to the analog-based proponent, NHK Narrow-Muse, they could not select a single best system among the remaining four all-digital systems. Instead, they recommended that the four finalists be allowed to incorporate improvements and that another round of testing be scheduled. Facing the prospect of expensive retesting, lost momentum, the probability of post-selection litigation brought by losing proponents, and “a not-insignificant amount of political pressure,”¹³ the seven companies behind the four systems announced plans to work together toward one single proposal. Dubbed the “Grand Alliance” by the chairman of the Advisory Committee, Dick Wiley, the venture would create a new system which would be an amalgam of the “best of the best.” This alliance was structured to “bring all the power players in the North American continent’s competition into concert,”¹⁴ and represented a move toward the sort of consensus needed to accelerate the adoption of the new system standard.

The HDTV standards-setting process, formerly centered around a public competition of competing systems, became a collaborative process of designing and endorsing a new single system. Six “expert groups,” consisting of both Alliance and committee representatives, began the work of examining issues related to the new system. When the former competitors allied in the Grand Alliance could not reach agreement, they relied upon the input of users from the cable and broadcasting industries, as well as the increasingly vocal computer industry, funnelled through the “one channel with the most likelihood of early consensus, if not uniform agreement—the public FCC Advisory Committee process.”¹⁵ There was one particular area, however, where neither the Alliance members nor the industry end users could reach a consensus: whether the Grand Alliance system would utilize the traditional method of interlaced scanning or the progressive scanning format preferred by the computer industry. The solution, both technically feasible and reasonably cost-effective, was to design the Alliance system so that it would incorporate both scanning formats, rather than the traditional single “standard.” Such multiplicity of modes resulted in a system “that is maximally useful to all industries, rather than one that burdens one industry at the expense of another.”¹⁶

The Grand Alliance system has completed the laboratory testing phase and is currently undergoing extensive field testing. The Advanced Television Systems Committee (ATSC) is charged with the responsibility of documenting the new standard. The ATSC membership includes more than 50 entities involved in the delivery of television programming in the United States. On April 11, 1995, a six-week letter ballot of the ATSC members was closed, with 42 votes in favor of the Grand Alliance standard and two opposed. The ATSC has documented the Grand Alliance HDTV transmission standard and sent it on to the Advisory Committee.

While the HDTV standards-setting process has moved forward, yet another acronym has been added to the debate which could have a major effect on the direction and pace of the process: SDTV. SDTV—Standard Definition Television—has been defined as a digital television standard which yields picture quality roughly equivalent to today’s NTSC system. This development raised some important questions. For example, would HDTV be *the* television standard in the near future or only *a* television standard? In other words, would television providers be required to

adopt the HDTV standard or would they be granted the flexibility to opt for the increased quantity of programming that SDTV affords over the improved visual quality of HDTV? Would HDTV be a mandatory standard and would “universal access” to HDTV be an explicit policy objective?

HDTV has been a pressing issue that has remained on the FCC agenda through several changes of the guard. On July 28, 1995, the current commission held an open meeting to announce their position and thoughts on the new television standard(s). They issued a Notice of Proposed Rule Making (NPRM) to solicit comments on an array of topics and to “revisit decisions made in an earlier 1992 order when it was not apparent that digital technology would permit, among other things, multiple program streams to be delivered using a single 6 MHz channel.” The notice identified four goals central to the standards-setting process:

- Preserve free and universal broadcasting.
- Foster an orderly transition to digital technology.
- Eventually recover spectrum and utilize for new services.
- Ensure that the spectrum is used to best serve the public interest.

In a significant departure from previous commission decisions, broadcasters would be permitted greater flexibility in offering a mix of HDTV, SDTV, and other services. The NPRM also sought comment on crucial unresolved issues such as possible limits on the use of ATV channels, the length of the transition phase, and the obligations, requirements, and public service commitments of broadcasters in a digital world. The commission also announced a Notice of Inquiry soliciting comments on how best to utilize recaptured spectrum after the transition period. The FCC is anticipating two additional proceedings before the end of the year. Once the ACATS makes its formal standard recommendation, the commission will solicit input on the proposed technical standard. The next item will address channel allotment for the transitional period. The present timetable includes plans for a final report and order to launch advanced television sometime in 1996.

Conclusion

Previous television standards which have proven to be unsuccessful or short lived have primarily been

those connected with and promoted by a large single organization. In contrast, those standards which have proven successful (NTSC monochrome and 1953 compatible color standard) have evolved through a process of coordination and negotiation and have gone forward with the blessing of an industry coalition. Significantly, industry agreement was coordinated before submission for government adoption.

PROponents FOR AN HDTV STANDARD

With the promotion of the new HDTV standard, the establishment of such agreement and consensus has been an integral part of the standards-setting process. Advocates have voiced a wide array of benefits and advantages of the new standard. Early on, a need was articulated which helped to initiate the whole proceeding. Having emanated from Japan, HDTV was viewed by some, from the start, as a major economic threat to the United States. They argued that, should the United States fail to aggressively pursue development of its own advanced television system, the negative impact on the balance of trade, domestic employment, and U.S. global competitiveness would be dramatic. At the same time, these advocates argued that the technology represented a major economic opportunity for the United States to revitalize its consumer electronics industry and to stimulate domestic economic growth. The economic benefits of HDTV remain one of the key selling points espoused by supporters. When coupled with fears concerning national security and increased foreign control of the electronics industry, HDTV was introduced as a national priority—a technology that would have significant societal payoffs.

A series of technological arguments has also been presented in the calls for the adoption of a new standard. The inefficiencies of the current NTSC color system have led some to refer to it derisively as “Never Twice the Same Color.” The flaws of the 525 lines of resolution have hampered sales of large screen televisions. Some espouse a general feeling that a standard originally set in the 1940s is outmoded and does not represent an appropriate television standard for the 21st century. Many have argued that it is time for television to follow other technologies that have already embarked on the transition from analog to digital. Recent arguments for HDTV have positioned it as “a critical driver” of the new National Information Infrastructure.¹⁷ These and other arguments have helped to prompt the current HDTV movement and

continue to propel the standards-setting process forward.

OPponents TO AN HDTV STANDARD

Concurrently, there has been a countervailing movement which has affected the pace of this process. Critics have emerged and questioned the motives and assumptions underlying the call for a new standard. Some have questioned the beneficial economic ripple effects that will purportedly accompany the introduction of HDTV.¹⁸ Some have argued that the innovation does not provide the sort of leap in technology that would necessitate such action.¹⁹ Some have questioned the underlying assumption that the technology will be an attractive product for consumers. Preliminary studies examining consumer reaction to HDTV have indicated a fairly weak response.²⁰ While this data has been criticized as an inaccurate indicator of an unpredictable phenomenon, questions surrounding consumer reaction have prompted some to proceed with caution. In comparison to previous standards discussions, questions concerning the existing need for a new standard have been more prevalent. With both monochrome and color standardization, the debate was centered more on the issue of when, and not if, such standards should be set.

PRIVATE INDUSTRY VS. GOVERNMENT INVOLVEMENT

While the previous successful standards (1941 NTSC, 1953 color NTSC) emerged after a consensus was achieved between competing organizations within the broadcasting industry, consensus concerning the standardization of HDTV must be coordinated through a much broader assortment of interests and concerns. The decade of the 1990s has been characterized by a technological convergence which has broadened the discussion over the nature of a new television standard. A new digital standard could do more than just provide clearer and wider television pictures. It could enable unforeseen applications not presently possible under the current television system. The sheer diversity of the vested interests with a stake in a new standard has effectively served to slow the selection process and complicate the consensus building efforts.

The HDTV strategy that has emerged through this interplay of forces serving to propel and delay the process has been one in which the standards selection proceedings have progressed incrementally—moving, but not rushing, forward. At the center of this process is the FCC. In contrast to the public hearings which helped to shape and determine the timing and selec-

tion of previous television standards, the commission has organized an industry Advisory Committee to oversee and direct the HDTV proceedings. One of the functions of the committee has been to work toward the establishment of agreement and consensus within the standards-selection process. The creation of the Grand Alliance has been a major step in the effort to establish the sort of wide support necessary to move the standards forward through the commission. In the creation of a new system, the design procedure has become a public process whereby potential users can offer their input and affect the development stage. Fortunately, digital technology has given the Grand Alliance the unprecedented opportunity to accommodate several formats and standards. Such flexibility has been extremely influential in the efforts to cultivate a wide inter-industry endorsement of the standard.

With the private industry representatives on the Advisory Committee guiding the process, and with a testing procedure paid for by private industry, the FCC has been able to serve primarily in the capacity of "umpire" or "facilitator." The level of U.S. government involvement in the development of HDTV stands in marked contrast to the strategies adopted by Europe and Japan. In both cases, their governments have directly intervened and been very aggressive in promoting the early development of HDTV. As with any innovation, the timing of the system selection has to be weighed against the fast pace of innovation and the possibility that an improved system might emerge. The comparatively neutral position of the U.S. government has resulted in delaying the process, and has enabled the development of a superior all-digital version of HDTV. Many have held up the development of HDTV in the United States as proof that early government intervention in technological innovation may, in the end, be counter-productive.²¹

Following the advice of the Advisory Committee, the FCC has endorsed a strategy to introduce HDTV in a nondisruptive fashion. It has, in the words of the FCC's William Hassinger, established a framework that will permit the technology to "stand or fall on its own merits."²² While the process has been led and coordinated by private industry, a situation might emerge in the future which will necessitate increased government involvement and intervention. There is a strong possibility that widespread consensus will not be achieved through the deliberations of such a disparate body of players, and such disagreement and dissension will prompt government direction of the process.

To ensure that the technology be given a fair chance to establish itself, future government encouragement and action might be required. Should broadcasters be required to provide "universal access" to HDTV? If the market appears to be limited, should they still be required to invest in the equipment upgrades? Should consumers be slow in responding to the technology, as was the case with color, how long will the technology be given to succeed? If the majority of consumers do not embrace the technology, which to some is a real possibility,²³ at what point will the requirements be relaxed? Once set in motion, can the process be aborted? With regard to the provision of HDTV service, what constitutes the "public interest?" How efficiently can the marketplace support two new television standards? These are the types of questions that may confront policy makers in the near future, and which might prompt a more interventionist government stance.

The HDTV standards-setting process is unique and unlike any previous development. The international dynamics surrounding the technology and the global "race" to develop and adopt a new standard have played a significant role in the process. The sheer number of issues and industries involved has made the process more complex and cumbersome than previous standards deliberations. The unforeseen possibilities of a digital system and the unique ability of the Grand Alliance system to accommodate multiple formats indicate that this standard is considerably "less defined" than previous standards. In addition, the sheer magnitude of the plan to bring this technology in as a replacement system for an existing and deeply entrenched standard is unprecedented. With the first monochrome standard, no officially sanctioned standard needed to be phased out. With the FCC initial adoption of the incompatible CBS color system, the established base of technology targeted for obsolescence pales in comparison. The recent discussion over the possibility of two new digital standards existing side-by-side also makes this debate historically unique.

The standards-setting process is a difficult and complex art. The process must balance the unpredictable nature of technological innovation and the ever-present possibilities of further improvements against the structure of bureaucratic procedures and the requisite need to create a semblance of certainty to propel the process forward. Considerations must also be given to the vagaries of the marketplace and the ambiguous concept of public needs and interests.

Thus far, the direction and development of HDTV in the United States has been in the hands of private industry leaders and government officials. Working together, government and industry have designed a fairly elegant plan which will allow for a nondisruptive introduction of this new innovation. Once the technology enters the marketplace, this strategy will be tested, as consumers will have their opportunity to influence the direction and ultimate fate of both NTSC and HDTV systems in the United States. nto

¹ M. Mirabito and B. Morgenstern, *The New Communication Technologies* (Boston, MA: Focal Press, 1990), p. 32.

² B. Rosen, S. Schnaars, and D. Shanni, "A Comparison of Approaches for Setting Standards for Technological Products," *Journal of Product Innovation Management*, Vol. 5 (1988):136-137.

³ C. Carbonara, "A Current History of High Definition Television," *HDTV World Review* (1990):7.

⁴ U.S. Federal Communications Commission, *Tentative Decision and Further Notice of Inquiry*, 3 FCC Rcd No. 23 (September 1, 1988), 6521.

⁵ U.S. Federal Communications Commission (September 21, 1990).

⁶ This strategy is similar to the approach followed by Britain in introducing their 625-line PAL color system while continuing 405-line monochrome service. See K. Blair Benson and D. Fink, *HDTV: Advanced Television for the 1990s* (New York: McGraw-Hill, 1991), p. 14.7 for further discussion.

⁷ U.S. Federal Communications Commission, *Memorandum Opinion and Order/Third Report and Order/Third Further Notice of Proposed Rule Making*, 7 FCC No. 22 (October 16, 1992), 6924.

⁸ *Ibid.*, 6929.

⁹ U.S. Federal Communications Commission, *Second Report and Order/Further Notice of Proposed Rule Making*, 7 FCC Rcd. No. 11, 3371.

¹⁰ P. Fannon, "And Then There Was One: A Market Meeting its Maker?" *Intermedia*, Vol. 21 (1993):39.

¹¹ U.S. Federal Communications Commission, Advisory Committee on Advanced Television Service, *ATV System Recommendation* (1993), pp. 7-9.

¹² *Ibid.*, pp. 7-13.

¹³ R. Hoffner, "Navigating HDTV's Tortuous Path," *TV Technology* (December 1993):24.

¹⁴ Fanon, "And Then There Was One," p. 39.

¹⁵ *Ibid.*, p. 40.

¹⁶ Grand Alliance HDTV System Specification (April 14, 1994), p. 2.

¹⁷ National Information Infrastructure and the Grand Alliance HDTV System (April 18, 1994).

¹⁸ See, for example, T. Moore, *The Promise of High-Definition Television: The Hype and the Reality* (CATO Institute Policy Analysis, No. 123, 1989) and U.S. Congressional Budget Office, *The Scope of the High Definition Television Market and Its Implications for Competitiveness* (Washington, DC: U.S. Government Printing Office, July 1989).

¹⁹ G. Gilder, "IBM-TV?," *Forbes* (February 20, 1989):72-76.

²⁰ See, for example, R. Neuman, "The Mass Audience Looks at HDTV: An Early Experiment," paper presented at the meeting of the National Association of Broadcasters (Las Vegas, NV, April 1988).

²¹ "Do Not Adjust Your Set," *The Economist* (February 27, 1993):65-66.

²² Interview with William Hassinger (July 20, 1994).

²³ *The Economist* (February 27, 1993):66.