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HDTV and DRM: A Need of Further Regulation?

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Georg Erber and Sven Heitzler
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Abstract

In Germany, the TV broadcasting of the Winter Olympics 2010 marked the official start of high definition television (HDTV). However, the transition from standard to high definition television has been significantly hampered by inconsistent change management. While the large international movie and TV-series producers aim for increased (end-to-end) intellectual property rights protection on the one hand, the satellite and cable-TV network operators in coalition with the private commercial TV-broadcasters strive for advanced business models with increasingly differentiated pricing models on the other hand. The resulting technological requirements lead to rapid changes in technology, which in turn affects consumers and equipment manufacturers. We analyze especially the related advancement of the systems and interface standards for encryption and copyright protection which are of central importance in this context, namely the so-called Common Interface (CI) and its enhancement to CI Plus as well as the HD+ satellite platform in order to identify critical issues for media regulators and competition authorities. Our analysis supposes that the German regulatory institutions' capabilities to deal with the issue of regulation against the background of efficient innovation management in a timely manner should be improved. This might also be an opportunity at the level of the European Community to set framework conditions based on principles similar to network neutrality to overcome the current deadlock in Germany and encourage regulatory reform. Especially consumer rights could be protected more effectively in a future regulatory framework for digital content distribution and in order to avoid a tragedy of the anti-commons being an impediment for the rapid transition to HDTV. Overall, our recommendations aim to contribute to achieve the goals of swift digitalization and transition to HDTV.

JEL codes L15, L51, L82

Key words HDTV, Innovation Management, Tragedy of the Anti-Commons

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HDTV and DRM: A Need of Further Regulation?

by

Georg Erber and Sven Heitzler

High definition television may now be poised for a breakthrough in Germany. Unfortunately, in the area of private free-TV, broadcasters and network operators are still blocking each other. Market participants hope to leverage encryption and digital rights management as sources of long-term profits. This, however, may come at the expense of television viewers. Despite the start of regular HDTV operations by public broadcasters, only a few consumers are currently in a position to actually receive high definition television. The government should facilitate a rapid resolution to the current standoff and ensure effective monitoring of competition by implementing new standards.

In the early 1990s, high definition television (HDTV) was touted in Germany as an upcoming new technology, but the promises made are, as yet, still unfulfilled as advertised or in the anticipated time frame.

Instead, the technological requirements for HDTV are being implemented in a series of small steps, for example, an initial conversion of screen display ratios from 4:3 to 16:9; then a transition from analog to digital transmission; and followed, with the introduction of flat screens, by a two-step improvement to image resolution, initially to 1280 x 720 pixels, and to 1920 x 1080 pixels as of today.

Ongoing Problems with HDTV Transmission and Reception

Recently, there is rapid growth in the introduction of HDTV-capable flat screen televisions in Germany (Table 1). However, despite a growing number of high definition capable televisions, viewers still face a rather sparse selection of television programs. Further the options for receiving HDTV transmissions are still quite limited because people lack the equipment required for reception.

HDTV is contingent upon the completeness of the HDTV value chain including all sub-segments that must be linked together in order to permit HDTV reception (Figure 1). At the receivers side, usually the reception of HDTV programs requires an HDTV receiver, in addition

to a flat screen, and these are typically not integrated into the screen itself, so they must be purchased separately.

With the start of the XXI Winter Olympics on February 12, 2010, both of Germany's public broadcasting companies began regular transmission of unencrypted HDTV signals. The 2010 FIFA World Cup, in June and July, was also aired in HDTV. Arte – the Franco-German cultural television network – is also transmitting some HDTV programs. It is expected that the range of available HDTV programming will incrementally expand.

HDTV transmission in Germany is primarily provisioned through the Astra satellite system. For cable television subscribers, most HD signals are fed into television cable networks in the pay-TV domain in January 2010 Kabel Deutschland, Germany's largest cable TV operator, agreed to transmit, unencrypted, the public HDTV programming on the company's digital cable TV networks.¹

Tabelle 1 - Revenues and sales of flat screens in Germany, 2005-2010.

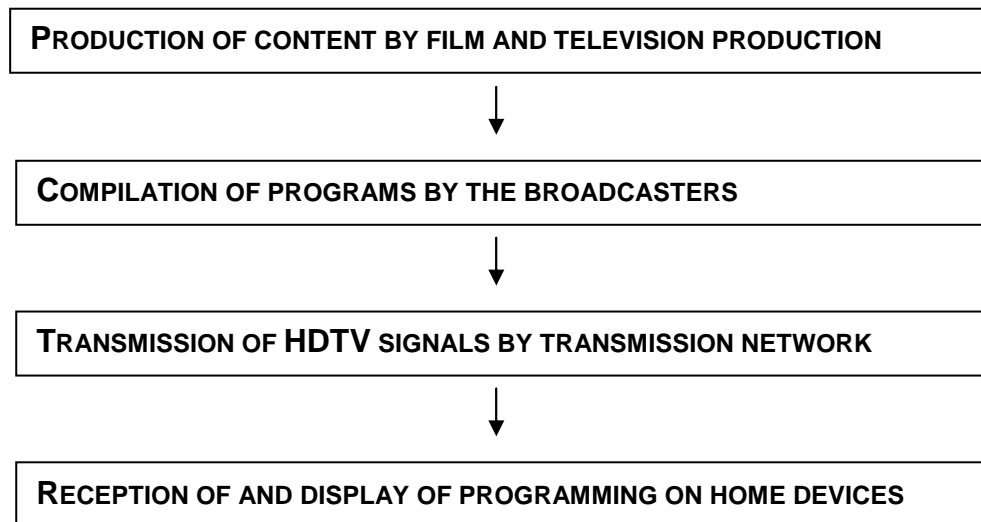
	Revenue			Sales		
	in Mill. Euro			in 1000 units		
	Total	LCD	Plasma	Total	LCD	Plasma
2005	2,149	1,474	0,674	1,612	1,297	0,315
2006	3,695	2,866	0,830	3,035	2,570	0,465
2007	4,269	3,568	0,700	4,411	3,883	0,528
2008	5,440	4,722	0,718	6,637	5,901	0,736
2009	5,600			7,700	7,000	0,700
2010				8,200	7,500	0,700

Source: GfK, EITO, BITKOM.

DIW Berlin 2010.

¹ As of 2010, in Germany there are five large providers: Unity-media (Hessen and North Rhine-Westphalia), Kabel BW (Baden-Württemberg), Kabel Deutschland (the remaining 13 federal states), Tele Columbus, and Primacon.

Figure 1 - The HDTV Value Chain



Source: DIW Berlin.

DIW Berlin 2010

In contrast to the situation in France, transmission using terrestrial digital video broadcasting (DVB-T) is not feasible in Germany due to the nature of existing transmission infrastructure that could not be upgraded to provide terrestrial HDTV transmission.²

In addition, Deutsche Telekom, Vodafone, and other providers feed HDTV programs through VDSL fiber-optic networks as a part of special entertainment packages. However, because VDSL is only available in a few cities, most German consumers wanting HDTV must obtain it through Astra, the satellite company.

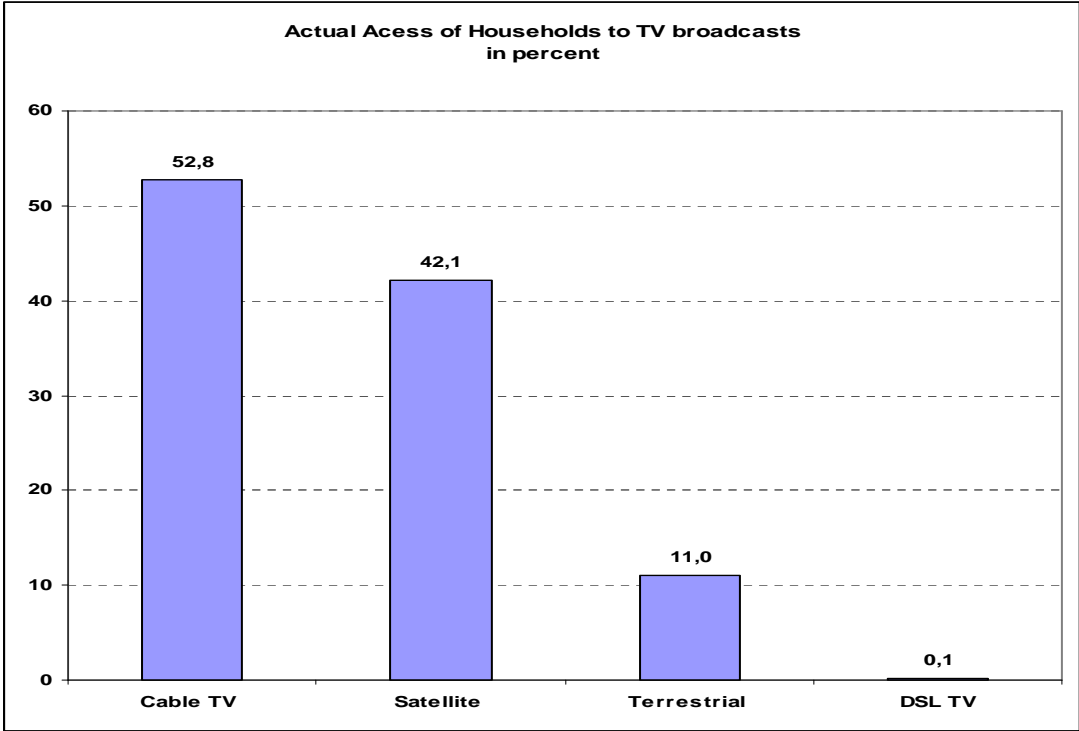
According to the 2009 Digitization Report, compiled by TNS Infratest,³ more than half of German households only have limited access to HDTV (Figure 2). Of course, reception via satellite is possible in principle, but of the 42 percent of households using satellite technology, many still need to upgrade their reception technology, or at least their HDTV receiver, before they can actually see HDTV. Because of the greater bandwidth required for HDTV, they might also find that their satellite equipment (satellite antennas and cabling as well as signal amplifiers) is inadequate, making additional upgrades necessary.

² In France, terrestrial transmission of HDTV started in 2008. At the time of the official launch of transmission, 27 transmitters supplied about 40 percent of the French population with HDTV content. By the end of May 2009, 60 percent of the population could receive the HD-Bouquet. This consists of the HDTV broadcasters TF1 HD, France 2 HD, Arte HD, M6 HD as well as Canal+ HD, for which a subscription is required. The French transmission company, CSA, has a timetable for introducing terrestrial transmitted HDTV. By the end of 2011, 90 percent of the French population should be able to receive terrestrial HDTV television. By the end of the first quarter of 2012, this should increase to 95%.

³ Ecke, O, Deck, R: *Digitalisierungsbericht 2009: Daten und Fakten*. TNS Infratest, ALM ZAK, Munich, July 2009.

This leads to the conclusion that, at this time, a large number of television viewers are still unable to see HDTV because of limited access options and the technical limitations of their installed devices. Therefore, the overall number of customers who actually see HDTV in the highest possible quality may be still negligible.

Figure 2



Sources: tns Infratest; ALM; ZAK.

Percentages do not add up to 100 because double access per household is possible

DIW Berlin 2010

About half of television viewers have cable access that only permits limited reception of HDTV; for satellite users, reception is theoretically possible, but requires the upgrading of receiving equipment.

Near future perspectives

The transition from SDTV towards HDTV is currently taking place in Germany. However, it is not clear how many of the particular obstacles in cable TV networks and terrestrial broadcasting via DVB-C2 whose standardization has been finalized in April 2010 will be overcome soon. These are particularly difficult where the cable network infrastructure is fragmented in a way that not the big cable network operators have direct control over the whole network infrastructure. Often real estate companies or private house owners have built their own cable TV networks. If they lack the incentive to invest in their networks the respective households cannot expect to be offered a cable network access.

Even if big cable network operators like Kabel Deutschland claim that whole cities like e.g. Berlin in Germany have access to HDTV via their cable TV this often cannot be confirmed for all households using cable TV for access. There seems to be a still lagging upgrading process of the existing cable TV networks.

Often the key focus of cable TV operators is still on offering digital access instead of analogue access of SDTV programs via their for this purpose upgraded cable networks. Since this already creates additional revenues for cable TV operator together often by offering triple play services, i.e. Internet-Access plus telephone services, HDTV is currently not a very hot topic on the cable TV operator agenda. Probably this might change when the recently released DVB-C2-Standard is implemented on the cable TV networks.

Since until recently the lack of HD+ receivers or HD+ Modules – delivery started only in May 2010 (about 300.000 have been delivered since then according to an official at the IFA HD+ booth) – made it impossible to obtain from Free-TV operators HDTV signals via cable networks, their full spectrum of TV-programs offered in SDTV could not be made available. Furthermore those who buy HD-receivers which are incompatible with HD+ have to wait until a solution might be offered at the end of this year according to HD+.

To increase revenues the cable TV operators also try to lease HD receivers to their customers invested to encourage them to buy this equipment themselves. This also goes together with long-term contracts of 24 months similar to those common in the mobile phone industry.

Often customers who bought off the shelf HD-receivers from third party distributors run into technical problems when they tried to use them with their particular cable network operator. This often discourages rapid adoption of HDTV.

Furthermore the HD-channels do not broadcast their whole program completely in HD-quality but only some parts of their program is really offered in HD-quality. By using up-scaling - a technique to generate pseudo-HDTV content from lower resolution sources via interpolation algorithms – the amount of HDTV content is currently extended when older content has not been recorded already in HD-quality, i.e. native HD-quality. All in all a full-scale HDTV-broadcasting of programs will still be a time consuming process.

This delay of a coherent diffusion strategy of a HDTV-migration will most likely slow down the adoption of HDTV in Germany in the near future. It is just this coordination failure which hampers the more rapid and smooth diffusion.

Copyrights, Digital Rights Management, and Distribution Battles

The introduction of HDTV is further complicated by disputes and uncertainties regarding the standards employed for copyrights and for Digital Rights Management (DRM).

Content Producers Insist on Copyright Protection with CI Plus

Especially the large international film and television companies place great stock in protecting their content from unwanted copying, as high-quality pirated recordings could be made from HDTV broadcasts. These firms, as the providers of content indispensable for an attractive programming lineup, can compel copyright protection.⁴ Film and television companies seek to prevent illegal pirating with end-to-end control (from initial production to final viewing) of media content.⁵

To this end, the Digital Video Broadcasting Project (DVB Project) developed a DRM system. It was adopted in 1997 in the form of the Common Interface (CI) Standard and became the prevailing standard for protected pay-TV transmissions. However, the CI Standard no longer fulfills current requirements concerning security and functionality, and for this reason the DVB consortium worked for a number of years on a set of updated specifications, known as CI 2.0. As the work did not lead to an updated standard, a group of companies established the “CI Plus Forum” in 2007; issuing a specification for CI Plus in January 2008.⁶ In November 2008, the CI Plus Forum was dissolved and supplanted by the CI Plus Limited Liability Partnership (CI Plus LLP), with the mission of establishing CI Plus in the marketplace and issuing licensing rights for components offered for sale.

Broadcasting Stations and Network Operators Must Upgrade and Wish To Do So

Since the principle content producers united to support the implementation of enhanced DRM technology and threatened to only license content if such systems are used, the broadcasting stations are under great pressure to introduce CI Plus.

Nevertheless, the implementation of a DRM system of this nature also provides opportunity for the introduction of new fees and innovative business models. Currently, private free-TV broadcasts are financed exclusively through television commercials and there are no additional usage or reception fees for viewers.

While the public broadcasting companies plan to continue broadcasting without encryption, the private free-TV broadcasters intend to encrypt programming, much like pay-TV broadcasters. In this regard, free-TV operators are supported by cable network operators and the interest group ANGA.⁷ Additionally, the satellite operator SES Astra is planning to encrypt high

⁴ Among the largest content producers are: Fox Entertainment Group, Paramount Motion Pictures Group, Dreamworks SKG, Sony Pictures Entertainment, MGH Holdings Inc., NBC Universal, Time Warner, and the Walt Disney Motion Picture Group.

⁵ Thus, the debates playing a central role regarding music downloads are reproduced. Erber, G: Musik-Downloads: Anbieterspezifischer Kopierschutz wettbewerbswidrig. *DIW Weekly Report No. 11/2007*.

⁶ The founding companies included Neotion, Panasonic, Philips, Samsung, SmarDTV and Sony. CI Plus, in its current version, is not an official standard, so there is a risk that additional changes may occur before an official standard is agreed upon.

⁷ ANGA – Verband Deutscher Kabelnetzbetreiber, e.V. (Association of German Cable Network Operators). ANGA represents the interests of more than 120 leading companies in the German broadband branch, including Kabel Deutschland, Unitymedia Group, Tele Columbus, Kabel Baden-

definition transmissions of the freeTV signals using CI Plus (under the brand name HD+). Of course, this fundamentally contradicts the principle of free-TV, which is supposed to be offered free of charge. Currently the status quo is maintained with SDTV broadcasts. The question is for how long this parallel broadcasting of the two different picture quality standards will prevail. If SDTV is switched-off, then the encrypted HDTV-broadcasting infrastructure will already be, *de facto*, in place. This will make it difficult for legislators to change this *de facto* situation when changing the legal and regulatory framework.

Both television broadcasters and transmission network operators hope to obtain additional income in the form of monthly fees. In the middle and long run, implementing a new and lucrative revenue models based upon the offering of customized programming and the stricter control of usage is sought. Thereby, network operators could, in principle, require fees from both viewers (for the provisioning of HDTV signals) and from broadcasters (for the transmission of HDTV), the latter of which would then have to incorporate these fees into their own price structures.

Thus, the business models of private HDTV providers differ in some important respects from the current private free-TV model, which does not allowed for the differentiation or customization of media offerings.

Consumers Potentially Disadvantaged

The introduction of HDTV technology involves a number of consequences for consumers, including additional fees for receiving transmissions from private broadcasters, the expense of purchasing suitable terminal devices, along with the uncertainty of their continued suitability for future use.

The traditional wide-ranging ways to view commercial free-TV are now being questioned by private television broadcasters, film and television producers, and network operators. Today, it is legally permitted and technically possible to record programs and copy them for private purposes, to edit them (for example, to remove the commercial breaks from a movie), and to play them back on any compatible viewing device whenever and however often one wants. All of these possibilities, however, can be significantly restricted through CI Plus.

Consequently, encryption not only serves to protect media content from illegal pirating, but it also systematically expands control capabilities, thus better enabling providers to extract consumer rents through the billing of special usage rights.

Wu'rttemberg, PrimaCom, NetCologne, EWE TEL, Marienfeld, and wilhelm tel. Additional association members include network operators such as HanseNet/Alice, UPC Austria, M-net, and Colt Telecom. The cable network operators in ANGA directly or indirectly serve more than 18 million of the approximately 19 million cable customers in Germany. At the end of June 2009, about two million households used them for cable connection as well as for broadband Internet access and telephony.

If the industry is able to enforce the introduction of CI Plus, customers will be obliged to purchase new receivers or make costly upgrades. Even customers who already own HDTV technology will be required upgrade if their equipment is only compatible with CI. However, many manufacturers already include CI Plus technology in the products, either to make them already CI Plus-compatible, or to enable future compatibility with a software upgrade.⁸

Small Equipment Manufacturers at a Disadvantage

In addition to such direct effects upon the consumers, additional, indirect, disadvantages can be expected. For example, the technical CI Plus licensing requirements are likely to reduce product variety.

The reduced variety may result as a consequence of the technology required for transmission protection, which requires great effort if it is to be implemented in computers or game consoles, and because of reduced consumer demand due to uncertainty concerning compatibility. Moreover, there is criticism of the relatively high costs for certification and licensing of devices and software, as well as for digital certificates, which tend to put smaller manufacturers at a disadvantage.⁹

No Agreement Expected Among all Stakeholders

It should come as no surprise that the introduction of HDTV is linked to long-term strategic goals, especially those of commercial television broadcasters. These goals extend far beyond copyright issues. Producers, broadcasters, and network operators all want to secure the largest possible share of revenues from HDTV. Therefore, a cooperative equilibrium, that is, a solution everyone agrees upon, is difficult to achieve, if not impossible due to the oligopolistic structure of the market and the limits to cooperation without violating antitrust law. The failure to coordinate the behavior of various stakeholders has impeded the introduction and broad utilization of HDTV in Germany, even though the necessary technology is essentially available.¹⁰

When intellectual property rights are held by a range of heterogeneous market participants, market failure can occur when introducing systemic innovations. This causes social welfare to suffer, as a cooperative solution concerning the innovation rent distribution fails due to the

⁸ Thus, a few manufacturers have already announced such software updates or included the new technology in their model series without mentioning this in their catalogs or similar publications.

⁹ “For [...] small and mid-sized companies with their own development departments like Dream Multimedia or MASCOM (Alphacrypt), this involves a large chunk of additional investment.” See: <http://hardware.magnus.de/desktop-server/artikel/digital-tv-in-ketten-neue-schnittstelle-ci-sperrt-nutzer-aus.2.html>; and *CI-Plus-Debatte: Zertifizierungs- und Lizenzkosten im fünfstelligen Bereich*, www.infosat.de/Meldungen/?msgID=52057.

¹⁰ Heller, M.: *The Gridlock Economy: How Too Much Ownership Wrecks Markets, Stops Innovation, and Costs Lives*. New York 2008.

individual economic incentives. In economic theory this form of market failure is described as the “Tragedy of the Anticommons.”¹¹

Market Foreclosure and Predatory Strategies Are Possible

From an economic perspective, the core question concerning CI Plus are, how much vertical integration including terminal devices is acceptable; how to distribute rents; and how open should the interfaces be. In this connection, the terminals may contain *shared infrastructure* components. This could make it possible to request a specified minimum level of transmission quality, but could also serve to bring encryption and digital rights management right to the television screen.¹²

If sufficient competition would prevail at all levels of the value chain, foreclosure and predatory strategies would remain irrelevant. However, if we assume instead that there are network operators of different size, partially holding market power, then the situation fundamentally changes. Such a situation would foster opportunities and incentives for the transfer of market power to other markets, especially through network effects.¹³ Accordingly, small providers have already announced the intention to file complaints with the Federal Cartel Office.

Incentives to abuse market power are grounds not only for monitoring under general competition law, but also for additional requirements to ensure access to important non-replicable facilities (as provided for by the German Telecommunications Act) and for guaranteeing the interoperability of individual networks and terminals through the establishment of common standards (as foreseen under the *Rundfunkstaatsvertrag* [Interstate Broadcasting Agreement] and the EU’s Interoperability Directive).

Thus, the impact of CI Plus varies between the different submarkets. In the movie market, where consumers have alternatives available (video rentals, online video services, or DVD purchase), the impact is less than where for current events, such as sports, there are hardly any (demand-side) substitution possibilities. For example, if any particular type of sport is exclusively transmitted by a single broadcaster through a fixed infrastructure partner, then consumers face significant disadvantages as a result of this kind of monopolization of the platforms by means of an exclusive, non-substitutable program.

¹¹ Heller, M.: The Tragedy of the Anticommons. In: *Harvard Law Review*, Vol. 111, 1998, 621–688.

¹² In this respect, the debate about CI Plus shows parallels with the debate about net neutrality (NN). In the case of net neutrality, however, there is a fear of discrimination against applications, and with CI Plus, the issue is discrimination against television broadcasters and equipment manufacturers by content producers and broadcast operators.

¹³ If a bottleneck exists within a distribution chain in the sense of diminished alternatives (i.e. when cable networks or satellites are the only option for reception), then this leads to a situation in which opportunities for profits are exploited by content providers (broadcasters); incentives to introduce new innovations are diminished; price discrimination against consumers is easier to impose; and competition-stifling behavior towards competitors becomes easier. See also Baake, P., Heitzler, S.: “Next Generation Networks” – Neue Herausforderung für Regulierung. *DIW Berlin Weekly Report No. 26/2007*.

Since only satellite transmission and, to some extent, high-speed broadband Internet access can offer the necessary resources for transmission, exclusive vertical agreements between network transmission operators and other market participants are in particular need of careful review by the Federal Cartel Office.

Existing Usage Options Questioned

Currently private free-TV should be exclusively financed through advertising revenues. However, as this source of revenue is nearly fully exploited,¹⁴ it should come as a no surprise that private free-TV broadcasters are looking for new sources of revenues.

Gradually private free-TV could be transformed to resemble the pay-TV usage model. However, this would transform Germany's dual broadcasting system, in which private and public broadcasters operate alongside one another, into a system of public free-TV and commercial pay-TV. Whether such a transformation would prove reconcilable with existing licensing contracts between private free-TV broadcasters and state media authorities, and with the currently valid federal broadcasting treaty, remains unclear.¹⁵ Rescinding and reissuing licenses under altered licensing terms may be necessary. Simply switching license contracts with the same existing licensees would potentially exclude competitors from obtaining a license to enter the pay-TV market. In order to create a level playing field, a process similar to the auction of broadcasting frequencies by Germany's Federal Network Agency might be preferable.

Additionally, changes to the existing legal framework may be appropriate to prevent negative effects on consumers from the extension of existing digital platforms. In the U.S., for example, the FCC introduced four new consumer rights provisions in response to the debate about net neutrality, including the right to open access to all content, applications and services, as well as the right to be able to use terminal devices of one's choice.¹⁶

Expediting Agreement among Stakeholders

Previous attempts by the film and television industry together with broadcasters and operators of television transmission technologies to find a solution that balances all interests, including those of consumers, have all failed, and there does not appear to be any feasible agreement in

¹⁴ Erber, G., Mundelius, M.: Online-Werbung: Wettbewerb und Verbraucherschutz kommen zu kurz. *DIW Berlin Weekly Report No. 9/2008*.

¹⁵ On 30 October 2009, the Conference of State Prime Ministers passed the 13th Interstate Broadcasting Treaty Amendment. With the signing of the 9th Interstate Broadcasting Treaty Amendment, the 8th Amendment was renamed effective March 2007 into the "State Contract for Broadcasting and Telemedia" (RstV), since a unified legal basis for the expansion of media content through broadcasting, television, and the Internet needed to be created due to the convergence of media.

¹⁶ See FCC: Federal Communications Commission Policy Statement, FCC 05-151, 2005.

the near future. Attempts to achieve and implement a solution by building coalitions have also run aground in the face of anti-trust considerations.¹⁷

Consequently, regulatory intervention needs to be considered as a means to finally resolve this debate, in the interest of the public interest, through the allocation and limitation of individual property rights. If the government can limit the ability of market participants to freely define usage rights and thereby, in particular, strengthen the rights of consumers, then it may be possible to achieve a better solution without the direct guidance of the government¹⁸ Currently, German consumers have no stake in the process of HDTV implementation: the only options are to take the proffered HDTV offerings or refrain from watching private HDTV. In the absence of an active effort to shape market developments, we can reasonably expect further obstacles to the introduction of HDTV and significant disadvantages for consumers in Germany as compared to other nations.

Conclusions

The introduction of HDTV in Germany has already encountered a host of obstacles, because individual participants were not ready to align individual interests with the common goal of broad-based introduction of this technology. Overall, this has led to significant welfare losses, since a technology that is ready for market has not been introduced due to coordination failures.

In particular, this is especially to the disadvantage of consumers who anticipated that HDTV would be introduced into regular service on a broad basis – that is, that HDTV would eventually be made available for all programming by every broadcaster on all available transmission platforms, i.e. if not through terrestrial broadcasting, then at least via satellite and cable TV.

Of course, consumer expectations have been deliberately aroused and advertising has sought to persuade consumers to purchase flat-screen TVs. Yet there is a failure of will on the part of commercial, free-TV providers to make HDTV available without restricting user options and new business models.

In addition, the push by private free-TV broadcasters to implement CI Plus in order to extend the control over content usage has fundamentally changed the legal position of consumers, especially regarding their right to make legal private copies of TV programming. While CI Plus

¹⁷ In 2006, the Federal Cartel Agency examined the encryption of ProSieben and Sat1 signals over the Astra broadcasting system. This encryption would have terminated existing free access to this TV channel. The television broadcasters, together with the SES Astra satellite operators, wanted to impose a monthly additional reception fee of 3.50 euros for end customers for the previously free reception of the channel. During the case, also prohibition was under serious consideration, but after the operators withdrew their plans, the case was closed without a decision. Equally as contentious is the so-called “basic encryption” of cable television through “set-top” boxes, which also seek to prevent previous free access to free-TV channels, including public broadcasting content.

¹⁸ Thaler, R. H., Sunstein, C. R.: *Nudge: Improving Decisions about Health, Wealth, and Happiness*. 2008.

offers producers, broadcasters, and transmission network operators new opportunities for revenues through a more precise control of rights, critics fear that consumers will be arbitrarily limited in their options, that consumers will face fees for previously free services, and that the choice of available terminal devices will be limited.

In such a value chain, vertical integration poses the additional risk of providing incentives for discrimination and predation on the part of providers who currently dominate their respective levels, which has to become subject to antitrust oversight and regulation.

The choice of the standard, prices, and access conditions for users, developers, and service providers, as well as the compatibility of standards with the requirements of competition, telecommunications, and media law should therefore be examined carefully by the Association of State Media Authorities and the Federal Cartel Office.

Regulation of network feeds, or simply the threat of such regulation, might accelerate the resolution of the problem of revenue sharing in the course of expanding HDTV services.

If broadcasters actually change their business model to charge monthly fees for HDTV reception, then regulatory authorities should to examine whether this change is compatible with existing broadcasting licenses or whether issuing new broadcast licenses might be necessary or useful.

As HDTV services expand, it will also be necessary to monitor the market on an ongoing basis in order to rapidly squelch and sanction possible anti-competitive activities.

Moreover, the difficulties associated with the implementation of HDTV could be avoided in the future with respect to other technologies through improved innovation management by the government. This, in turn, would enhance planning reliability for all participants. Clearly, regulatory intervention is often appropriate in order to prevent welfare losses, particularly when it comes to innovative markets with vertically integrated value chains.