Overview of digital television switchover policy in Europe, the United States and Japan

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Abstract

Purpose – *The purpose of this paper is to review current policy and practice in management of analogue-digital switch in broadcasting.*

Design/methodology/approach – *The paper adopts a case study approach.*

Findings – *The paper finds that with regard the objectives of switch-off, the broad policy aims of clearing spectrum, modernising infrastructure, and improving the services to the consumer are shared across the major countries studied. Uncertainty about the cash value and potential alternative uses of spectrum is natural given rapid technological change, but the common potential broadcasting uses include mobile television, high definition digital terrestrial television, and more digital broadcasters and channels, including regional and local developments.*

Research limitations/implications – *The study is restricted to Europe, Japan and North America.*

Practical implications – *The study has implications for assessment of European switchover strategies and role of Digital Terrestrial.*

Originality/value – *There are some overviews, but none of so up to date, nor with this geographical coverage.*

Keywords *Digital communications systems, Television systems, Europe, United States of America, Japan*

Paper type *General review*

1. Introduction

The transition to digital television at present is largely a preoccupation of the advanced economies of the world and the major markets are the USA, Japan and Europe – and, within Western Europe, the UK, Spain, Germany, Italy and France. This paper aims to draw out some of the findings from comparative policy analysis without trying to offer definitive conclusions at a time when developments are still very much in progress.

The paper does not attempt to provide an exhaustive survey but to portray the big picture – for four intertwined reasons. Research from different countries experiencing similar transitions can provide information about technical performance, market take-up, and consumer behaviour. Policy dilemmas and trade-offs experienced may be similar, in which case one can examine how and why have they been resolved differently, and whether a best-practice consensus is emerging. Markets (e.g. for transmission technology and receiver decoders) are trans-national. Finally, switchover policy making in the European Union (EU), in certain respects, takes place in conjunction with other member states.

2. The USA

2.1. Leap to digital high definition television

At the outset the digital television agenda in the USA centred on high definition television (HDTV). In 1986 Japan put forward its analogue high-definition system, Hi-Vision, as the

basis for a global standard. Had this been agreed, it would have placed the Japanese consumer electronics industry, already powerful in an increasingly global market, in pole position for the next generation of technology and products. US companies reacted by lobbying for a US version of terrestrial HDTV. The US Television market consisted of over 100 million homes with over two sets per household: prime territory for marketing a new generation of technology.

The Federal Communications Commission (FCC) set up an Advisory Committee and, after General Instrument announced a technical breakthrough in 1990, this recommended an all-digital HDTV system. After much testing, the Advanced Television Systems Committee (ATSC) standards for digital terrestrial television in the USA were established.

2.2. Evolution of FCC policy

The FCC's initial approach to digital terrestrial television was to loan all the existing terrestrial broadcasters an additional frequency (sufficient for an high definition (HD) transmission), oblige them to simulcast their analogue service in digital HDTV for perhaps 15 years, then shut down all analogue transmission and take back the extra frequency. The ''carrot'' for terrestrial broadcasters lay in free new spectrum and the absence of any new competition.

However, while plenty of broadcaster expenditure was envisaged, there was no source of additional revenue: simulcast advertising carried on the HD channel would initially be to tiny audiences. The broadcasters showed strong interest in standard definition digital services as well. By the time the legal foundations for launching digital terrestrial television were laid down in the 1996 Telecommunications Act, HD had become optional. The terrestrial broadcasters would be loaned the extra spectrum, but whether they used it for HD was left to their discretion. The simulcast requirement was eased and later removed.

In return for commercial flexibility, the broadcasters were required to achieve digital switchover on an accelerated timetable, so that spectrum could be released and auctioned. They were set staggered start-dates between 1999 and 2003 and the FCC's target was to terminate analogue broadcasting by 31 December 2006 (FCC, 1997).

The broadcasters lobbied for a softer switchover date and found ready allies in Congress. The Balanced Budget Act of 1997 introduced a qualification whereby analogue broadcasts could continue after 2006 if fewer than 85 per cent of households in any given area were equipped to receive digital terrestrial television (directly or via satellite or cable relay).

Even this plan hit problems. Many broadcasters faced planning or financial hurdles relating to transmission masts and were unable to start digital broadcasting on time. Digital television receiver sales were slow, as consumers waited for more digital content and lower receiver prices. No date for 85 per cent take-up could be confidently forecast.

2.3. Mandating digital television sets

The FCC acknowledged that 2006 was no longer credible and gave case-by-case consideration to arguments by broadcasters unable to launch on time, with penalties for undeserving cases. More controversially, it broadened the regulatory framework to encompass the receiver industry. It decided to use powers it had been granted in a different context under the All-Channel Receiver Act of 1962 to mandate the inclusion of digital tuners in new TV sets (FCC, 2002a). The receiver manufacturers challenged this in court. The FCC won.

The requirement is being phased in and is now due to be complete for all screen sizes by March 2007 (FCC, 2002b). One of the side-effects was an increase in the production of ''HD-ready'' flat screen television monitors with no tuner at all (but suitable for linking to a digital HD set-top box). However, the policy is beginning to show results and the receiver manufacturers, reconciled to it, have become advocates of fixing a ''hard date'' for digital switchover.

2.4. Cable and satellite

Terrestrial transmission is of only modest importance in the USA. Around 60 per cent of homes are on cable (a mixture of digital and analogue) and a further 20 per cent are served by digital satellite. In 2003 the FCC endorsed an agreement between the television set manufacturers and the cable companies on a standardised interface between the digital cable input and a digital television set, making it possible to ''plug and play'' one-way digital cable services without the need for a set-top box (although a cable card would be needed for conditional access)[1].

Cable companies are obliged, under ''must carry'' rules, to relay the local broadcast services. Satellite operators are not obliged to carry local broadcast services but, if they choose to do so for a particular market (which, in general, is an attractive business proposition), they have to carry all the relevant local services and not just some.

There has been much debate over how to apply this approach to digital television. Should the ''must carry'' obligation cover the new digital as well as the analogue broadcast services (''dual carriage'')? And if broadcasters transmit several standard definition services, do they all have to be carried (''multi-casting'')? The FCC's answer to both questions has been ''No''[2].

Post-switchover the broadcasters want cable companies to be obliged to carry their digital signals throughout their systems. Some cable operators want to be free to ''down-convert'' the digital signal at the head-end for analogue distribution to continuing analogue television viewers.

This issue remains unresolved but allowing this exception to an all-digital world could dramatically reduce the number of American households affected by switchover. The Government Accounting Office estimated in 2005 that about 19 per cent of US households (disproportionately non-white and Hispanic and disproportionately poor) rely wholly on terrestrial television, though switchover would also affect cable and satellite homes with terrestrial second and third television sets (e.g. in bedrooms or kitchens) (General Accounting Office, 2005).

2.5. Fixing a ''hard date''

Both political and industry pressures have been mounting to jettison the 85 per cent digital penetration threshold and fix a ''hard date'' for full digital switchover. Congress is interested in the contribution (variously estimated at between $10 billion and $30 billion) which a spectrum auction could make to reduce the federal budget deficit[3]. The 9/11 Commission (2004, p. 397) highlighted the need for increasing the spectrum allocated to ''first responders'' (fire, police, ambulance services) in an emergency – so taking spectrum away from television for this purpose commands political support. Through the High Tech Digital Coalition, leading electronics companies have emphasised the suitability of the released spectrum both for public safety use and for wireless broadband.

Spectrum reallocation has some support among consumer groups who are not opposed outright to switchover, but advocate a ''consumer-friendly'' implementation, with financial protection for those compelled to switch. The terrestrial broadcasters have invited the receiver manufacturing industry to design cheap converter boxes to enable analogue television sets to keep functioning when they receive only a digital signal. So there is political debate about whether such boxes should be subsidised and, if so, for whom and how. Putting warning labels on analogue receivers in the shops is also under consideration and would probably be accepted by the industry.

The timing mooted for a ''hard date'' is 2009 and the issue is currently caught up in the Congressional Budget Reconciliation process. Meanwhile, a great deal of work remains to be done. The FCC has to finalise the post-switchover frequency plan which will involve significant frequency changes (it has ruled out doing a phased switch-off, region by region, because of the complexity of frequency boundary issues among some 1,700 terrestrial broadcasters). Cable regulatory issues and copyright protection methodology need

resolution. Responsibilities and any new cross-industry collaborative arrangements need to be decided: Congress would make the decision about a ''hard date'' but would not lead implementation. Once responsibilities have been clarified, public communication needs to change gear and the logistics need mapping. The operational implications are not yet in sharp focus. However, a political decision to commit to 2009 would still allow three years for managing the practicalities of implementation.

3. Japan

In 1989 NHK, Japan's public broadcaster, launched analogue satellite services including analogue HDTV, financed by a supplementary licence fee. It was Japan's bid to have this HD technology recognised as the basis for a new global standard that triggered the rival digital television initiatives of Europe and the USA. Once the US committed instead to digital HD, Japan had to catch up in the new digital television business.

3.1. The framework for digital television

Japan has adopted its own set of digital television technical standards, termed Integrated Services Digital Broadcasting (ISDB), with some similarities to the European system. ISDB maximises technical compatibility between digital satellite and digital terrestrial television. This, coupled with agreement between free-to-view broadcasters on a common Conditional Access system to restrict copying, makes it possible to manufacture dual platform (satellite and terrestrial) HDTV sets.

These technical standards, along with spectrum allocation policy, were also designed to support mobile television via hand-held mini-televisions or mobile telephones. Unable to be first-to-market in digital television, Japan aspired instead to be the most far-sighted.

3.2. Digital satellite

Japan's first digital broadcasts started outside of its government-regulated framework. As Sky had done in the UK, multinational commercial companies entered the Japanese market using satellites to offer multi-channel subscription services for reception either via their own proprietary set-top boxes or via cable. One of these, Sky PerfecTV, has built up over 3 million digital satellite subscribers.

Government-regulated digital satellite television began in 2000, based on Japan's allocated direct-to-home satellite slots (Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan, 2002). NHK is licensed to provide three satellite channels: two simulcasts of its analogue satellite services and the third wholly HD. Licences also went to two pay television operations and five advertising-financed services provided by sister companies of the main terrestrial commercial broadcasters. An open market in digital satellite receivers developed, with tuners either built into, or sold to accompany, large flat-screen televisions.

However, by the time these government-licensed digital satellite services were launched, NHK had built up over 10 million supplementary licence fee-paying households on analogue satellite. It could not alienate this constituency of ''legacy'' households by compelling them to transfer to digital satellite without plenty of notice. The plan is to stop HD programming on analogue satellite in 2007 and to end standard definition analogue satellite services in 2011 (Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan, 2003).

3.3. Committing to full digital switchover

Through no coincidence 2011 is also the year in which analogue terrestrial television is due to end. The Japanese government boldly announced the analogue terrestrial switch-off date before digital terrestrial television in Japan was even launched. Indeed, for licensing reasons a precise date has been set: Japan is to switch fully to digital television on 24 July 2011.

The government motives, here as in other countries, are to remain abreast of changing television and telecommunications technology and to seize the opportunity to release, and

re-use, scarce spectrum. In this high-technology economy, spectrum is under heavy demand and vacated analogue television frequencies are likely to be used for digital radio and for telecommunications, including mobile communications.

The challenge of accomplishing digital switchover by this date is formidable. Japan is a densely populated country, with some 48 million television households possessing over 100 million television sets and a high level of communal reception. Cable and master-antenna relay systems account for around 50 per cent of households. The cable companies are mostly small and local – there are over 600 – and many lack the capital to switch to digital. The government is encouraging them to work to the 2011 timetable but has not required them to do so by law.

Perhaps the greatest challenge comes from Japan's mountainous topography. In total Japan has around 15,000 transmitting devices mounted on around 8,000 transmission masts (compared to the UK's 1,100 masts). Spectrum is intensively used and, whereas in the UK it has been possible to find new frequencies for digital terrestrial television in between the frequencies used for analogue, this is impractical in Japan.

Accordingly, the Japanese government decided to spend 180 billion yen (about £900 million) reorganising the analogue terrestrial frequencies in order to make space for digital terrestrial transmissions (Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan, 2002). This is a complex technical project, and over 4 million homes need to be visited for television retuning. The advantage of the scheme is that digital terrestrial services can be launched on their correct long-term frequencies, avoiding the complex four-year region-by-region digital frequency changes which switchover will involve in the UK.

3.4. Digital terrestrial services and receivers

The Japanese government awarded digital terrestrial licences to NHK and to the current terrestrial commercial broadcasters (of whom there are around 170), who are expected to make large investments in digital production and transmission infrastructure. A total of 85 per cent of their output has to be a simulcast of their analogue terrestrial services and 50 per cent has to be in high definition. The latter has the effect of requiring so much spectrum that, ahead of switchover, no new broadcasters can enter the market (a point which has perhaps helped soften the costs of switchover to the broadcasters).

New data-cast services will be launched and a segment within the spectrum allocated to each broadcaster has been set aside for transmission to hand-held mobile receivers from 2006. Initially the content for mobiles will simply be the main terrestrial output, but special programming specifically designed for mobile reception may be permitted subsequently.

Digital terrestrial transmissions to the Tokyo, Osaka and Nagoya regions – the main centres of high population – began in 2003. The extension of digital terrestrial television to the rest of the country is planned for 2006, only five years ahead of the switchover deadline.

Because the consumer proposition is based on HD, mainly free-to-view, services, reception is designed to be on new integrated HD digital television sets. These are normally flat-screen (as distinct from cathode-ray tube) and can receive both digital satellite and digital terrestrial services (assuming the appropriate aerial). They were initially introduced at the top end of the market, with large screen sizes and prices in excess of £1,000. There is as yet no substantial set-top box market aimed at converting analogue televisions, although stand-alone tuners are sold to work with HD-ready television monitors or with analogue HD sets.

Digital televisions are still regarded as expensive and analogue sales continue to dominate the market, outselling digital receivers in 2004 in a ratio of 3:1. However, for 2005 the ratio is closer to 2:1, so the market is changing[4]. For digital televisions to start outselling analogue sets on a major scale, digital tuners will need to be included in small screen-size models.

3.5. Collaborative action planning

In 2001 the government and the terrestrial broadcasters formed the National Council for the Promotion of Terrestrial Digital Broadcasting. It has produced a ''road-map'' giving dates and target coverage figures for the roll-out of digital terrestrial transmissions.

In 2003 it convened a wider body, called the National Conference for the Promotion of Terrestrial Digital Broadcasting, which also included the receiver manufacturers, the cable companies, local government bodies and other stakeholders. It issues annual Action Plans. The goal for 2011 is the conversion to digital terrestrial (or to wired relays of digital terrestrial) of 48 million homes and 100 million receivers, and key milestones have been set for take-up by 2006 (football World Cup in Germany) and by 2008 (Beijing Olympics) (Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan, 2003).

The Action Plans also cover activities carried out by a non-profit organisation formed by the broadcasters and receiver manufacturers to undertake promotion. This body runs an outsourced Call Centre (financed by a government grant), publishes explanatory leaflets, and administers a system for labelling receivers in the shops, including a yellow warning sticker with the date 2011, for display on analogue televisions. This is a voluntary system, only agreed after much dialogue about the need for a planned phasing-out of analogue televisions and about the obligation to give consumers timely information about potentially obsolescent equipment[5].

By the end of September 2005 a cumulative total of over 6 million digital terrestrial-capable receivers and digital cable set-top boxes had been sold[4] leaving a dauntingly steep graph of projected sales required for 2011 to be workable. On this basis digital household penetration is quoted as around 13 per cent, though the methodology for measuring it is still under review. Publicity about switchover remains relatively low key. Research undertaken in March 2005 showed that, while 66.4 per cent of respondents had heard about switchover as a long-term goal, only 9.2 per cent were aware of the 2011 deadline[6].

If there are any unvoiced doubts as to whether 100 million digital receivers will really have been sold by 2011, they may be offset by expectations of significant growth in broadband reception of broadcast television services. Japan has confidence in its high-tech growth. In 2004 the government published a White Paper noting that at the end of 2003 78.2 per cent of Japanese households had a personal computer; 61.7 per cent used always-on internet connections; and 93.9 per cent had mobile phones, of which 56.5 per cent were internet compatible (Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan, 2004). This is the electronic environment to which digital television is now being added. The Japanese government is unlikely to waver in its aim to release broadcasting frequencies for telecommunications.

4. Europe

4.1. The EU and the pattern of national diversity

In the 1980s Europe reacted to Japan's analogue HDTV initiative by developing its own rival analogue satellite system, including high definition, called Multiplex Analogue Component (MAC). Embodied in a European Directive, it proved technically over-ambitious and commercially disastrous.

In the 1990s European broadcasters and receiver manufacturers reacted against politically-driven high technology strategies and vowed to implement what the market would support. Many European countries, with a history of state or public service dominated broadcasting, had relatively few television channels. The market was ripe for multi-channel choice which new standard definition digital televison could supply. Unlike the USA and Japan, Europe therefore opted for standard definition digital television. While there is now a growing interest in HDTV, no European country's switchover policy is based on it.

Because of the failure of the MAC Directive and the liberalising trend emerging from Information Society documents such as the *Bangemann Report* and the *Green Paper on*

Convergence, the EU has favoured a market-driven approach to the digital transition. It endorsed the commercially-based and collectively developed Digital Video Broadcasting (DVB) standards and, by deciding not to be prescriptive in detail, has permitted considerable technical diversity.

The EU framework has been broadly set by the *Television Without Frontiers Directive*, currently under revision, the *Electronic Communications Framework*[7] and all areas of competition law, including the Merger Control Regulation Antitrust (Articles 81 and 82 EU Treaty), standards for services of general interest (Article 86) and State aid review (Article 87).

The *Communication on a New Framework for Electronic Communications Services* in 1999 (European Commission, 1999a) and the subsequent communication Principles and Guidelines for the Community's Audiovisual Policy in the Digital Age (European Commission, 1999b) crystallised a horizontal and technologically-neutral regulatory approach that was reinforced with the *Communication from Digital ''Switchover'' to Analogue ''Switch-off''* (European Commission, 2003). The switchover process was to be guided by a neutral multi-platform approach.

In 2005 the EU has reinforced its role of enabler: recommending that its members phase out analogue terrestrial broadcasting by 2012 through a coordinated approach[8] supporting a vision of the Information Society based on converging media services, networks and devices (European Commission, 2005a) and, with an eye on Europe's regional radiocommunications conference in 2006, advocating a common European approach and market mechanisms to manage radio spectrum[9].

However, policy decisions and timing issues have been left largely to member states. While national governments are not free individually to mandate digital television sets, for example, since the market for television receivers is a European one, in other respects they have considerable latitude. They are not precluded from taking steps to promote a specific technology for transmission of digital television as a means for increasing spectrum efficiency, provided such actions are ''proportionate''.

The result has been a very varied set of experiences in different European countries, reflecting different market sizes, the balance between platforms, the pattern of competition, the availability of terrestrial frequencies, the strength of the desire to safeguard public broadcasting and/or to foster broadcasting pluralism, and the degree of focus on re-using released analogue spectrum for other purposes.

Two general observations can be made: western Europe is much further advanced than eastern Europe; and smaller countries and/or countries in which cable and satellite predominate, and terrestrial reception is therefore relatively unimportant, are likely to find it easier to switch off analogue at an early date than others[10].

Beyond that it is necessary to look in more detail at the individual national experiences. The UK is a well-known case. Following the recovery from the collapse of ITV Digital in 2002, over two-thirds of UK households are now equipped for digital television, the highest digital penetration in the world. Digital switchover will be regionally-phased and is due to start in 2008 and finish in 2012. In the section below, for comparison, we describe briefly the situation in Europe's other major digital television markets: Spain, Germany, Italy, and France.

4.2. Four major national markets

4.2.1. Spain: a second chance for DTT. In Spain terrestrial television plays a major role. In a country with 13.7 million households[11] cable and satellite penetration is modest (1.1 million and 2 million subscribers, respectively[12]. A single satellite platform, Digital +, controls the pay-TV market. Even though Telefonica's TV over DSL has made an impact, a successful digital terrestrial platform is viewed as essential to analogue switch-off.

That is why after a period of inaction, on 30 November 2005, Spain officially re-launched digital terrestrial television. Its first venture into the field ended with the collapse of the

pay-television service, Quiero, in circumstances similar to those surrounding the collapse of ITV Digital in the UK. The new Government elected in 2004 decided to modify the regulatory framework and technical plan and re-launch DTT before the end of 2005, bringing forward analogue switch-off from 2012 to 2010. Free-to-view services, with a key role for the state broadcaster, RTVE, are central to the scheme.

Technical planning takes account of possible mobile and HD developments and after switchover, each existing analogue national broadcaster will get a whole multiplex. In addition, the 17 Spanish regions (''*Comunidades Autónomas*'') have been granted a second multiplex. The Canal + pay analogue channel was converted to free-to-view (and renamed Cuatro) and another new analogue terrestrial channel, La Sexta, was created: both have digital terrestrial simulcasting obligations. The strategy is to drive through switchover spearheaded by a ''Freeview''-style digital terrestrial platform. At regional and local level public competitions are being organised for the regional and local services.

There is now an open market in unsubsidised receivers, but the receiver market is still in its infancy. There are no official plans to subsidise digital take-up and/or digital switchover, though all main stakeholders demand subsidies. Nor are there any official plans to mandate digital television sets or label analogue televisions as obsolescent, despite pressure from manufacturers.

The switchover process is organised through the government and the independent regulatory commission. In 2005 a new stakeholder body, the ''Comisión para el Seguimiento de la Transición a la Televisión Digital Terrestre'', was set up under the presidency of the State Secretary of Telecommunications, to foster digital terrestrial and establish a switchover strategy – and the broadcasters launched a new organisation to undertake promotion.

After a period of relative stagnation following the collapse of Quiero, digital terrestrial television in Spain now has a second chance, strongly linked to switchover. The plans are now mostly laid, though some uncertainties remain; the platform has been relaunched; it remains to be seen what will happen in practice.

4.2.2. Germany: switchover through low dependence on terrestrial. The German television market is dominated by cable: in a country with 36.2 million households, only 2.6 million rely on terrestrial television, cable penetration is the highest at 20.6 million, followed by satellite at 13 million[13] (satellite has a strong free-to-view character in Germany, as well as offering pay television options). The number of people directly affected by analogue terrestrial switch-off is therefore relatively small. Digital switchover began in 2002.

Frequencies for terrestrial broadcasting in Germany are scarce and there was no possibility of having a lengthy period of digital and analogue simulcasting. Digital terrestrial is therefore being launched shortly before analogue switch-off and marketed on the basis that analogue transmissions will cease. The switchover process is regional, based on ''islands'' formed by large conurbations, under the regulatory authority of the ''*Lander*'' who have responsibility for media regulation.

It is significant that digital terrestrial has been chosen to facilitate switchover. The alternative would have been to attempt to convert everyone to cable or satellite, with satellite as the non-subscription option. This, however, would have been more disruptive and expensive for consumers, satellite signals in urban environments are subject to high building shadows, and many cable operations take their feed from terrestrial transmissions. Terrestrial is also valued by some consumers for portability and set-top reception, often for second or third sets (and Germany's technical planning takes this into account). The potential of digital terrestrial for mobile reception was also a factor.

Digital terrestrial was initially launched in Berlin in October 2002. Legislation has been in place since spring 2002 and the sunset date for completing switchover, following a detailed timetable, is 2010. Analogue switch-off has now already happened in several regions[14]. There is an open market in digital terrestrial receivers, with about 20 models available and an average cost of 100 euros (*Screen Digest*, 2004). The business model is free-to-view.

The Berlin government body, MABB, coordinated all the terrestrial broadcasters in its region and acted as an enabler for digital terrestrial, bringing together the main stakeholders to develop a joint communications campaign. ''Must carry'' obligations were imposed on cable. MABB also provided subsidies on the supply side (reduced the digital transmission costs to commercial broadcasters) and the demand side (supported set-top box rental and purchases). The European Commission has recently ruled against the supply side subsidy.

It is unlikely that digital terrestrial coverage will be universal, and some rural areas will rely on the established pattern of free-to-view satellite reception. Nevertheless, the public broadcasters have committed to bring digital terrestrial television to 90 per cent of the population, beyond the major conurbations and into more rural areas, making it available to 45 million Germans, although only a small fraction will use it.

Completion of analogue terrestrial switch-off by 2010 in Germany looks very feasible. Germany will almost certainly be the first major European market to complete the process and the primary reason for this is its relatively low dependence on terrestrial reception.

4.2.3. Italy: an unusual subsidy policy. The Italian market is dominated by free-to-view multichannel analogue terrestrial services. There are eleven analogue terrestrial channels, essentially constituting a duopoly in that RAI, the public service broadcaster, and Mediaset, the dominant commercial broadcaster, own three channels each and between them account for approximately 90 per cent of the audience. In a country with 21.5 million households, cable penetration is low (0.2 million) and satellite services, though they dominate the pay market, are limited compared to other countries (2.6 million)[13]. Overall, however, as in Spain, terrestrial remains the dominant means of television viewing and digital terrestrial is seen as critically important to analogue switch-off.

Although Italian regulators regarded the introduction of digital television as an opportunity to restructure the terrestrial sector and introduce more competition, the historic RAI-Mediaset duopoly continues. Legislation passed in 2001 was modified, controversially, in 2003: the so-called Gasparri Law overturned an earlier Court ruling that would have forced Mediaset to give up on one of its three analogue terrestrial channels in order to promote pluralism. So Mediaset and RAI retain their hegemony and, at present, digital terrestrial development rests on cooperation between them.

Mediaset was first to launch in December 2003 with a multiplex of five channels. RAI followed one month later with two national multiplexes. In January 2004 Telecom Italia and TV International launched two channels and in February that year TF1 and Holland Co-ordinator and Services (HCS) reached an agreement to exploit another multiplex. By the end of 2004, five multiplexes were in operation. Approximately 25 national channels and 40 local ones, including the simulcast of the existing national terrestrial channels, are available in total[15]. The business model for digital terrestrial was originally all free-to-view, based on advertising revenue. However, led by Mediaset, the broadcasters decided to challenge Sky Italia in offering premium content and now offer event-based pay-TV content through pre-pay rechargeable cards.

Italy has had a rapid take-up: by mid-2004, there was a market of approximately 500,000 digital terrestrial set-top boxes (the cheapest ones are around 100 euros[16]. Growth was kick-started by the Italian government's decision to offer subsidies of 70 euros to consumers (provided they have paid their licence fee) with purchased set-top boxes capable of providing interactive links to web sites with the potential to support e-government development. Such digital terrestrial set-top boxes contain multi-media home platform (MHP) technology. Fastweb boxes can also qualify, but satellite receivers do not. While Sky Italia has complained about this, there is at present no indication that the European Commission will rule against this unique form of subsidy. Few e-government services are yet available and few receivers have a return path but trials are underway. RAI and Mediaset have accompanied the subsidised receiver purchase scheme with a strong marketing campaign. Two other organisations are involved: the independent regulatory body for converged communications and the ''Associazione DGTVi'' of stakeholders collaborating in the transition to digital.

While Italy initially launched digital terrestrial services to 50 per cent of the population, coverage is now being extended to 70 per cent and the longer term aim is to reach nearly 90 per cent of the population (with satellite coverage having a supplementary role). Due to spectrum constraints, a long simulcast period is impractical. Switch-off is therefore officially planned for the end of 2006 (a date established by law) and will be organised on a region-by-region basis. A very short transition period is assumed. The local governments of Sardinia and Val d'Aoste have already agreed with the national Ministry of Communications to switch-off their analogue signals in 2006. Subsidy may well be involved. The next candidate for analogue switch-off will probably be Friuli-Venezia Giulia. How much force the 2006 target will have in practice remains to be seen.

4.2.4. France: later terrestrial entry and MPEG4. The French television market is characterised by a large variety of pay-TV operators offering multi-channel television through cable and satellite, though their penetration is limited. In a country with 23.5 million households, 3.75 million subscribe to cable and 4 million to satellite[13]. As in Spain and Italy, terrestrial remains the dominant means of television viewing and the existing terrestrial broadcasters are major players.

France has been a relatively late entrant to digital terrestrial tlevision, following strong initial opposition from commercial broadcasters and lengthy debates about the regulatory framework (put in place in August 2000 but altered in 2004). Digital terrestrial was finally launched in 2005, however, with the goal of analogue switch-off in mind.

Finding frequencies has not been easy and has involved some analogue frequency changes. Digital transmission obligations are based around providing about 85 per cent coverage from 115 transmitter sites by 2007. How to cover the rest of the country has not yet been decided and a Task Force has been created to propose technical, legal and economic solutions. The analogue switch-off target is 2010 (five years after the launch of digital terrestrial) provided receiver penetration is high enough. In other words, this is not a hard date.

''Télévision Numérique Terrestre'' (TNT), the first French digital terrestrial service, was launched on a free-to-view basis on 31 March 2005 following a protracted regulatory process[17]. Digital cable operators (not satellite) are obliged to carry the free-to-view channels. Digital terrestrial television in France is following a hybrid free-pay business model. A total of 18 free-to-view national channels are currently being offered[18]; 11 pay-TV national channels (www.csa.fr/upload/decision/multiplex_19juill2005.pdf) will be on the air by March 2006 at the latest. The regulatory body has decided to reserve three channels per area, which can be shared, for local and regional broadcasters.

While all other European digital terrestrial television, including the French free-to-view services, use the well-established MPEG-2 coding system, France has decided to introduce a more advanced compression system, MPEG-4, for its digital terrestrial pay-TV services. Because it is less demanding of spectrum, MPEG-4 is likely to be used in due course for high definition digital terrestrial television, for which France is making planning provision. France is also considering mobile television, based on the DVB-H standard, and trials are underway.

Meanwhile growth in MPEG-2 digital terrestrial television makes progress. According to the regulator, reception equipment is available at prices ranging upwards from 79 euros. TNT quotes digital terrestrial penetration at 8 per cent of covered areas and forecasts 2005 receiver sales of 1 million.

5. Market-specific and common features

Across the globe and within Europe, several of the features of digital television are specific to individual countries and help explain their different switchover strategies. Key differences include:

- size of market;
- extent of analogue multi-channel television before start of digital;
- scope for HDTV versus scope for more standard definition channels;

- relative importance of terrestrial in relation to satellite and cable;
- strength of satellite and/or cable pay-TV;
- availability of frequencies for digital terrestrial before analogue switch-off;
- role played by public service or state television;
- nature and scale of competition among commercial television companies;
- strength of concern about the prevention of copying (greater for HD services);
- degree of government interest in interactive services via digital television; and
- detail of plans for auctioning and/or re-using released spectrum.

It is easier to point to differences than to point confidently at common features and principles, which some unexpected development in the future could contradict, but the following observations form a helpful hypothesis at this stage:

- No country has decided to ''skip'' digital terrestrial completely, even countries where terrestrial reception is least important.
- No country has launched digital terrestrial without also adopting an analogue switch-off goal (implying a compulsory final phase).
- To facilitate analogue switch-off, digital terrestrial spectrum needs to be allocated to existing terrestrial broadcasters (not necessarily exclusively).
- To facilitate analogue switch-off, consumers need to be offered a free-to-view option with receivers available at affordable prices in the open market: in practice this tends to mean digital terrestrial and/or free-to-view digital satellite.
- Digital terrestrial pay-TV is commercially risky where satellite and cable pay-TV is well-established and/or strong – but hybrid free-pay digital terrestrial can work.
- Analogue switch-off dates which are set politically without regard to consumer take-up of digital television tend to be postponed.
- Full switchover is generally easier in countries where terrestrial reception is of limited importance and, at least in respect of their main television set, only a minority of households are affected.
- In countries where terrestrial reception is dominant, high digital penetration achieved during the period of voluntary take-up is important as a pre-condition of switchover, since this reduces the number of households whose main television set is likely to be analogue at the point of compulsion. Such take-up does not have to be exclusively digital terrestrial but other platforms only contribute if they carry digital versions of the analogue terrestrial services to be withdrawn.
- Coordination between government, regulatory bodies, broadcasters, and television manufacturers and retailers is important for a number of purposes: from standard-setting at the outset through to the practicalities of implementing switchover.
- Possible re-uses for released spectrum generally include high definition, greater pluralism, and mobile television, but also go wider than broadcasting.

6. Digital switchover: tentative conclusions

With regard to the objectives of switch-off (see Table I), the broad policy aims of clearing spectrum, modernising infrastructure, and improving the services to the consumer are shared across the major countries studied. Uncertainty about the cash value and potential alternative uses of spectrum is natural given rapid technological change, but the common potential broadcasting uses include mobile television, high definition digital terrestrial television, and more digital broadcasters and channels, including regional and local developments.

Alternative uses outside broadcasting are proposed in the USA, where there is a desire to allocate additional spectrum to the emergency services and perhaps to develop wireless broadband more fully. Options within Europe will depend on agreements with other

Table I Digital switchover at an over-simplified glance

	UK	*Spain*	*Germany*	*Italy*	*France*	*USA*	*Japan*
TV households (hhs million)	24.5	13.7	36.2	21.5	23.5	110	48
Switchover target date	2008-2012	2010	2010	2006 (start)	2010 subject to take-up	2009 is under consideration	2011
Importance of terrestrial (analogue/digital) in platform mix	High	High	Very low	High	High	Low	High
Role of digital terrestrial in switchover strategy	Major: full coverage for public services	Major: RTVE 98 per cent coverage	Minor, though coverage up to 90 per cent	Substantial: coverage target c. 90 per cent	Substantial: coverage target c. 85 per cent	Modest: only 19 per cent hhs without cable or satellite	Major role with cable (satellite does not simulcast)
Approximate per cent digital terrestrial hhs (estimate only: current figures not available on standardised basis)	21	1	5	13	3	3 (receivers with ATSC tuner)	13 (including cable relays)
Feasibility of achieving target switchover date	High	Too soon to say	High	End date uncertain	Date not hard	Date not yet hard, but 2009 possible	Too soon to say

countries, in the context of the major conference on regional spectrum policy in 2006 and bilaterally as well.

In relation to public policy intervention, no country has attempted to achieve an entirely ''hands-off'' digital switchover process. Government and regulators therefore have been involved in a range of interventions: from cajoling, facilitating industry bodies, formalising standard-setting, licensing new spectrum allocations, planning the practicalities of switchover and protecting the interests of the consumer. Where there is a major national public service broadcaster, it has generally taken a central role, though this role varies.

A range of other policy levers exists, including mandating digital tuners in new televisions, voluntary or required labelling of digital sets, and warning notices on analogue televisions for sale. These would naturally be the subject of consultation with industry and, in Europe, any mandatory regulation could have an EU dimension. Subsidy options can arise either in kick-starting digital television or in completing switchover. EU case law will evolve following the ruling that a Berlin subsidy was illegal.

While coverage and take-up criteria apply in judging the timetable, hard dates for switchover are required for both consumer and investor clarity once the prospect is imminent. Region-by-region switchover, if practical, has the potential to reduce risk and assist the logistics.

Digital terrestrial has a role in the switchover strategy of all the countries surveyed here. The pattern of launch of a pay-TV service and its collapse has been experienced by many countries, and its replacement with a free service is not unique to the UK. The extent of head-on competition with well-established satellite and/or cable subscription services is a relevant factor. No country in our survey has opted for an all-pay system of digital terrestrial: the emerging pattern is either fully free-to-view or hybrid free-pay.

Digital terrestrial's role in switchover varies according to the importance of terrestrial reception and the extent to which the analogue services to be withdrawn are available on cable and satellite. Whether full national coverage should be achieved by digital terrestrial or whether free-to-view satellite is appropriate as the only non-subscription option in some areas has been a matter for individual countries to decide and the resulting picture is a varied one.

When considering platform monopoly and pluralism, fears that switching-off of analogue terrestrial broadcasts might result in a decline in competition and pluralism by gifting dominance or near monopoly to one of the platforms – particularly one partially outside national jurisdiction – have been offset by the consolidation of the positions of incumbent broadcasters, whether on a single or multi-platform basis. Allocating digital terrestrial spectrum to existing terrestrial broadcasters has been a common feature of switchover policies. Whether the freeing-up of additional spectrum after analogue switch-off will bring greater pluralism will depend on regulatory priorities and ground-rules at the time the new spectrum is auctioned or allocated.

Finally, in relation to consumer information, the purchase of the right equipment for switchover, based on reliable and relevant advice, is of critical importance. At present digital television receivers are predominantly set-top boxes. However, the market for integrated digital television sets and its relationship to the growing popularity of flat-screen televisions will also be important as analogue switch-off comes into sharper focus. The range of equipment on which television via broadband can be displayed is also relevant. In the USA explaining the difference between HDTVs and HD-ready televisions, not to mention digital cable-ready televisions, is part of the communications challenge. Clarity of consumer advice is likely to be of increasing importance throughout Europe too.

Notes

1. FCC press release on easing digital TV transition for consumers, 10 September 2003.
2. FCC press release on resolving dual and multicast carriage issues, 10 February 2005.
3. See, for example, evidence from Motorola and from Aloha Partners to the Senate Committee on Commerce, Science and Transportation, July 12, 2005.
4. Japan Electronics and Information Technology Industries Association, November 2005.

5. Association for the Promotion of Digital Broadcasting, November 2005.
6. Norio Kumabe, Visiting Professor, Global Information and Telecommunication Studies, Waseda University, Japan, November 2005.
7. The new legal framework draws upon the following directives: Framework Directive, Authorisation Directive, Access Directive, Universal Service Directive and Directive on privacy and electronic communications.
8. European Commission (2004) (the EU had already requested that by the end of 2003 all members states submitted their plans for achieving switchover to digital television (European Commission, 2002)).
9. Three communications have been adopted: *A Market-based Approach to Spectrum Management in the European Union* (European Commission, 2005b); *A Forward-looking Radio Spectrum Policy for the European Union: Second Annual Report* (European Commission, 2005c); *EU Spectrum Policy Priorities for the Digital Switchover in the Context of the Upcoming ITU Regional Radiocommunication Conference 2006* (RRC-06) (European Commission, 2005d).
10. It is probable, for example, that Finland, Sweden, The Netherlands and Germany will complete switchover ahead of the UK.
11. End 2003, European Audiovisual Observatory (EAO).
12. 2004, CMT.
13. February 2005, Analysys.
14. DTT map in www.ueberallfernsehen.de/ North Rhine Westphalia, northern Germany and Bavaria, have followed Berlin; digital terrestrial services are planned to start in the Halle/Leipzig, Erfurt/Weimar and Rostock/Schwerin areas, with the Kassel, Mannheim and Stuttgart areas following.
15. A detailed offering can be found at www.dgtvi.it/stat/DGTVi/Page1.html
16. Recent STB prices comparisons at www.trovaprezzi.it/categoria.aspx?id=79&libera=MHP
17. The initial licensed national channels included simulcasts by the existing terrestrial broadcasters, six additional free-to-view channels, and 14 pay-TV channels. However, in October 2004, in the interest of pluralism the Conseil D'Etat revoked six of the channels awarded to Canal + /Lagardère. A public tender was organised to award them plus two more (initially reserved for the public sector but rejected by the government).
18. Details at www.tnt-gratuite.fr/

References

9/11 Commission (2004), *9/11 Commission Report*, authorised ed., W.W. Norton, New York, NY.

European Commission (1999a), *Communication on a New Framework for Electronic Communications Services*, COM 1999 (539) final, European Commission, Brussels.

European Commission (1999b), *Principles and Guidelines for the Community's Audiovisual Policy in the Digital Age*, COM 1999 (657) final, European Commission, Brussels.

European Commission (2002), *Europe 2005: An Information Society for All*, COM 2002 (263) final, European Commission, Brussels.

European Commission (2003), *Communication from Digital ''Switchover'' to Analogue ''Switch-off''*, COM 2003 (541) final, European Commission, Brussels.

European Commission (2004), *Communication on Accelerating the Transition from Analogue to Digital Broadcasting*, COM 2004 (204) final, European Commission, Brussels.

European Commission (2005a), *Communication i2010 – A European Information Society for Growth and Jobs*, COM 2005 (229) final, European Commission, Brussels.

European Commission (2005b), *A Market-based Approach to Spectrum Management in the European Union*, COM 2005 (400) final, European Commission, Brussels.

European Commission (2005c), *A Forward-looking Radio Spectrum Policy for the European Union: Second Annual Report*, COM 2005 (411) final, European Commission, Brussels.

European Commission (2005d), *EU Spectrum Policy Priorities for the Digital Switchover in the Context of the Upcoming ITU Regional Radiocommunication Conference 2006 (RRC-06)*, COM (2005) 461 final, European Commission, Brussels.

Federal Communications Commission (FCC) (1997), *Fifth Report and Order*, FCC, Washington, DC, April.

Federal Communications Commission (FCC) (2002a), *Second Report and Order*, FCC, Washington, DC, August.

Federal Communications Commission (FCC) (2002b), *Second Report and Order*, FCC, Washington, DC, November.

General Accounting Office (2005), *Digital Broadcast Television Transition: Estimated Cost of Supporting Set-top Boxes to Help Advance the DTV Transition*, GAO 05-258T, General Accounting Office, Washington, DC, 17 February.

Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan (2002), *Major Aspects of Japan's Broadcasting Policy*, Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan, December.

Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan (2003), *Third Action Plan for the Promotion of Digital Broadcasting*, Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan, April.

Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan (2004), *Information and Communications in Japan – Building a Ubiquitous Network Society that Spreads throughout the World*, White Paper, Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan.

Screen Digest (2004), ''Cost of buying into European DTT'', No. 395, August.

Further reading

Analysys Consultants (2005), ''Report on the public policy treatment of digital terrestrial television (DTT) in communications markets'', study produced for DG Information Society and Media, European Commission, Brussels, 25 August.

Brown, A. and Picard, R. (2004), *Digital Terrestrial Television in Europe*, Lawrence Erlbaum Associates, Mahwah, NJ.

Bustamante, E. (2002), ''Televisión: errores y frenos en el camino digital'', in Bustamante, E. (Ed.), *Comunicación y Cultura en la Era Digital. Industrias, mercados y diversidad en España*, Gedisa, Barcelona.

Bustamante, E. (2003), ''Televisión digital: globalización de procesos muy nacionales'', in Bustamante, E. (Ed.), *Hacia un nuevo sistema mundial de comunicación: industrias culturales en la era digital*, Gedisa, Barcelona.

Frezza, G. and Sorice, M. (2004), *La TV che non c'è. Scenari dell'innovazione televisiva in Europa en el Mediterraneo*, Edizioni 10/17, Salerno.

Galperin, H. (2004), *New Television Old Politics. The Transition to Digital TV in the United States and Britain*, Cambridge University Press, Cambridge.

Gaptel (2005), *Televisión Digital*, Red.es, Madrid.

Perrucci, A. and Richeri, G. (2003), *Il mercato televisivo italiano nel contesto europeo*, Il Mulino, Bologna.

Shulzycki, A. (2003), ''DTT in Europe. Market overview and assessment'', paper presented at the DigiTAG Exploratory Meeting, European Broadcasting Union, Geneva, September.

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