Digital Switchover in Broadcasting

A BIPE Consulting Study for the European Commission
(Directorate General Information Society)

Final Report

April 12, 2002

Digital Switchover in Broadcasting

A study by BIPE Consulting

BIPE Media Practice

Pascal Lefort (pascal.lefort@bipe.fr)

Vincent Létang (vincent.letang@bipe.fr)

Pascal Marlier (pascal.marlier@bipe.fr)

Associated experts

Gordon Harold (brendon_associates@compuserve.com)

Jean-Luc Renaud (globalcom@lineone.net)

CONTENTS

0 Executive Summary

This study was commissioned by the European Commission (Directorate General Information Society) and undertaken by BIPE Consulting in 2001. The executive summary provides a synthesis of the Final Report and a more general view of the study, its assumptions, approach and results. This paper is aimed at readers that are not necessarily familiar with the switchover issues and the television background, and for that purpose it has been kept intentionally simple.

We will first examine the context and the objectives of the study, and then describe our approach and structure of the deliverables. Finally, we highlight our **20 main findings and recommendations** to policymakers.

The context

After the introduction of digital broadcasting in television and radio ("turn-on"), we define « switchover » as the progressive migration of households, from analogue-only reception to digital reception. « Analogue turn-off » (ATO), or « switch-off », refers to the termination of analogue broadcasting, which is considered to be possible when most TV households are equipped to receive digital signals.

Digital broadcasting has already been introduced in the Union. At the end of 2001, 27 million households were receiving television in digital format[1] (18% of European television households).

To date, these households access digital TV mainly by satellite (19 of the 27 million). On the supply side, there are more than 600 digital television channels, though many channels are still broadcast in analogue mode too. During 2001 the satellite platforms *Viasat* and *Sky* have completed their digital switchovers and turned off their analogue broadcasts ; now nearly all European, satellite-based, pay TV platforms are transmitting in digital format only.

[1] Source: Seventh Report on the Implementation of the Telecommunications Regulatory Package (annex 2.1). See study introduction for full reference.

About 80% of European cable systems have been upgraded to support digital transmissions and digital services but, to date, only some cable operators actually commercialise digital access and few households are actually receiving digital signals through cable connection (the United Kingdom being the only country where a significant part of cable subscribers – 2 million - are already “digitised”).

Regarding the third delivery mechanism, terrestrial broadcasting, digitisation has started to be implemented commercially in four Member States (Spain, Sweden, Finland and the United Kingdom) and there are plans to launch in nearly all other Member States. It should be kept in mind that about 50% of European households currently receive television only through terrestrial reception, while 30% receive it through cable and 20% through satellite dishes. This breakdown reflects the delivery mechanism used for reception on the primary set in the house, but many households who use cable or satellite for their primary set also use terrestrial reception for their secondary or tertiary sets.

The objectives of the study

With regard to various Community policies (information society, consumer interests, promotion of open competition and the single market), the European Commission seeks to have a thorough understanding of the issues related to the switchover. European Commission services wish to be ready to anticipate what could come out of the combined actions of industry players and Governments, and assess what could be their impact on markets and on spectrum management. Finally, the Commission would like to explore what could or should be its role during the switchover; this could range from a limited role that would include European ‘guidelines’ on best practices, to a greater involvement in co-ordinating the switchover process, if there were overriding Community interests justifying European co-ordination and synchronisation of the switchover/turn-off and spectrum re-farming processes.

BIPE approach

To provide the Commission with a thorough understanding of the issues at stake, BIPE Consulting has carried out a survey to gather first-hand information on players’ objectives, concerns, expectations, plans and strategies for the switchover.

This included interviews with about 80 entities from virtually all categories of players : free-to-air broadcasters, incumbents and new entrants, public and commercial broadcasters, pay-TV operators, radio operators, cable operators, transmission service providers by satellite or terrestrial means, consumer electronics manufacturers, other spectrum users like mobile telecommunications operators, Government officials and regulatory bodies.

Directorate General Information Society and BIPE Consulting organised in April 2001 a workshop in which all those categories of players were invited to express their views about the switchover.

And last, Directorate General Information Society and BIPE Consulting constructed and distributed a questionnaire that resulted in about 30 contributions. We not only considered the *official* statements made by entities but also assessed what may be the actual - sometimes « hidden » - strategic agendas of the players, deriving from their long-term interests.

The Final Report and other deliverables

First, in the **Market Chapter**, we analyse the drivers and obstacles to the digital TV migration. To build a complete understanding of these, we refer to historical precedents of technological adoption-migration. Then we focus on consumer behaviour regarding television, new technologies, and turn-off announcements. Last, we widen the scope by describing the strategies of *all* the categories of players involved in the process, and we focus on what appears to be the most controversial issue : digital terrestrial television and the way it is introduced. At the end of this Chapter we have a clearer vision of **how far the switchover can go if driven by market forces alone** under current regulatory/market rules, and what kind of market failures imply new policy action.

In the **Spectrum Chapter**, we first recall the basis of spectrum management and spectrum efficiency. We analyse the **consequences of the introduction of digital terrestrial broadcasting** (TV and radio) on spectrum management, describe and compare the different options taken in Europe. We then analyse the potential re-use of frequencies released after the terrestrial analogue turn-off, and the options for re-farming and licensing policy.

The **Public Policy Chapter** addresses the policy and regulatory stakes related to TV switchover and spectrum management. We analyse the general interest objectives that are related to TV switchover and spectrum management, and the other drivers of government policy. Then we systematically describe and comment on the whole range of **policy measures that can be taken in order to encourage the digital switchover**. Last, we develop a cost-benefit analysis of some policy options concerning the digital switchover: the infrastructure policy (role of terrestrial broadcasting in the global digital TV market), the timing policy (pros and cons of a policy which seeks to accelerate the pace of switchover). We analyse qualitatively the benefits, costs and risks associated with the main policy options, then we use a quantitative model to simulate and assess the areas of macro-economic efficiency, depending on market environments and other hypothesis (spectrum valuation).

After the three chapters, we can draw general conclusions from which we derive recommendations to policy makers, at national and European levels.

Digital Radio issues (obstacles, possible solutions) are addressed in a separate chapter.

In addition to the main report, two volumes of annexed documents are available : one volume for Country Profiles (focus on digital switchover in the EU, applicant countries, Japan and the USA); one volume for additional developments on spectrum, cost-benefit methodology, case studies from past technological migrations, and the issue of secondary TV sets.

Issues at stake

The termination of analogue broadcasting may be considered as the future *consequence* of the introduction of digital broadcasting. **Digital broadcasting indeed brings many advantages compared to analogue broadcasting** : opportunities to provide a better image (including wide-screen aspect ratio and possibly high definition) and sound quality; lower transmission costs or the ability to transmit *more* channels or services for the same cost; better efficiency in spectrum use (as more data can be transmitted within the same bandwidth); the ability to transmit associated data allowing for enhanced television or fully interactive applications when associated with a return-path facility.

These benefits from digital broadcasting can be achieved whatever delivery network is used, though **some benefits are more specific to a particular network**. Wireless indoor reception and mobile reception can be implemented through digital *terrestrial* broadcasting only. The better spectrum efficiency expected from digitisation has much wider consequences in the case of a scarce *public* resource like the UHF and VHF spectrum bands used for terrestrial broadcasting, than in the case of radio-electric frequencies used in ‘closed’ systems like those used by cable operators, or the high frequency bands used by satellite transmission operators.

Digital broadband cable is the delivery mechanism that offers the largest potential bandwidth, the greater diversity of services and the highest interactive capacity ; and satellite reception is the delivery mechanism which is the most cost-effective for the delivery of nation-wide or pan-European services.

Some of the expected benefits from the digital migration come at the very start of the introduction and adoption of digital broadcasting (i.e. the *turn-on* and *switchover* period), while other benefits, like the release of spectrum and more efficient spectrum management, would specifically derive from the *turn-off*.

All those advantages (that benefit broadcasters, or consumers, or policymakers), would make analogue broadcasting *redundant* when digital reception is widely available, so that the simultaneous broadcast in analogue and digital (« simulcast ») would certainly be abandoned ("turned-off"). Then the **turn-off will have impacts on spectrum management**, as it would release sections of the frequency bands currently used for terrestrial broadcasting. This raises the question : « what to do with the released frequencies ? », i.e. the re-farming issue.

This is the story of a **market-driven technological migration**, namely the progressive replacement of a technology by another, better one. But we shall also consider the process in a *reverse* story : analogue turn-off being not only the *consequence* of a widespread switchover to digital, but can be also viewed as one of the main *reasons for* switchover.

More specifically, some of the players involved - like Governments, regulators, and spectrum users - could benefit from the analogue turn-off. Governments are **interested in achieving a better use of spectrum** and are or may be interested in increasing budget resources out of the sale or leasing of the released frequencies. The precedent of UMTS auctions is evoked by some Member States, in debate about the future re-farming of the released frequencies. Finally, spectrum users, be they television broadcasters or not, would be interested in using released spectrum to support services and programmes.

As a result, policy makers (i.e. Governments and/or regulators) are likely to accelerate the introduction of digital transmission, and to encourage digital reception penetration, in order to achieve a faster turn-off, especially for terrestrial television. Market players (broadcasters, pay TV operators, and consumers) do benefit from the switch to digital, so **this switch is likely to happen under market forces, though at a moderate speed**, which will be determined by transition and switching costs (like the upgrade of networks to support digital broadcasting ; the equipment of every household with digital-compliant receivers).

However, the possibility to turn-off as soon as possible then resulting in better spectrum efficiency would benefit entities that are *not* directly involved as players in the television market, like Governments, non-television spectrum users and Society as a whole. On the other hand, *direct* market players, either free-to-air broadcasters, pay-television operators or consumers, would not benefit directly, individually, from the release of some additional spectrum, so that they have little incentive to optimise spectrum use. They are therefore not likely to take future spectrum benefits into account in their spontaneous behaviour, i.e. to accept the costs necessary to accelerate the switchover/turn-off process.

When it is proven that there are benefits which are « external » to market players, economic theory suggests that the action of market forces alone cannot result in an optimal situation ("market failure" situation). Therefore the intervention of public authorities can be recommended in order to influence the market forces. This can be done by creating incentives or imposing obligations on players so that market forces act in a way that is more beneficial to the general interest. However, potentially negative "side-effects" of public intervention (e.g. competition distortions, moral hazard, etc) must be considered as well, and the **expected benefits from public intervention must be compared with the potential costs and risks**.

Key findings and recommendations

1. Structural obstacles to the digital migration

The study of past technological migrations and market mechanisms at work in television (market chapter) teach us that **four types of structural market failures** prevent a faster and a wider switchover for DTV equipments and services. These market failures are : (i) **chicken-and-egg situations** (DTV services, equipments and networks are totally inter-dependent), (ii) the **situation rents** of incumbents (oligopolistic revenues derived from spectrum/licence scarcity always encourage status quo), (iii) the **free-rider** syndrome (which requires co-ordination of investments when collective benefits are at stake), (iv) **external benefits** (some of the benefits expected from a faster or more universal switchover affect the economy or the Society as a whole and not the players involved in television markets), (v) **threshold effects** (full benefits are achieved only when switchover is almost complete and analogue turn-off possible).

2. General interests in reaching a faster, wider migration

There are **general interest objectives at stake**, which are social and economic (extension of the information society, more efficient spectrum management, as seen in the spectrum chapter, etc).

3. Therefore the need for policy intervention

Since there are structural obstacles to more rapid or wider market development under the action of market forces alone (point 1), and since there are general interest objectives from a faster/ wider migration (point 2), **policy intervention can be justified** (see policy chapter).

4. Cost-benefit analysis assesses the relevance and limits of policy intervention

Our cost-benefit analysis confirms this at macro-economic level. An analysis of the macro-economic costs and benefits of a policy aiming at accelerating the switchover shows that optimal decisions derive from national situations (initial digitisation level, cost of converters, cost of analogue broadcasting), policy trade-offs between conflicting switchover benefits, and spectrum valuations (opportunity cost of not being able to release/refarm frequencies earlier). In most circumstances, **accelerating the process can be indeed a optimal policy** (see cost-benefit subsection of Policy chapter).

5. A wide range of regulatory tools and incentive

If policy intervention is justified, the question remains as to **what regulatory tools should be used** to achieve a faster/ wider digital switchover. There is indeed a wide variety of measures that could be taken and only a few of them are actually used today by national policymakers (policy chapter).

6. Risks in policy intervention on TV markets

This question is all the more critical because there are **risks related to any new policy intervention** on these complex and intricate markets. Any new intervention, or even its anticipation by market players can potentially trigger market distortions (like investment inhibition) or competition distortions (some market players favoured over others).

7. Switchover roadmaps to help co-ordination of market forces

In order to overcome the “free-rider” and “chicken-and-egg” syndromes and to help players co-ordinate their expectations and investments, policymakers could give political signals and improve legal and business certainty. Therefore the recommendation of national **Switchover roadmaps** and related action plans (R1).

8. Public debate on post-ATO policy and DTV/broadband consistency

More generally, Governments should publicise their vision of long-term spectrum management and information society developments. Therefore the recommendation on **Post-ATO public debate** (R4) and the **linkage of broadband policy to DTV policy** (R5) to prevent the policy dilemma that could arise : pushing DTV too far and at any price in the short-to-medium term could jeopardize the development of broadband networks and services and therefore the information society in the long term.

9. Spectrum tax to encourage digitisation and spectrum efficiency

Tax measures could make spectrum users internalise the costs from inefficient spectrum management and contribute to overcome the inhibitions caused by situation rents. Therefore the recommendation R7 on a tax on spectrum. A tax based on the quantity of spectrum used could change the attitude of incumbent terrestrial broadcasters, who have no compelling reason to work for a fast digital switchover today. Indeed, although turn-off would result in transmission savings for them (simply because transmission in digital uses six-times less spectrum than in analogue), the released spectrum capacity will attract new market entrants that could challenge the oligopolistic situation of the incumbents.

10. Encourage consumer switchover by reducing their switchover cost

The most effective way of accelerating the switchover would be to lower the cost which is borne by consumers in the process, i.e. acquiring or renting digital TV equipment. Therefore the recommendation R12 to **encourage consumer switchover by reducing their switchover cost**. Here again tax incentives could be implemented : discounted rate on audiovisual licence-fee for households who have switched to digital, general VAT reduction on all DTV equipments and services (converters, IDTVs, digital pay TV subscriptions).

11. A reservation mechanism to reveal economic utility

It should be made clear whether the **apparent lack of interest of telecom operators for UHF-broadcast frequencies,** even in the long term, comes from technical/economic reasons, or from a financial/strategic/regulatory analysis as a result of which they renounce to claim these bands because they are pessimistic over their political chances to get them anyway, any time soon. Economic theory (Coase…) suggests that monetisation of resources is often a good way to reveal true economic utility (spectrum chapter). A mechanism of reservation, i.e. **option to buy or lease future "releasable" frequencies**, could provide such information, and help policymakers appreciate the proportionality of their switchover measures, with reference to the potential market value for releasable frequencies (R11).

12. Proportionate regulation on standards

Policymakers may be tempted to regulate standards in order to help industrial co-ordination (on Application Programme Interface – APIs - for instance) or to stop the growth of the non-digital installed base of equipments (with a "mandatory digital tuner" measure). The latter measure would be effective by mechanically converting the receivers installed base at renewal pace, but would entail risks of markets distortions, and implications on the single European market if it was not co-ordinated at European level.

Therefore our recommendation R9 of **proportionate regulation on standards for receiving equipments and facilities**, and on a special cost-benefit study led at European level on this specific issue.

13. Drive competition by allowing more freedom for DTV players and consumers

Some DTV and broadband players have to bear heavy regulations on programming ("must carry" rules) and pricing. These regulatory burdens prevent them from investing more systematically in networks and services to deliver digital television and other digital services.

Therefore we recommend **ensuring increased commercial freedom to DTV players and removing regulatory obstacles** in order to allow/encourage them to drive the switchover process (R6). At the same time, consumers should be given a wider choice in terms of access to delivery mechanisms. In particular, excessive installation restrictions on satellite dishes and rooftop terrestrial aerials should be removed. Indoor reception for DTT could be encouraged as a solution for consumers to be able to bypass such restrictions. Therefore our recommendation to **ensure multiplatform access to all consumers** (R14) : all consumers should be able to access all the available delivery mechanisms of their area (satellite, terrestrial and cable when there networks are rolled out). These measures in R14, aimed at increasing actual competition and encourage operators to be more commercially aggressive, will only be efficient if operators on their side really have the sufficient business and commercial freedom we recommend in R6.

14. Surveys and information campaigns

In order to encourage a faster, more cost-efficient switchover, public and market players must have some degree of certainty and common information about each others. Therefore we recommend that **policymakers at national and European levels monitor DTV development** (R3) and encourage market players to conduct **common research on consumer behaviour** and expectations (R10). And because the concepts of digital television, digital sets or analogue turn-off remain often confusing or even frightening, for some population groups (see market chapter), policymakers could also encourage or partly finance **information/awareness and equipment labelling campaigns** (R11).

15. A Digital Switchover Fund

In the previous points, we recommend a number of actions that should be implemented or at least encouraged by public authorities (in addition to the direct, spontaneous actions from market players), partly because co-ordination is often needed or even indispensable for certain actions.

These actions would cost money. We also underlined that some other measures, aimed at making players reveal their economic utility from future spectrum use (spectrum options mechanism, R8) or optimise their spectrum use (spectrum tax, R7), could provide public revenues, even if this should not be their primary purpose. Therefore our recommendation to set up a **Switchover Fund** (R2) that could **consolidate the macro-economic transfers**. The funds raised from some of the players that will ultimately benefit from the switchover and/or turn-off (terrestrial broadcasting players, other spectrum users, Governments themselves) would be used to finance some of the measures that will help accelerate the process and thus achieve the benefits from it.

Compared with financial transfers through the general public budget, a dedicated Fund would provide some specific advantages : higher guarantees of transparency, platform neutrality and proportionality, consensual private/public decision-making.

16. Horizontal recommendations to prevent market distortions

Precisely in order to limit the above-mentioned risks inherent to public intervention on markets, all incentive measures should respect some **horizontal recommendations for public intervention :** platform and technological neutrality in order to avoid excessive competition distortions, transparency of objectives, proportionality of actions and consistency with objectives. We should add synchronisation with market developments ; public intervention could be necessary in take-up phases to help break chicken-and-egg problems and in turn-off phases because of threshold effects and in order to overcome structural divides. Indeed we recommend **ex-post, targeted measures** to deal with the structural, permanent, component of the “digital divide” risk (R13).

17. Need for European co-ordination

All the above recommendations are aimed at national policymakers, but in many cases there is a European dimension that requires intervention of European public authorities. In the name of efficiency and under subsidiarity principles, the European Union should ensure certain co-ordination of several intervention measures above mentioned. The **need for European action** in this area derives in particular from : (i) the transnational nature of spectrum management, (ii) the free circulation of goods and services in the single European market, (iii) the promotion of global European competitiveness in all the industries involved (television services, consumer electronics, advanced television technologies…), which requires co-ordination and synchronisation of developments.

18. Optimising the economic efficiency of spectrum management

The EU should encourage an **evolutionary process in approaching spectrum management** at national and European levels. As seen in the Spectrum Chapter, spectrum management should indeed evolve from the current administrative approach to an approach based on the economic optimisation of spectrum use, so as to better reflect its economic and social value, through the use of more sophisticated tools (spectrum tax, reservation or option mechanisms…). The recent EU *Spectrum Decision* has paved the way for a *Spectrum Policy Experts Group* which will be entitled to discuss these issues : better spectrum management, more efficient spectrum planning, alternatives for pre and post-ATO scenarios, etc. Moreover, the UMTS auctions have shown the need for more preparation and greater co-ordination at EU level on these matters.

19. European actions required by Law

In addition to the actions justified in terms of added value from European intervention, there are matters in which EU has responsibilities *by Law and Treaties*. This comprises its competence in **competition law, notably State aids** (compatibility of national measures with fair competition on the European single market); the control of **technical specifications** for products sold within the EU (e.g. specifications for hardware and middleware of broadcasting receivers), to guarantee the free movement of goods within the European single market; **cross-border spectrum planning** (negotiated in the CEPT).

20. Digital radio needs political signal to overcome chicken-and-egg

Digital radio is much less advanced than digital television in the switchover path. Though licences have been granted and services are broadcast in some countries, actual penetration of reception is close to zero. Many specific obstacles explain this “chicken-and-egg” situation : the price of the receivers is still much too high compared with the perceived added value of digital radio over the analogue FM/RDS proposition ; there are no spectrum incentives to encourage switchover as analogue radio uses little spectrum today and digital requires *additional* bands ; some key players like car manufacturers, who could trigger price drop with factory-fitted digital radios, are not really committed to the process today ; electronics manufacturers, too, are much less committed than they are on digital TV. Lastly, while many European players support DAB-T as “the” technical standard for digital radio, some broadcasters still feel sceptical or foresee a variety of complementary delivery mechanisms (DAB-S, DRM, DVB, internet…). To overcome these obstacles and be able to look for a viable business model, radio broadcasters and other digital radio supporters may need to receive a **political signal**, at national and European levels, in order to build **confidence among their relevant partners** (carmakers, electronics manufacturers).

SUMMARY OF THE MAIN FINDINGS AND RECOMMENDATIONS ON SPECTRUM AND DIGITAL TV

FINDINGS

1. Four types of structural market failures prevent a faster and a wider switchover for DTV equipments and services: chicken-and-egg, situation rents, free-rider syndrome, external benefits.

2. Killer applications are needed to drive a migration. Digital pay TV and then free-to-air digital TV will drive the penetration to a large extent, but probably not towards *universal* penetration by mid-term.

3. As there are **general interest objectives** related to digital switchover (social, economic, spectrum, competition, culture). This therefore is considered a problem by policymakers, which justifies policy action.

- Non-universal : a social problem (permanent « digital divide »).
- Non-complete : a spectrum problem (impossible to turn-off analogue and refarm).
- Not-fast-enough: an economic problem (obstacle to information society services growth)

4. Cost-benefit analysis shows that (i) optimal decisions on big choices derive from initial national reception mix, policy trade-offs (competition) and spectrum valuation, (ii) in some circumstances, **accelerating the process can be indeed a justified policy**.

5. Then **what regulatory tools** should policymakers use ?

6. Dilemma is that policy intervention in itself creates **risks of new market distortions**.

RECOMMENDATIONS

7. Signals like switchover roadmaps give certainty to market players, to overcome free-rider syndrome and chicken-and-egg problems (R1).

8. Define **post-ATO policy** (R4). Link DTV and broaband policy (R5) to overcome **dilemma** between long-term broadband objectives and short-term DTV policy.

9-10. Fiscal incentives (taxes on current Mhz use, R7; tax discounts on equipments/subscriptions, R12) can help internalise external benefits and break situation rents.

11. Reservation mechanisms would make spectrum users reveal their economic utility, to optimise long-term spectrum management (R8).

12. Regulation on technical **standards** (on hardware and middleware) are effective but delicate tools (R9).

13. Deregulation of some DTV and broadband players to increase commercial freedom (R6). Broaden consumers choices in terms of delivery mechanisms in order to drive **competition** (R14).

14. Information : Monitor DTV development and conduct common research on consumers (R3, R10). Information/awareness campaigns (R11).

15. A **switchover Fund** could consolidate macro-economic transfers in a transparent way (R2).

16. To limit these risks all signals and incentive measures should follow some **horizontal principles** : neutrality, proportionality, timing, clarity, **ex-post social treatment** (digital divide, R13).

17. International spectrum management harmonisation, single market consideration and global European competitiveness require the **intervention of EU.**

18. The EU should encourage best practices, co-ordination of national policies and evolution in the approach to spectrum management at national and European level.

19. By Treaty, the EU must control national State aids and national specifications for terminals (single market).

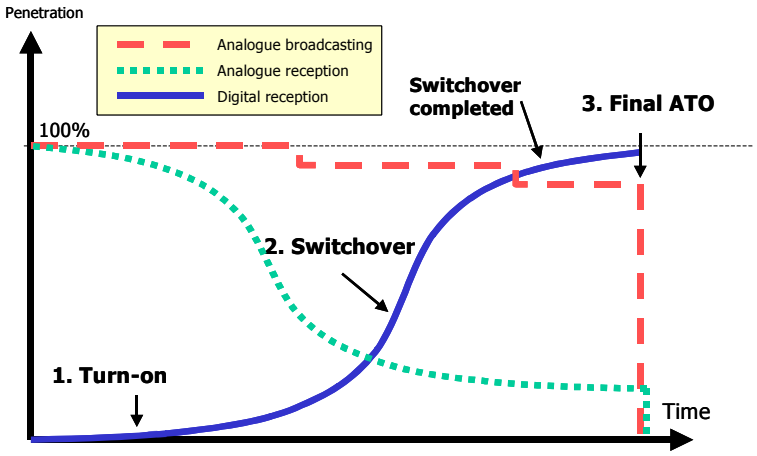
1. Introduction

1.1 Definitions

In this report on digital broadcasting migration (television and radio), we shall use specific terms to distinguish betweendifferent aspects or phases of this process.

- **Digital switchover** ("SWO"): the global digital migration process, involving a gradual replacement of analogue broadcasting (transmission and reception) by digital broadcasting (transmission and reception).
- **Digital turn-on** : introduction of digital broadcasting, involving the upgrading of the infrastructure and the launch of digital transmission.
- **Analogue turn-off** ("ATO"): extinction, termination of analogue transmission which assumes the completion of the switchover process, so that it won't occur, in principle, before almost all households can receive digital signals on their different receivers.

Figure 1: Three concepts to describe the digital migration (turn-on, switchover, turn-off)



1.2 The context

1.2.1 The development of digital television in Europe

Digital television has appeared and developed in different ways depending on the countries concerned, in accordance with the analogue television context inherited historically, and notably the existence or absence of multi-channel services in analogue mode (with multi-channel TV also being the main attraction of digital television up to now). Three groups of countries can be distinguished in this respect, depending on which delivery mechanisms are used for the main set in the home[2] :

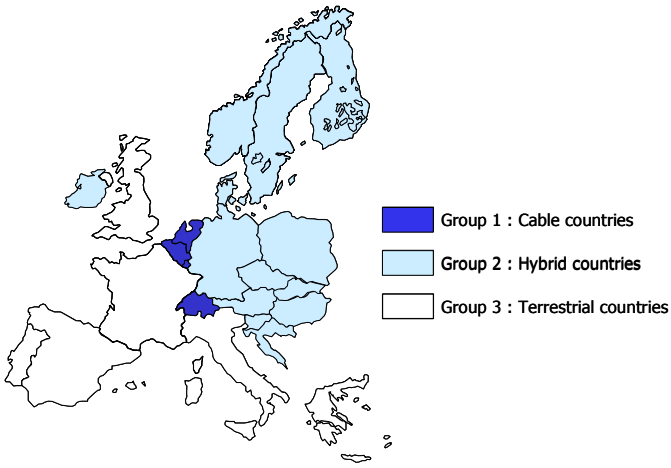
- **Group 1: "Cable" countries**. Over 90% of households receive television by cable: Belgium, the Netherlands and Luxembourg.
- **Group 2: "Hybrid" countries**. Reception via cable and satellite traditionally covers more than half of the households: Germany, Austria, Ireland, Sweden, Finland and Denmark.
- **Group 3: "Terrestrial" countries**. Terrestrial reception (via Hertzian airwaves) still remains the dominant delivery mechanism: Greece, Portugal, Italy, France, the United Kingdom and Spain.

The study will also often use the concept of "cable-satellite" or "cabsat" countries. The term refers to countries where cable and/or satellite reception (analogue or digital) have a dominant market share[3]. It covers the countries ingroups 1 and 2 mentioned above. In these States, the majority of the population has access to multi-channel television services (15 to 30 channels), on a totally free basis via satellite reception or via a "basic" subscription to cable. In contrast, analogue terrestrial television in "terrestrial" countries only provides 3 to 8 free-to-air channels and access to multi-channel television requires a consumer to switch to pay TV, most frequently via satellite.

[2] "Main set" refers to the television set which is the most used by household members. It generally happens to be the most recent and high-end.

[3] Even in "cable-satellite" countries, many of the households that use cable or satellite reception for their main set still use terrestrial reception for their secondary sets. Therefore a per-TV approach would indicate a bigger terrestrial market share than the per-household/main set approach.

Figure 2 : The different television contexts in Europe (EU and neighbouring countries)



Digital television transmission was introduced to the European Union in 1996, firstly via satellite, then by cable and finally through terrestrial broadcasting. At the end of 2001, an estimated 26 million digital households existed (18.3% of households in the Union)[4]. At present, the digital households are almost exclusively households which subscribe to a pay TV service, and in two thirds of cases, to a pay TV service transmitted via satellite.

Figure 3 : Digital households[5] in the European Union[6]

Digital TV households in EU 2001, by delivery mechanism
(in millions/ in % of digital households over total number of national households)

	Total DTV			DCATV		DSTV		DTTV	
	Total HH	Digital HH	% digital HH	Digital HH	% digita	Digital HH	% digita	Digital HH	% digita
Belgium	3.8	0,11	3,0%	0,11	3,0%	0,00	0,0%	0,00	0,0%
Denmark	2.4	0,61	25,3%	0,38	15,8%	0,22	9,3%	0,01	0,2%
Germany	34,7	4,20	11,8%	2,03	5,7%	2,16	6,1%	0,00	0,0%
Spain	12,4	2,86	22,5%	0,05	0,4%	2,37	18,7%	0,44	3,5%
Greece	3,6	0,14	3,9%	0,00	0,0%	0,14	3,9%	0,00	0,0%
France	23,2	4,21	17,6%	0,75	3,1%	3,46	14,5%	0,00	0,0%
Ireland	1,0	0,12	11,9%	0,03	2,9%	0,08	8,5%	0,00	0,5%
Italy	22,8	2,94	12,5%	0,06	0,3%	2,87	12,2%	0,00	0,0%
Netherlands	6,5	0,69	10,4%	0,19	2,9%	0,50	7,6%	0,00	0,0%
Austria	3,3	0,19	5,3%	0,03	0,8%	0,16	4,5%	0,00	0,0%
Portugal	3,5	0,22	6,1%	0,03	0,8%	0,20	5,3%	0,00	0,0%
Finland	2,3	0,08	3,7%	0,01	0,4%	0,08	3,3%	0,00	0,0%
Sweden	3,9	0,88	22,0%	0,27	6,8%	0,52	12,9%	0,09	2,3%
UK	23,6	9,55	40,1%	2,02	8,5%	5,92	24,9%	1,35	5,7%
TOTAL EU	**143,7**	**26,63**	**18,3%**	**5,94**	**4,1%**	**18,54**	**12,6%**	**1,89**	**1,3%**
Japan	41,7	4,40	10,0%	0,00	0,0%	4,40	10,7%	0,00	0,0%
USA	105,0	31.8	31.8%	13,60	13,5%	18,10	17,7%	0,10	0,1%

Source: prepared by EC services from Strategy Analytics data

[4] "Digital household" : a household receiving television signals in digital mode on at least one of its receivers (generally the main set).

[5] Figures indicated in this table - and, except special mention, in the rest of the study – are based on the digital household concept, which is itself based on whether the main set in the home can receive or not digital signals. We shall notice that digital TV percentages would be lower if the unit of measure was the receiver and not the household, because more than half of European households have two TV sets or more, and these secondary and tertiary sets are almost never digital-ready.

[6] From *Seventh Report on the Implementation of the Telecommunications Regulatory Package* (annex 2.1) - Communication from the European Commission [COM(2001) 706] available at http://europa.eu.int/information_society/topics/telecoms/implementation/annual_report/7report/index_en.htm.

In terms of service supply, more than 600 channels are transmitted digitally. The free-to-air channels are almost all transmitted in analogue as well ("dual illumination" or "simulcast"). Nearly all digital pay TV platform operators are now operating exclusively on a digital basis. More than 80% of European cable networks have been upgraded to be capable of carrying television in digital mode, although only a small share of connected households have already been equipped with the set-top boxes that are needed for digital reception[7].

In contrast to what happened historically for analogue television, which was launched and transmitted solely via terrestrial broadcasting for a long period, digital television is developing simultaneously today over the three distribution platforms (terrestrial, cable and satellite). This is leading to heightened competition in the television market.

1.2.2 Digital convergence

This term is used to designate the convergence between the audiovisual, telecommunications and information technology sectors which results from generalised use of digital technologies. All editorial contents and information services produced in digital mode can be increasingly transmitted to, or accessible from, all types of terminals, and through all types of networks.

This technological convergence is viewed as having important consequences both economically (general de-fragmentation of markets, lower entry barriers, growth in economic sectors concerned and employment) as well as socially (development of an "information society", although this entails risks of a "digital divide"). In particular, networks than other the three traditional broadcasting networks are becoming capable of providing audiovisual services such as video on demand. In turn, broadcasting networks are also becoming capable of providing services other than audiovisual ones (e.g. data-casting, Internet access, etc.).

Digitisation of television is therefore not only an internal question for the television industry; it also impacts strongly on the pace of migration towards the information society, notably due to television's socio-political importance and its ubiquity in households.

[7] Current household televisions have analogue tuners. Reception of digital signals therefore requires an external demodulator (or "decoder" or "converter"), which is integrated into a set-top box, whatever the reception mode (terrestrial, cable or satellite).

1.2.3 European Community legislation

Community legislation intervenes when a specifically European dimension exists, while respecting the subsidiarity principle. It can be divided into two broad categories:

- **Economic legislation**, which seeks to establish and consolidate a single European market for goods and services, in the interest of European consumers and companies. It pursues objectives such as the free movement of goods and services, deregulation and harmonisation of certain economic activities, fair market competition, industrial promotion, etc. These goals notably apply to communication services, transmission networks and terminal equipment markets.
- **Social and political legislation**, which seeks to defend other goals of general interest, such as the promotion of European culture and its diversity, protection of the citizen, etc.

In particular, the **"new regulatory framework for electronic communications"**, which comprises six Directives and a Decision[8], and results from the process of telecommunications liberalisation and the debate on convergence in the 1990s. It covers all communications networks, including broadcasting (radio and television).[9]

[8] Five of these measures (the "framework", "authorisation", "access and interconnection" and "universal service and user rights" Directives and the Decision on the radio-electrical spectrum) were formally adopted in February 2002. (http://europa.eu.int/information_society/topics/telecoms/regulatory/new_rf/index_en.htm).

[9] This new regulatory framework :

- establishes a clear **separation between regulation of communication networks** (subject of the new framework) **and regulation of content** (outside the new framework), while the impact of convergence is more important for the former ;
- is inspired by the principle of **technological neutrality**, i.e. all communication networks have to be subject to similar regulatory obligations, again in response to the phenomenon of convergence ;
- sets **minimum harmonisation rules** which leave a maximum space for private initiative in the markets concerned ;
- is **flexible**, as it is periodically adjustable on the one hand, and applied by national regulatory authorities while taking account of specific local features on the other ;
- nonetheless offers the required **legal security** to investors ;
- is **centred on shortcomings of competition** in the market and in particular, certain players' "significant market power" (dominance), which is dealt with by preventive intervention mechanisms (*ex ante* regulation) ;
- **gradually makes way to competition Law** (*ex post* regulation) as deregulation consolidates and markets become more competitive.

1.3 The stakes

1.3.1 Benefits and objectives

A certain number of benefits can be expected from turn-on and the development of digital broadcasting, independently of analogue turn-off. Their impact varies according to the delivery mechanism (cable, satellite or terrestrial) and affects the different categories of players concerned in different ways. In particular:

- Digital compression makes it possible to **enhance the efficiency and capacity** of transmission networks. This in turn enables broadcasters to transmit more channels, to ensure a better picture and sound quality, to transmit data for programme guides and personalisation of the service. All of these improvements benefit the consumer and service providers.
- From the providers' point of view, digitisation makes it possible to **reduce transmission costs** by a factor of 5 to 8.
- The expansion in capacity and networks and the drop in transmission costs should also **reinforce competition** in markets and benefit the end consumer.
- Migration to digital reception requires the acquisition of digital television sets or converters and therefore benefits consumer electronics manufacturers. In the long term, digital convergence makes it possible to envisage a complete **renewal of the consumer electronics** market.
- From the point of view of general interest, digital television appears to be a **shortcut to the information society**, which is a driving force for economic growth and social integration.

The turn-off of analogue broadcasting (ATO) also brings specific benefits, which switchover alone does not fully provide.

- **Savings on transmission costs.** After turn-off, broadcasters will save the cost of the digital/analogue simulcast[10] which represents approximately €5m per year for satellite transmission (leasing of a transponder) and €30m to €60m for national terrestrial analogue broadcasting.
- **Enhanced management of the radio spectrum resource**. This is particularly true for analogue terrestrial broadcasting, which uses approximately 500 Mhz. Depending on the modalities applied for introducing and migrating towards digital broadcasting, turn-off could release up to 300 Mhz. The released frequencies could then be used for new services (e.g. mobile telecommunications, additional television services, etc.) and perhaps generate tax income.

[10] Simultaneous broadcast of channels in analogue and digital mode, which allows consumers to equip themselves gradually with compatible digital receivers, before analogue turn-off.

1.3.2 The obstacles and challenges

However, to achieve the expected benefits, a certain number of obstacles will have to be overcome so that all European households can access television in digital mode. There is a need:

- for infrastructure owners/operators to invest in **upgrading transmission networks** ;
- for consumers to **equip all current analogue receivers** (main televisions, secondary televisions and video-recorders) with converters/decoders and/or to replace them gradually by integrated digital receivers which will initially be more expensive than the equivalent analogue receivers ;
- for operators to **find key functions (killer applications**) which will make consumers want to acquire the equipment concerned, within the various national contexts ;
- for regulators in some countries to **modify national frequency planning** so that simulcasts can be organised ;
- for the States to **rethink international frequency planning** so that the frequencies released by terrestrial analogue turn-off can be reallocated while retaining the harmonisation of band allocation needed to maintain the existence of a single European market for transmission and reception equipment ;
- to promote relatively uniform and **sustainable development of digital television across the European Union** to ensure that economies of scale can be achieved rapidly, to prevent market fragmentation and to maintain European leadership in this area.

1.4 The objectives of the study

Based on the terms of reference of the study, the objectives are to

1. describe the state and development of digital migration in various Member States, to analyse the stakes involved in, and the dynamic of, this migration as well as to analyse the situation and strategy of the various players involved ;
2. analyse the economic and competition impact of public decisions made to support the process ;
3. analyse the impact of digital TV migration on national and international management of the radio spectrum ;
4. analyse the consumer's situation and interest within the context of the migration.

While the study essentially focuses on digital television, one section will be dedicated to digital radio. The geographical scope of the study is essentially made up of the overall European Union. Information on several States applying for membership, as well as the United States and Japan, is also provided.

1.5 The BIPE approach

To respond to the needs of the Commission, BIPE adopted a four-phase approach.

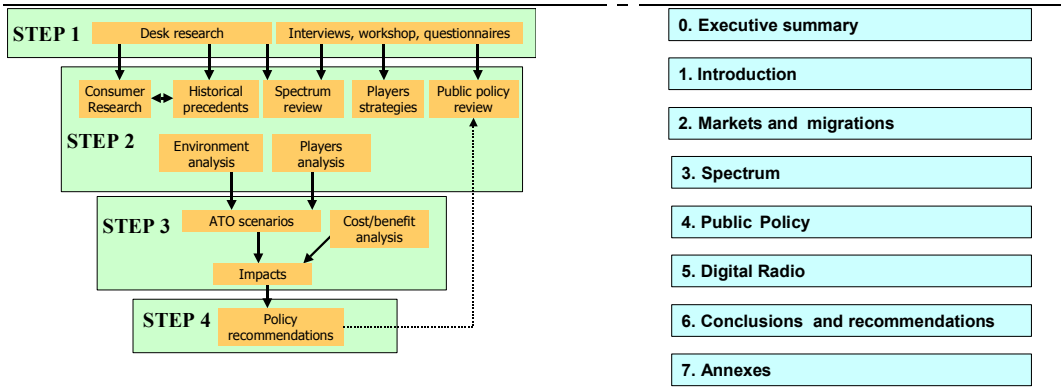
Stage 1: BIPE collected a substantial amount of first-hand information on migration to spectral television and radio, the action and position of each of the players involved in this process or impacted by it, as well as concerning management of the radio spectrum. To do this, BIPE met approximately 80 people in 7 different countries[11], distributed a written questionnaire to regulators and market players (approximately 30 responses received) and organised a one-day workshop in Brussels which was attended by representatives from almost 70 entities. BIPE also studied the history of technological migrations to draw insights which would be useful for an understanding of the present situation.

Stage 2: BIPE formalised this mass of information by carrying out studies on the spectral challenges, digital radio, consumer behaviour, lessons to be drawn from previous migrations, the strategy adopted by each of the players involved, etc. Some of these developments are found in the present final report; others such as the "Country Profiles" are available as annexes.

Stage 3: BIPE then examined the most decisive regulatory scenarios in the framework of the digital migration and built a cost-benefit model to assess the economic pertinence of public decisions in any given national context.

Stage 4 : Based on the outputs of the previous stages, BIPE drew up conclusions and public policy recommendations to national and European public authorities.

Figure 4: Overview of the BIPE approach and plan of the report



[11] See the annex for a complete list of the people interviewed.

2. Market aspects

2.1 Synthesis

This chapter aims to **analyse the market mechanisms at work in the migration to an all-digital television landscape,** in order to be able to predict its progress under market forces, and assess the need for public policies in relation to it (next chapter). To obtain a good understanding of these mechanisms, it is first of all necessary to draw lessons from similar episodes in the past, to analyse the expectations and motivations of television's end-users (consumers), and finally to analyse the strategy adopted by industrial players (content, service, infrastructure and equipment providers). These points therefore form the three sections of this chapter.

The drivers and impediments intervening in digital migration can usefully be put into perspective against technological migrations observed in the past (section 2.2).

1. A distinction must be made between **two categories of migrations**: **adoption migrations** (technological innovation leads to a "killer application" which is adopted *en masse* by consumers) and **purely technological migrations** which modify production modes without having a major impact on the final value perceived by the final user.
2. **The transition to digital television is based on these two historical frameworks**. After digitisation of pay digital television subscribers (phase 1), two frameworks can be envisaged for terminating the digital migration, in parallel or successively: (2) adoption-migration by consumers spontaneously equipping themselves with digital terminals ; (3) technical-migration within the framework of incentive-based public policy or industry action, to convert the last reluctant consumers and thus achieve the expected benefits of analogue turn-off.
3. If phase 3 is implemented in an overly State-controlled or premature manner, it may bypass phase 2, generate possible moral hazard[12] effects, inhibit innovation and commercial risk-taking, and prevent market forces from finding free-to-air digital "killer applications".

[12] "Moral hazard" is a term from financial regulation describing a situation where investors behave recklessly because they know the central bank will not allow them to go bankrupt. In the context of digital TV it implies public policy underwriting industrial risks, in a way that might not be economically sustainable or justifiable under general interest grounds.

4. The majority of adoption migrations follow an "S" curve: the externalities or network effects[13] generally trigger an inflection-acceleration of conversion from a critical threshold located at between 10% and 20%.

5. Subscriber pay TV, like television in general, only displays *indirect* network effects, which is linked to the fact that it is a uni-directional means of communication (from the operator to the user). Therefore the growth rate is bound to diminish rather than to increase, and then to saturate at a certain level.

6. In contrast, the functionalities offered by "**interactive television" could someday bring a *direct* network externality dimension** to digital television, as it offers the possibility of communication (including the user to the operator and even between users). This may lead to an acceleration of penetration for (interactive) digital television from the critical threshold equipment provided by digital pay TV.

7. Intensity of competition plays a decisive role in the dissemination of new services and technologies. **Migrations can be blocked by market incumbents**, who prefer to exhaust and recoup their current competition and technological advantage rather than to invest prematurely in a new technology.

   By contrast, purely technological migrations are often supported by industry players or policymakers, as they are not given a market-driven impetus by an immediately visible benefit to individual consumers.

8. Historical precedents show that such infrastructure migrations usually **take a very long time and sometimes fail** purely and simply, when they are too far from the agendas of the key players in the market.

9. **Incentive measures** can break "chicken-and-egg" dilemmas, reduce the cost of migration or stop the progress of a stock of equipment which is incompatible with a new technology, but ideally they should remain as "technologically neutral" as possible so that competition is not distorted. Information for the consumer may be preferred to subsidies or prohibitions of certain products or technological options, which can generate market distortions as well as impinging on the technological innovation process.

10. When technological migration occurs at different times or different speeds in different countries or regions, this can lead to a fragmentation of markets (persistence of minority standards, incompatibility, etc.) leading to regression in economic efficiency and in economic integration. This could justify synchronisation and **co-ordination of digital migration at European level**.

    Regarding the role of the end-user in digital migration, several behavioural trends and consumer attitudes can be observed relative to television and innovation which will strongly determine the nature, rhythm and scale of migration (section 2.3).

[13] A service/product creates externalities/network effects when this service's benefit to the individual user increases with the total number of users. This can occur *directly* (thanks to the value created by the interaction among users, as in the case of communication services – telephone, fax, email) or *indirectly* (the increase in the number of users provides the service provider with economies of scale and additional income which enable it to improve the quality of service in return).

11. Global viewing time is stagnant, while television-viewing is gradually becoming more pro-active (despite the fact that TV-viewing habits only change slowly). TV and audiovisual spending keeps growing (equipment, subscribers, pay services, etc), notably among digital pay TV subscribers. The adoption cycle for new information and communication products/services seems to be more rapid than it used to be.
12. The pay TV market is beginning to approach saturation in certain countries (drop in the growth rate). **The continuation of digital migration should therefore occur via free-to-air (i.e. non-pay) digital services and by households equipping themselves for digital reception** on a spontaneous basis, i.e. without the operator subsidising the equipment, as has been the case with pay TV.
13. One problem will then arise: the existence of a **residual group of consumers who are reluctant to accept either spontaneous equipment or subscription**.
14. **The most critical segment will consist of households which are reluctant to adoptpay TV but which are potentially attracted by the advantages offered by free-to-air digital services** to the extent of investing spontaneously to equip themselves with facilities for digital reception.
15. The success of digital equipment in this segment will depend on **numerous factors**: information on the advantages of DTV, new digital channels and the attractiveness of free-to-air services, pricing schemes, the range of products available and of digital reception "solutions" (purchase, hire, "turnkey" service, etc.).
16. Although the demand for quality is growing unceasingly because of the development of digital packaged media such as DVD (people become used to having crystal-clear picture), the number **amount of channels remains the main incentive for consumers**.
17. An extended choice of free-to-air channels (in "terrestrial" countries where the choice is limited in analogue) and indoor reception/picture quality (in "cabsat" countries where the analogue choice is already large) will be the main drivers for consumer take-up of digital equipment. We should **not over-estimate the attractiveness potential of "interactive" television services.**

    As regards consumer interest in the context of digital migration:

18. While the **benefits** of transition to an all-digital television are obvious in the long term (see the introduction), the short-term benefits are not always clearly *perceived* by consumers. In particular, the perspective of terrestrial analogue turn-off could upset consumers and their representatives.
19. Migration also involves **costs**. In particular, to receive digital television, households which are not subscribers to a pay TV service will have to equip each receiver (television set or video cassette recorder, VCR) with a converter whose low-end price should soon drop to €150-€200.

20. Consumers' interests could be safeguarded by improved **information** so that they can adapt to the new technologies[14] as well as by market **regulation** (e.g. by making digital compatible televisions compulsory at some point).

    History teaches us that the progress of a migration is not only determined by consumer demand, but also by supply-side players and regulators which each pursue complex and occasionally contradictory objectives (section 2.4).

21. **A large variety of players** are involved in the migration towards digital TV. The objectives and strategies in question are multiple and multi-dimensional.

22. The **9 main players** identified in this study (who are both heavily concerned by the outcome of the process and influential enough to impact on the process) are the governments, consumers, cable operators, incumbent commercial broadcasters, public broadcasters, satellite pay TV operators, digital terrestrial pay TV operators, satellite transmission operators and consumer electronics manufacturers.

23. **The most controversial objectives as regards digital television** relate to the introduction of digital terrestrial television, its modalities, and the planning of analogue turn-off.

24. As always in such crucial periods, all industry **players seek to influence the national and European public authorities**, in the name of general interest, so that regulatory decisions impacting on the digital future could favour or at least not harm their own long term interests.

25. An analysis of the players' behaviour and strategy shows that, from the point of view of classical economic theory, **imperfections in market operation exist**: economic rent linked to free licences in terrestrial and satellite broadcasting, co-ordination and moral hazard problems, etc. These structural factors prevent the market players from acting in accordance with the general interest and even with their own long-term interest in some cases.

26. In particular, **market forces alone are not likely to pave the way for a rapid and *total* digitisation** of households' main TV sets in the medium term, let alone of *all* receivers, which would however be an unavoidable political prerequisite for any analogue turn-off.

27. The general interest benefits that could be expected from a rapid global digitisation and the ensuing analoguetuen-off are ***external* to market players**. They therefore do not have an incentive to take account of these in their behaviour. This is why, to a certain extent, we can speak of a "market failure" situation.

28. In this type of situation, economic theory suggests that it is **justified for public authorities to intervene** and to modify the markets' operating mode by introducing corrective mechanisms or incentives.

[14] For example, an obligation on manufacturers to provide clear information on the predictable obsolescence of purely analogue equipment by using logos such as "non-digital compliant ".

29. Conversely, certain imperfections in market operation can derive *precisely* from the fact that **some players anticipate intervention by public authorities** in their own strategy, which can lead to moral hazard or inhibiting effects or other market distortions, and can make them try to influence public authorities in the direction they anticipate, in a ways that suit their strategies.

Then focusing on the issue of the "sustainability of DTT" (section 2.4), we come out with four main findings.

30. We must **distinguish between the concepts** of the "sustainability" of pay-TV players using DTT (and in particular the sustainability of DTT-based pay-TV players) and the long-term sustainability of (digital) terrestrial broadcasting as a delivery mechanism.

31. The difficulties and risks of failure of DTT-based pay-TV players are in fact, above all, the **failure of vertical, "me-too" business models on maturing markets**. Satellite TV "second-movers" experience similar difficulties.

32. The **cost-competitiveness** of the delivery mechanism for commercial players is yet to be proven. Only major free-to-air broadcasters clearly have a reason to pay for almost nation-wide digital terrestrial broadcasting. For all other players, it will depend on national/local conditions and business models.

33. Policymakers should perhaps not try to *make* this delivery mechanism sustainable at any cost in the short-mid term. Instead they could licence broadcasters and then let market forces (TV players, network operators and transmission service providers) decide how and to what extent DTT should be used in order to **make their *own* businesses sustainable**. This might require the correction of some market failures so that market forces can really give way to economically efficient "decisions".

2.2 Technological migrations

2.2.1 The mechanisms

2.2.1.1 The different types of migration

Analysis of certain episodes from the past enables us to distinguish **two aspects** of technological migrations:

(i) **The rhythm of adoption of new services and** consumers' attitude to novelty.

Digital television can be considered as a technology which facilitates access to **new services**: migration to digital television is essentially stimulated in this case by the adoption of these new services ("**adoption migration**").

(ii) **Management by industrial groups and/or public authorities of replacement of one technology by another** and its turn-off over time.

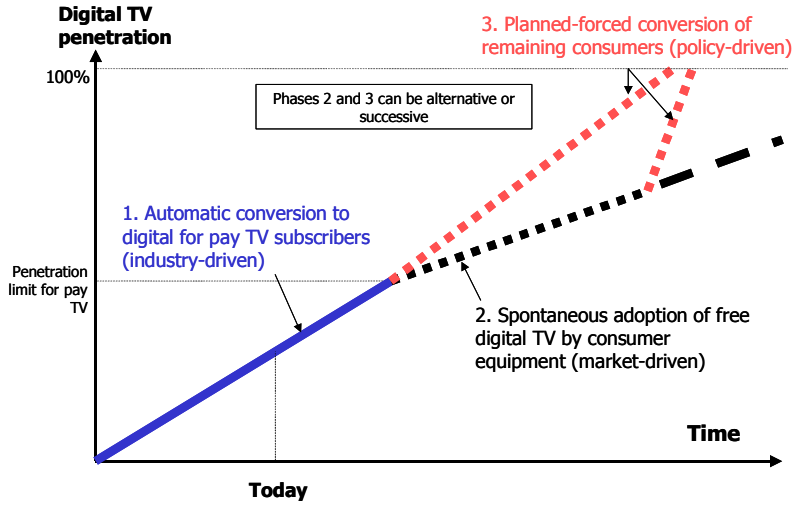
It can also be held that digital TV changes the *conditions* of production of the service, while the latter essentially remains *the same*. In this case, migration cannot be drawn solely by demand for new services; it must include an industrial policy dimension: industrial groups and/or public authorities encourage and even plan this migration (**"purely technological migration"**).

Priority can be assigned to one or other of these aspects, i.e. one or other interpretation of the process, according to the degree of attractiveness for the consumer which is believed to be incorporated in digital television services *per se*, relative to analogue television. In reality, the two approaches appear essential and complementary to us.

- In a *first* phase (currently), some television viewers (the early adopters, i.e. pay TV subscribers) are being **"digitised"** by their service provider, who supplies them with digital decoders when they subscribe to a pay TV service.
- In a *second* phase, some other consumers (the followers) will consider the characteristics and new services provided by free-to-air digital television as sufficiently useful to justify purchase of the necessary equipment. In their case, we are in an **adoption migration** framework and lessons from the adoption of other products/services in the past can be useful.

- In a *third* phase (which may also be contemporary with the second), a significant proportion of consumers (the reluctant) will remain indifferent for their part to the new functionality offered by digitalTV technology. They can only be migrated to digital reception within a *planned* framework. The situation requires an **organised technological migration** and a planned turn-off based on a change of *infrastructure* (including reception equipment), in contrast to the preceding phase where the emphasis is put on a change of service with market forces driving the process.

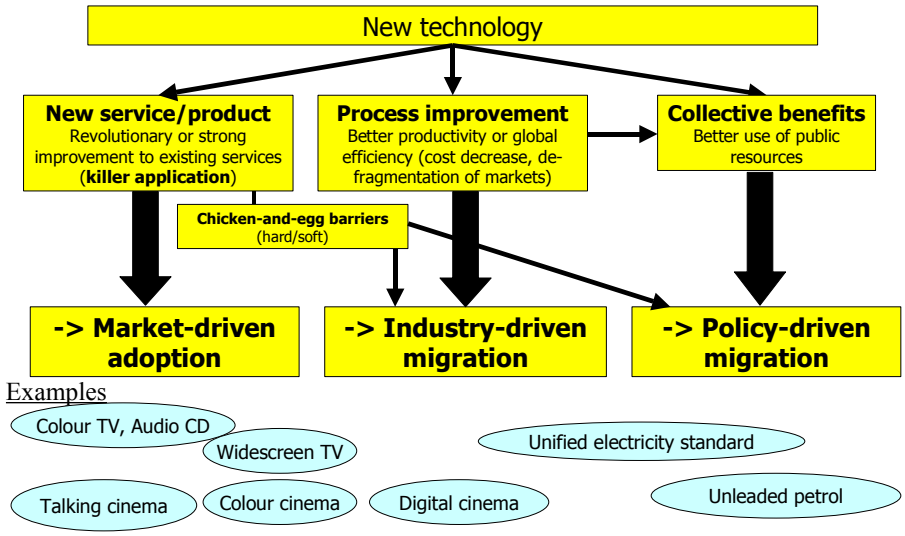
Figure 5: The three phases of migration towards all-digital television: conversion, adoption and turn-off



This indicates the need to study both spontaneous instances of adoption of new services and episodes of planned migration to a new technology.

The case studies show that **depending on the type of benefits provided by a new technology, particularly for the consumer, migration mechanisms and process differ significantly.** Some of the historical examples studied, have been placed within this conceptual framework in the following figure.

Figure 6: Three types of migration according to the effects of technological breakthroughs[15]

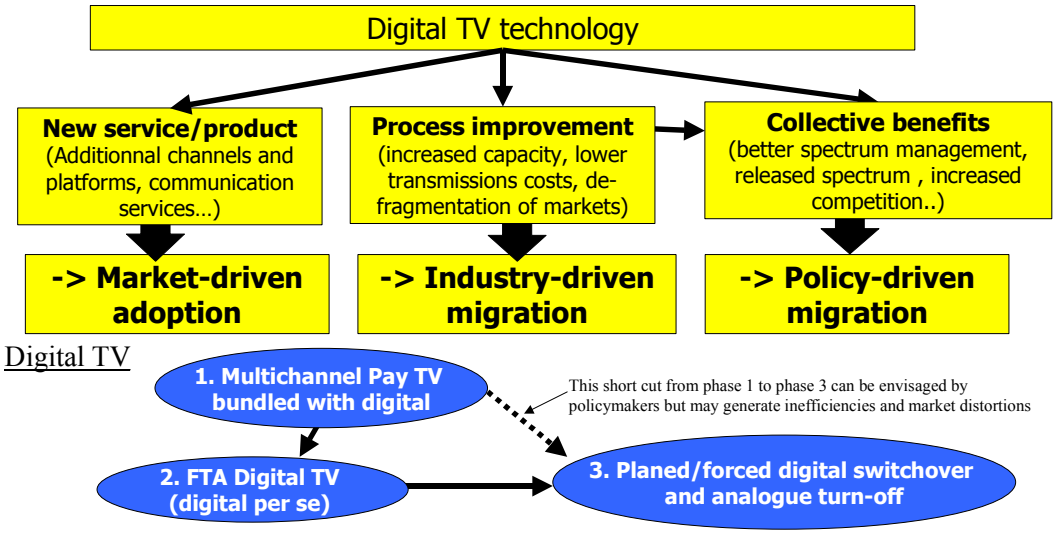


When we try to apply this conceptual framework to digital television, it is noticeable that we are in a **hybrid situation**. Digital TV technology bears characteristics deriving from the three types of innovation processes, which explains that migration is drawn in parallel or successively by the *three* types of mechanisms identified.

For example, the first phase involving "bundling" digital television and multi-channel pay television entails an improvement in service but also an improvement in the production process (while multi-channel analogue television was perfectly feasible, at least on cable and satellite, it was more costly and less effective). Phase 3 of migration will include terminating the reception switchover, by addressing consumers who will have been indifferent to the improvements introduced in phases 1 and 2. It can therefore only be driven by players with an interest in extinguishing the old technology (governments in order to re-farm frequencies, broadcasters and industrial groups in order to move to all-digital television and to reduce the costs of analogue simulcast, etc.) As indicated above, the objective here is to change infrastructure (including reception equipment) in contrast to the preceding phase where the emphasis is placed on a change of service.

[15] « Chicken-and-egg barriers » : even when there are obvious consumer benefits, the chicken-and-egg problem can delay product/service take-up because of the need for co-ordination between players concerned, so that industry or public intervention can be necessary in this phase.

Figure 7: Phases in migration towards digital TV and their mechanisms



2.2.1.2 Adoption curves and migration timing

Typical adoption and migration curves for new products/services are differentiated by three characteristics:

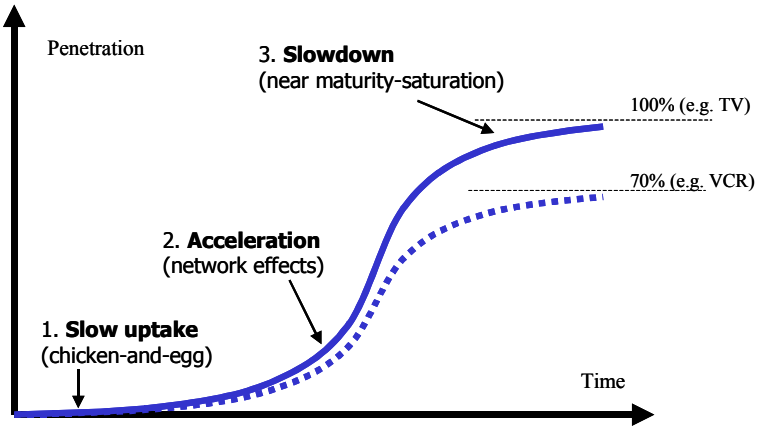
a) The level of saturation, corresponding to the final level from which penetration barely progresses any further. Some products/services are owned or used over time by more than 95% of households or individuals (e.g. fixed line telephony or television sets), whereas other products stop at a lower level, for example, 75% (video recorders). What makes the difference? Basically the price and perception of whether the product/service is essential or not for the household's well-being. There is no perfect method for forecasting a product/service's potential over time exactly. For instance, many analysts were surprised by the scale and speed of the success of mobile telephony which seems now to be likely to join the category of universally used services.

b) The shape of the penetration curve (linear, exponential or other). Some products/services have an "S-shaped" adoption curve, while others follow a regular, linear progression up to their saturation level. Products/services with network externalities[16] generally have an S-shaped adoption curve with an inflection point and acceleration corresponding to a critical mass of users. Fixed as well as mobile telephony fall into this pattern.

[16] A pure telecommunications service (e.g. telephone, email) is of little interest when few people are connected and becomes almost essential to everyone when many others use it. The value of using a network service increases on the basis of the square of the number of users (Metcalfe's law).

Televisions services only present *indirect* network externalities: by increasing advertising and subscription revenues without raising broadcasting costs, the increase in the number of viewers and/or subscribers makes it possible to improve the content of the service and to reinforce its value for each new user accordingly.

Figure 8: Services with network externalities display S-shaped adoption curves



Source : BIPE

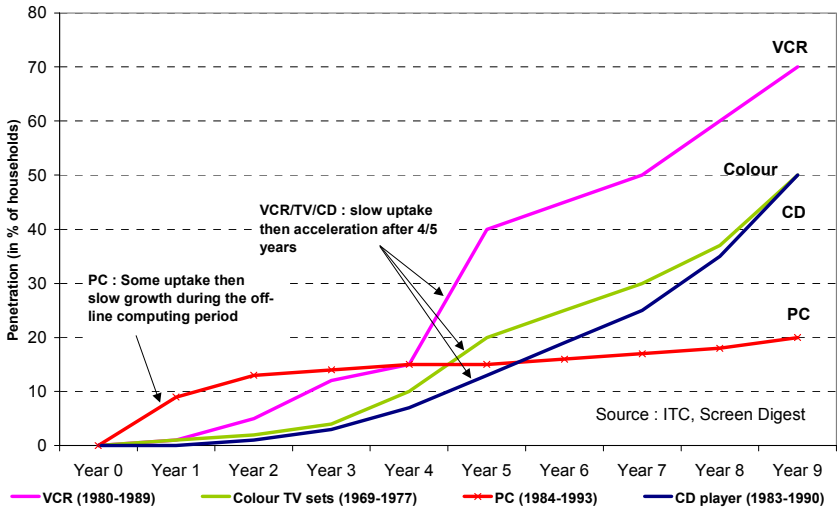
c) The **duration** of the adoption. Except when otherwise mentioned, reference will be made to the duration which it will take for a new product/service to reach its saturation level, which represents the "plateau" in the "S" curve.

2.2.1.3 Some historical examples and their lessons for DTV

In the United Kingdom, the personal computer (PC) took off in the 1980s, achieving a penetration of almost 10% of households. However, following this, the substantial price and the absence of direct externalities at the time (off-line, pre-Internet period) prevented the triggering of an acceleration and the conquest of other segments of the population beyond the most financially and culturally well-off households. Penetration by the PC had only reached 20% seven years later in 1993, i.e. after ten years. Since then, as we know, new networking applications (web-surfing, email) offering powerful externality effects have placed the PC on a new trajectory.

Similarly, if digital technologies make it possible to associate interactive networked services with traditional television, we could witness **accelerated adoption due to direct and indirect networking externalities** in the future (votes, enhanced game shows, bets and chats will be all the more interesting as the number of users increases).

Figure 9: Speed of penetration of different ICT services (United Kingdom)[17]



The first ten years of colour television (1969-1978) in the UK show a slow take-off (5% after four years), followed by a strong acceleration which made it possible to reach 50% penetration in year 10.

For its part, the video cassette recorder (VCR) reached maturity in only ten years. Its adoption curve also shows an acceleration after 4/5 years which is probably due to indirect external network factors (broadening of the range for complementary products: rent and sale of video cassettes) and the victory of a single standard, JVC's VHS, over competing standards.

The examples mentioned as well as experience of other products such as the DVD player offer indications that **new product adoption cycles are tending to shorten**.

Figure 10: Adoption cycles for new products/services are tending to shorten

New product/service	Period	Duration before reaching saturation level
Colour TV in the USA	1954-1975	30 years
Colour TV in the UK	1967-1983	15 years
CD audio Western Europe	1983-1992	10 years
Video recorder in the UK	1980-1990	10 years
Mobile telephony – Italy	1991-2000	10 years

[17] Sources: ITC (Annual Report 2000) ; Screen Digest (http://www.screendigest.com).

Three types of explanations for this phenomenon are possible:

- More open national and international competition allows economies of scale and faster price decreases. The opening of international markets facilitates a unification of standards and economies of scale, on the one hand, and an increase in local competition, on the other. The first element enables manufacturers to reduce costs while the latter compels them to reduce their margin. All of this helps to accelerate the price reduction cycle.
- The public's level of information and more precisely its level of acceptance of new technologies is improving ("digital literacy");
- Saturation of traditional needs is progressing, often creating a rapid success for new products/services in the area of information and communication.

It would be a mistake to relate the initial launch of "digital television" to the speed of adoption of previous products/services. As such, the immense majority of consumers currently move to digital television "automatically" when they take out a subscription to pay TV, as it is often supplied in digital mode. Or they are converted ("digitised") by their pay TV or cable-distribution provider when it changes over to digital broadcasting itself. In a tiny number of cases, the transition to digital television today corresponds to a real choice made by a consumer seeking the specific advantages linked to digital technology *per se*.

In contrast, these historical examples can act as a reference for the second phase of digital television development, when market forces will have to convince consumers reluctant to subscribe to pay TV that they should equip themselves with digital television equipment.

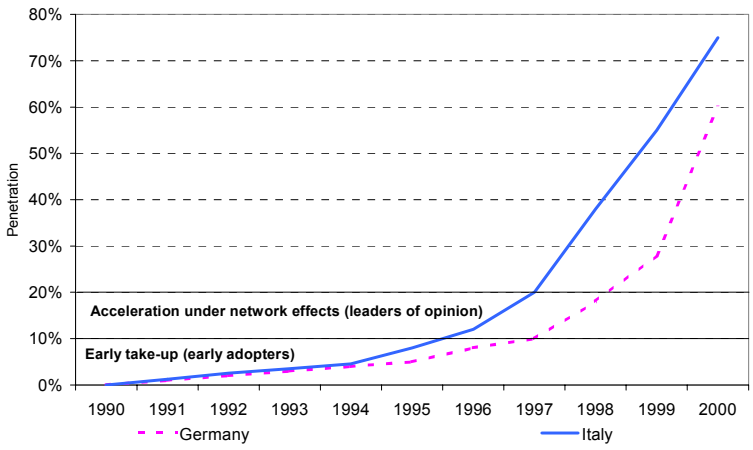
2.2.1.4 Where is the inflection point situated?

At what level is the inflection point from which we can expect accelerated adoption of services with strong network externalities?

Studying the adoption of mobile telephony in Europe offers many lessons in this respect. First of all, a relatively similar adoption profile from one country to another has been noted. The figure below shows the "slowest" and the "fastest" countries in the adoption of mobile telephony (Germany and Italy respectively); all of the other countries lie between the German and Italian curves. The first two phases of the S curve (slow take-off, then an "explosive" acceleration) can be recognised clearly.

It may be considered that up to 10% of the first users are “early adopters”, i.e. systematic technology fans. The success of the new product among this atypical category of the population in this trigger phase does not necessarily guarantee a broader subsequent success. Some products have failed to impose themselves on the market after taking off among technology fans (laser discs, CDIs, etc.). It may generally be estimated that the inflexion area, the beginning of the acceleration, where the success of a technology or a product is played for, is actually located at between 10% and 20% of market penetration, when the new product/service succeeds in seducing”second-wave” adopters. These are no longer just technology or gadgetry fans: they are people in diverse sectors who appreciate the real usefulness of the services offered. They trigger the mass movement via “viral marketing” (positive word of mouth), but also by substantially increasing the use value of the service by the simple fact of connecting them to it, i.e. via the network effect.

Figure 11: Inflexion thresholds in the adoption of services with network effects (example of mobile telephony)



2.2.2 Main lessons from the case studies[18]

The history of the cinema offers various examples of technological innovation.

- Some technical innovations led to a revolution in the product (the “talkies” which supplanted silent cinema in less than three years), while others created an improvement (colour, which was disseminated more progressively), and others finally to a simple change of process which is almost invisible to the consumer (digital projection).

[18] A more detailed analysis of each of these cases can be found in the annex.

- In the transition to digital television as with the transition to digital film projection, the players who have to invest to equip themselves are not necessarily the direct beneficiaries of migration; thus the **search for an economic model and equitable distribution of migration costs complicates and slows down the process**.

Figure 12: Types of technological migrations

	New service	Process improvement	
	Revolution	Improvement	Technical migration
Added value perceived by final users	**Strong**	**Medium**	**Low**
Television	Colour TV sets, multichannel television	High definition, widescreen sets	
Cinema	Talkies	Colour movies, large formats	Digital projection
Other examples	Vinyl to audio CD		Migration to unleaded gas
	DVD		Introduction of the euro
			110 to 220 voltage
			Driving on right
	-> Market forces alone can drive a fast migration.	**-> The new technology may need to be borne by the industry consensus and/or regulation at least until its take-off phase or the turn-off of the former technology.**	

The broad, rapid success of audio CD (equipment in players, purchases of discs and reconstitution of music collections) is considered as a success model due to a combination of factors, of which many could also be key success factors for digital television.

- **Industrial consensus** on the format and genuine cooperation which makes it possible to synchronise the market launch of equipment and contents/services.
- Need to ensure a clear breakthrough and **added value for the consumer** relative to previous products ("killer applications").
- **Consumers' investment capacity** when they perceive major added value in the new service/product and an affordable price. Thus, for digital TV equipment, we believe that a supplementary cost which would not exceed €150[19] is acceptable.
- **It is not always necessary to plan a withdrawal of the former format or to subsidise the first players**

[19] 150 euros or £99 represents the price targeted by the major manufacturers of decoders intended for the general public, such as Pace or Netgem, and is considered the psychological ceiling for this type of equipment.

However, certain factors explaining the fast success of packaged media migrations are absent in the case of a digital media like television. The low number of major video publishers and consumer electronics manufacturers at European level, minimal regulation of these markets and partial integration of the two industries have actually facilitated the co-ordination and synchronisation of equipment and content necessary to achieve critical mass rapidly. These conditions are not found in the case of European television, whose markets are national and highly regulated, and involve many players.

The colour television market did not take off in the 15 years following the development of colour technology in the United States.

- This occurred for two reasons: (i) launched around 1950 shortly after black and white TV, colour TV was not able to benefit immediately from the replacement of black and white TV television sets, (ii) viewers had to wait approximately 10 years for the first successful colour programmes specially designed to show colour reception to its best advantage. Thus **each new technology needs a popular "killer application"** which clearly shows its superiority over the existing system and catalyses consumer desire, to drive take-up.
- The underlying reason is nonetheless to be found on the supply side. Major vertically integrated players such as RCA controlled both black and white technology, colour technology and the main national channels at the same time; they deliberately preferred to devote their efforts to developing black and white television sets to recoup their investment before triggering a new investment and product cycle. It was only when black and white penetration was approaching saturation that these same players actively and successfully promoted colour[20] by broadcasting colour programmes and launching affordable colour sets on the retail market.
- Moreover, the USA regulator (*Federal Communications Commission,* FCC) prematurely sought to define a technical standard in 1948, whereas the technology had not stabilised yet and the market was not ready. This premature intervention by the public authorities sent wrong signals to the markets and froze the technology too early. Generally speaking, it may be desirable to **limit regulatory intervention in the initial phases** of a new technology, to allow the market to determine the best development direction and timing.

[20] Voir BALIO Tino : Hollywood in the Age of Television, (Allan & Unwin 1990) (see in particular "Red, Blue and Lots of Green : the impact of Color Television on Feature Film Production", chapter by Brad Chisolm).

The transition to the 625-line format and the UHF band for UK television amounted to a technical choice.

- The slightly better picture definition would not have been sufficient to generate a massive migration towards the new standard. What made the difference was the fact that the programmes broadcast in colour and the new channel BBC2 in particular could *only* be received with 625 lines and *not* in the old 405 lines format. Without these exclusive features, 625 line technology could only have imposed itself in a planned framework with incentives or compensations for the additional cost. This suggests again that **digital technology will have to find clear, attractive and if possible exclusive consumer benefits** to enable it to take hold in the market.
- **The consumer advantage does not have to be intrinsically linked to the new technology; it is sufficient for it to be *bundled* with it**. It would also have been possible to envisage creating colour television in 405 line format, but a choice was made to develop and launch colour *solely* on the technological vehicle of the future, the 625 line format. Similarly, multi-channel, high definition, wide screen aspect ratio and even certain types of interactivity are technically possible in analogue format; the important thing is that some of these characteristics are clearly and definitively associated with digital in the minds of the consumer.

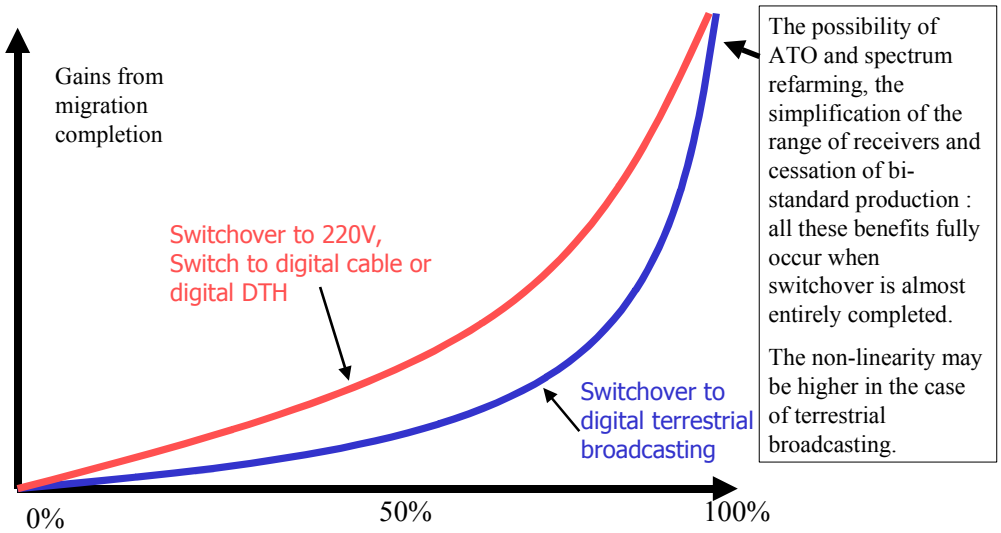
The unification of the electrical network (transition to 220 volts in Western Europe) presents shared features with the transition to all digital TV.

- In both cases **the benefit for the consumer is only a (small) share of the *global* benefits**. In fact, the move involves producing a similar service in more efficient macro-economic conditions in terms of better management of public resources (the cost of the national electricity infrastructure, the public channels' broadcasting cost, the management of radio frequencies, etc.), i.e. in line with the long-term general interest.
- It has been noted that the **stock of non-compatible terminals continued to grow,** which led to a fragmented market and a fragmented installed base, thus slowing down the migration. In the case of digital TV, to avoid similar costs induced by fragmentation and to accelerate the migration process, some policy makers currently envisage for example prohibiting the sale of television sets with only an analogue tuner in the same way that forty years ago, they forbade exclusively 110V electrical devices.

- A generalised takeover of the consumer's migration costs can lead to certain perverse effects (e.g. moral hazard, free-rider effect). It is particularly **necessary to provide consumers with full information about the timing of migration and the options** available to enable them to migrate at their own pace. And this must occur before authorities consider whether more interventionist measures (e.g. terminal conformity obligation) are really necessary.
- In the electricity case, the transition took a long time as maintaining some "islands" at 110V did not create a substantial additional cost at national scale. We are in the same situation today with cable television: **some local networks could be kept analogue or "simulcasting" by their operators if converting/turning-off them were not economical**. In contrast, in the case of terrestrial digital television, it would be non-economical to maintain a digital/analogue simulcast for too long over a large area, as this would prevent broadcasting cost savings and the release of nation-wide frequencies.
- Finally, from the point of view of today's electronics manufacturers, like the electrical appliance manufacturers of yesteryear, there is a **limit or threshold effect**[21] linked to the conquest of the last % of penetration and total turn-off of the old format (110V or analogue). In practice, as long as "holes" like 110V zones, (i.e. areas without digital reception or analogue households exist, it is necessary to maintain the production and distribution of *bi-standard* devices.
- This non-linearity of benefits with penetration could justify public intervention to help market forces to deal with the last percentages of market penetration.

[21] Limit (or threshold) effect: effects caused (catalysed) on a non-linear basis with their causes, following the example of a chemical reaction which only occurs when a certain temperature is reached.

Figure 13: Non linearity of the gains from technological conversion (threshold effect)



The failure of MAC analogue television standards in Europe also provide some lessons for public policy intervention in these markets.

- The MAC plan resulted from an industrial policy action promoted by public policy-makers, public broadcasters and the main European electronics manufacturers. In a first phase (start of the1980s), they sought to promote a common satellite broadcasting standard in order to prevent a re-occurrence of the market fragmentation of the 1960s with the PAL and SECAM analogue standards in terrestrial broadcasting. In a second phase, they tried to promote high definition TV (HDTV). This plan required substantial private and public investment (*Eureka 95* programme) to develop an admittedly technologically advanced but costly broadcasting standard. But this **did not match the level/timing of development of European television** markets and the expectations of the time. Indeed, operators' and consumers' priorities were focused on multi-channel and premium TV, not high definition.
- Similarly, the majority of researches on consumer attitudes now seem to show that the European public is not yet ready for massive interaction with the television beyond video-on-demand (VOD) and use of electronic programme guides (EPGs).

Consequently, it is necessary to be prudent and **not over-estimate the benefits of "interactive" digital television and the need for public intervention.** On the other hand, it should be noted that with the turn-off of analogue broadcasting (notably in terrestrial broadcasting) there is at least one good reason for intervention which did not exist in the MAC episode: optimisation of the radiospectrum public resource.[22]

- **Time-to-market and technological timeliness are decisive factors**. Although arriving too early with regard to the market's needs and priorities, high definition analogue technology also arrived too *late,* as digital broadcasting, which also brought picture quality enhancement, appeared as of 1992 in the USA and 1996 in Europe. This technology missed its window of opportunity. Similarly, some people argue today that digital technology is arriving too late for it to be worth the trouble of upgrading terrestrial broadcasting and that it would be better to migrate directly to cable/satellite broadcasting[23].
- Incentive-based or restrictive government measures aimed at accelerating a **migration can be circumvented by the key players in the market**. For example, *BskyB*, by launching DTH pay TV via medium-power satellites in PAL standard, precipitated the failure of MAC technology. It is therefore important to ensure the involvement, or at least the absence of opposition, of such players in a policy-driven migration strategy.

The late, but now confirmed, take-up of widescreen television teaches us several lessons.

- **Developing free-to-air digital television means coming up against** a **chicken-and-egg situations like the one encountered with widescreen TV** (programmes and receivers).
- The success of digital **premium pay TV may be a way of breaking the chicken-and-egg** situation by giving free-to-air broadcasters and other service providers a base of digital households to whom they can start offering services. In the case of widescreen television, in the end it was not the subsidised pilot programmes broadcast in widescreen format which helped market take-up, but the appearance of perfectly complementary products/services: the DVD player and digital pay TV. Thus the "killer applications" are not always where they were expected.

[22] The MAC plan had another general interest motivation which was to avoid a fragmentation of the single market, as stated above.

[23] Is it better to improve a technology in difficulty or to abandon it immediately? Historically, France lagged behind by several decades in telecommunications when it was decided under pressure from the union of engineers to electrify the semaphore networks rather than abandon them to develop wireless telegraphy.

- **The difficulty is much worse in the case of digital radio** insofar as digital television makes it possible to increase the number of available TV channels in many countries, whereas FM analogue radio has always been "multi-channel" everywhere. Moreover, radio cannot expect a subscription-based business model to start breaking the chicken-and-egg problem**.**
- As in the case of the widescreen TV Action Plan[24], **some governments hope to catalyse the movement and accelerate migration though financial or other types of incentives**.

[24] See http://europa.eu.int/comm/avpolicy/mediapro/pl169_en.htm and the Final Evaluation of the 16:9 Action Plan (prepared by IDATE, November 2000) (http://europa.eu.int/comm/information_society/evaluation/pdf/report1691_en.pdf).

2.3 Consumers

2.3.1 Objective – The consumer's place in the process

In addition to constituting a new paradigm in production and broadcasting, digital technologies are also introducing new functions which improve the viewer's experience more or less significantly. Consumers' demand for these new services and their willingness to pay for them (through subscription to a service or investment in a new piece of equipment) will be a decisive factor in the way and the speed with which these services will impose themselves and thus impose digital technology.

Thus in this section we shall first refer to the fundamental aspects of consumer behaviour and attitudes to digital television and the attitudes expressed in the face of the prospect of an analogue turn-off. We shall then examine **the obstacles, the drivers and the market mechanisms** lying in consumer behaviour and impacting on digital migration.

Up to now digital migration has been driven by (i) consumers' subscription to digital pay TV and (ii) digital "upgrade" of analogue pay TV subscribers when their service provider migrates to digital and ceases to offer the service in analogue mode. We should therefore begin by examining the motivations associated with, and potential offered by, subscription-based television services. Then, for households which will *not* wish to subscribe to a pay TV service, we shall have to determine which perceived digital advantages are or will be likely to lead these consumers to equip themselves with digital receivers (integrated receivers or external converters). To do this, it is **useful to segment the consumers facing the migration**.

2.3.2 Trends

While viewing time is stagnating, spending is increasing

Television viewing time is now more or less stable in Europe. The deployment of multichannel pay TV offerings has only increased it slightly in the past 5 years[25].

The amount of time devoted to television in traditional mode (on air, real-time) should evolve as a function of opposing factors in the future: on the one hand, the observable increase in leisure time seems to be allocated to television-viewing rather than to any other activity[26]; on the other, competing audiovisual/multimedia leisure platforms (DVD, video games, PVR, etc.) in terms of "time-budget" and monetary budget are increasingly diverse and challenging traditional television.

More and more consumers are ready to pay for improved quality and characteristics which enable them to optimise the satisfaction/time ratio for their television experience: a large choice of thematic channels, access to pay-per-view (PPV) or NVOD, and navigation tools. Time is becoming the scarcest resource; therefore Consumers wish to improve the "productivity" of their leisure time.

As the massive digital migrations organised by *BskyB* and *Viasat* have proven, the average spending (ARPU) by pay TV subscribers increases when they are converted to digital, in two ways.

- Consumers are ready to pay a higher subscription for the perceived benefits of digital (picture and sound quality, increase in the number of channels and services available, access to PPV/NVOD, electronic programme guides)
- They use supplementary paiy services above and beyond their monthly subscription (PPV/NVOD[27], games, betting , "t-commerce", etc.).

Thus in 2000, Sky subscribers' ARPU increased by 7% to £313 (€500) of which interactive services accounted for £11.

Fragmentation of the audience and uses

Television consumption is moving gradually from a passive, extensive model (default viewing) to an active, personalised model (destination viewing) characterised by intentional choices, mastery of search and navigation tools, and a permanent trade-off between real-time viewing and delayed off-line viewing[28].

---

[25] Source: IP Television Europen Key Facts 2001.

[26] A survey carried out by INSEE (Institut National de la Statistique et des Etudes Economiques) shows that television consumption as a main activity was one of the main beneficiaries of regulations limiting the French working week to 35 hours instead of 39. There is therefore still a propensity to allocate marginal leisure time to television.

[27] Pay Per View. Near Video on Demand.

[28] Source: FT Media report "TV Viewer of the Future " (1999).

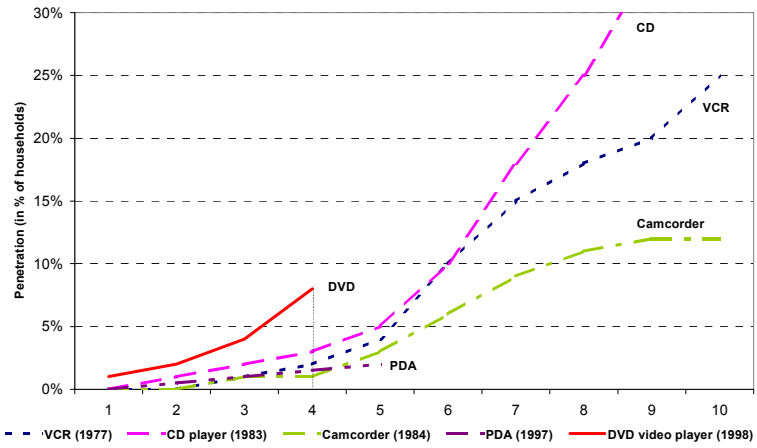
However, we think that behavioural inertia is such that, as has happened in the USA, the oldest 2 to 3 general channels which federate the audience most will be able to retain 50% to 60% of the global audience. It is less easy to predict the development in terms of advertising income.

The "leader premium" which enables holders of the most powerful advertising slots to sell GRPs[29] at the highest price[30] will probably be retained. On the other hand, the advent of more targeted marketing rules and tools which facilitate improved measurement of and capitalisation on the targeting could move much advertising investment towards the thematic, or even "narrowcasting" channels.

Adoption cycles are becoming shorter

We have already highlighted this trend in the chapter on migrations. Thus, the DVD player, which was launched in 1998, had sold more than 12 million units at the end of 2001 in Western Europe, representing a penetration of approximately 8% of households, two or three times higher than the level achieved by the CD player or the VHS player-recorder after four years on the market (see following figure).

Figure 14: Launch of new products over 25 years in Western Europe



Source : BIPE

[29] GRP: Gross Rating Point. Advertising transaction counting unit: a GRP equals to exposure of targeted 1% of individuals within the total population.

[30] For example, TF1 has 33% of overall audience share, but controls 50% of the French advertising market and can obtain a higher GRP price than its competitors.

Packaged products educate consumers as regards quality

Our analysis of technological migrations in the past has shown that packaged media have often contributed to creating new quality standards in users' minds, which real-time media are then obliged to follow. For example, the history of radio is the story of a chase to catch up with the quality of phonographic recording (stereo then FM to follow LP quality, digital radio tomorrow to follow CD). Today, the development of DVD may similarly lead to a demand for enhanced picture and sound quality in real-time television too, and might eventually accustom viewers to using navigation menus.

Attractions and limits of interactive television

There is a gap between the forecasts made by television operators, on the one hand, and financial results and the outcomes of independent consumer studies on the other.

In France, for example, the two operators of pay TV by satellite point to a high level of use of interactive services offered, rising as far as 25% of global income. However, these announcements consolidate PPV/NVOD income with revenues from genuinely interactive services, which are much lower. In the UK, the Open e-commerce platform, created by the *BIB* consortium led by Sky, has produced disappointing results. After the integration of *British Interactive Broadcasting* into *BSkyB*, the share represented by interactive services in *Sky*'s ARPU in 2000-2001 only amounted to 5%, i.e. £11 (€17).

While pay TV subscribers frequently use free functions such as electronic programme guides, interactive weather forecasts and some games, only horse betting has proven to be a new and significant source of revenue up to now. For their part, other transactional services (t-commerce) are also performing below expectations.

Some recent consumer studies show a certain lack of interest among consumers in interactive television, except for PPV/NVOD or for functions which can optimise and personalise viewing of traditional programmes, such as EPG. When questioned by Statistical Research[31], 70% of the people surveyed recently stated that they were *not* interested in the idea of "interacting" with programmes. This is not simply a lack of interest due to limited information and opportunity, as the proportion of the uninterested consumers is the same among those who *can* access services of this type (digital pay TV subscribers).

[31] Source: Statistical Research Report "How People Use™ Interactive Television " (http://www.statisticalresearch.com/press/pr082801.htm).

In contrast, a majority of those who access an EPG use it and tell researchers they are satisfied with it; however, at the same time, they do *not* consider it as an "interactive service" but as a natural improvement, which should be part of the television terminal from now on , just like the remote control. 73% of households with access to PPV/NVOD services purchase films and 43% occasionally buy other types of events. Finally, it seems that technology is beginning to change the way television is consumed: 50% of EPG users declare that they do less "zapping" and 80% use fewer paper-based programme guides.

Figure 15: Consumers faced with interactive television

	Willingness to use	Willingness to pay
PPV	+++	+++
Betting	++	++
EPG	+++	
T-commerce	+	
Games	+	
Polls, chats	+	
Programme enhancement	+	
Email, websurfing (PC internet users)		
Email, websurfing (others)	++	+
T-banking	+	

Source: BIPE based on consumer surveys

Consumers still prioritise range of choice

In traditionally terrestrial countries like France, the level of household satisfaction expressed by households with multichannel access is higher than that of households which only receive the 5 free terrestrial channels (63% compared with 50%).

Other elements are available which lead us to think that the European consumer still primarily wishes to have a wide choice of channels. At European level, a survey highlighted major differences in the degree of global satisfaction felt by consumers in various countries[32]. It appears that the most satisfied viewers are those in countries where the greatest number of free-to-air channels are available (Italy) or the greatest number of basic cable channels (Germany).

In theory, consumers would possibly agree to be satisfied with a relatively small number of high-quality channels or the opportunity to access a range of programmes on demand. In practice, however, they continue to prefer access to a wide range of general and thematic scheduled channels combined with user-friendly tools enabling them to search for what matches their own preferences at any moment.

[32] Source: Ipsos barometer on European consumer satisfaction as regards services. The results have been corrected to take account of the overall propensity of national consumers towards dissatisfaction, so that international comparisons can be made concerning a given service.

2.3.3 Drivers and obstacles

2.3.3.1 The vision of digital television in different countries

The concept of digital television is not only vague; it also **differs significantly from one country to another**.

- **In the majority of "terrestrial" countries** (Spain, Italy, France, Greece), multi-channel television appeared in the form of pay TV packages. Thus, **from the outset, "digital" was synonymous with "multichannel" and "pay".** It was only later that the development of services and functions which were unknown in analogue television (EPG, NVOD, interactive services), made it possible to alter the initial perception of "digital television".
- In the United Kingdom, for millions of viewers multichannel pay TV preceded digital (analogue *BskyB*), but today "digital" has also become a synonym of "pay television" in the minds of consumers. This is due to the major investments in communication undertaken by *Sky*, *ITVdigital* and *NTL* to establish the equation "digital = quality = pay", whereas the existence of free-to-air digital channels has received little concerted promotion by terrestrial market players.
- Viewers in **heavily cabled and "hybrid" countries** (Benelux, Germany, Austria, etc.) have been familiar with an analogue multi-channel environment via "basic" cable supplemented occasionally by direct satellite reception of free-to-air channels (Scandinavia, Ireland, etc.). They already have diversity; it cannot therefore be a differentiating element for digital as it is in terrestrial countries.

  It is therefore **necessary to convince the consumer to associate "digital" with other, new characteristics**, such as picture quality, interactivity, indoor reception/portability, on-demand programmes, premium content, etc.

In a majority of countries, marketing departments in pay TV operators succeeded in establishing an awareness of the "digital television" product which can be defined as "digital-quality-PPV-premium-multichannel-with-added-services". Today, other marketers have to work to explain that digital television can be something else or can focus on one element of the preceding bundle, for example: (i) a traditional free-to-air offering although broadcast in digital with improved picture and sound quality (ii) new free-to-air channels which were previously not unavailable in analogue mode, (iii) interactive services including "on demand" pay applications available without a prior subscription. **The digital television marketing concept needs to be "unbundled".**

Confusion also exists as regards reception equipment, with this largely due to the over-use of the fashionable term "digital" by electronics manufacturers for designating sound or imaging processing within analogue TV receivers, for example. British industry recently agreed on reserving the term "digital television" for terminals which can receive digital *signals*, and on identifying them for consumers via the DVB logo.

2.3.3.2 The wish to migrate

In April 2001, a Gallup survey for Pace Micro Technology[33] showed that 28% of British households had already converted to digital television[34] and that another 22% envisaged doing so by the end of 2002[35].

While 53% of analogue households in April 2000 declared that they did not envisage migrating to digital television before being obliged to, by analogue turn-off, only 34% of respondents were still expressing the same negative view in 2001. This may be interpreted as a sign that some consumers are now better informed and are beginning to consider digital migration and the corresponding turn-off as a progress which is interesting to *achieve early* rather than as a constraint and a matter of fate. Another interpretation could be that, as they are aware of an inevitable turn-off, certain households prefer to avoid migrating at the last moment to avoid running the risk of having their service cut off. Now that low-cost converters are arriving on the market, this trend will certainly be confirmed.

In September 2001, Ipsos Media[36] asked French consumers the following question: *"Would you be interested in the possibility of receiving 30 new terrestrial channels, of which 15 would be free-to-air and 15 with a pay option, knowing that to do so it would be necessary to buy a new television in the same price range as traditional televisions or to rent a decoder for approximately 7 euros per month?".* Not only did 72% of all French people find this proposal "attractive": the other results show that a service of this type could compete with multichannel pay TV.

- Households envisaging subscribing to multi-channel pay TV were more interested than others in the prospect of multi-channel access *without a subscription* (87%), while 66% of consumers who were *already* subscribers to multi-channel pay TV were interested in the arrival of a new mode of access.

[33] Source: *The Pace report 2001: consumer attitudes towards digital television.* (www.pace.co.uk).

[34] Pay or free-to-air digital television; primary reception.

[35] By March 2002, such forecasts for end-2002 remain reachable.

[36] Source: Ipsos/Strategies barometer on the image of television by cable and satellite (Ipsos survey carried out by telephone among 2024 representative individuals) (http://www.ipsos.fr/articles_fr/0112/tnt/tnt.htm) .

- This latter point gives an idea of the possibility of transfers from subscriber television to free-to-air multichannel digital television without a subscription, especially as the same survey revealed a growth in the number of consumers who considered multi-channel pay TV "too expensive" (54%, representing +9% over 12 months).
- In contrast, only 35% of those which did not have interest in pay multi-channel TV considered that acquiring multi-channel *equipment* was of interest.

Why migrate ? The pay TV "driver"

The age of individuals and the composition of households are the two determining criteria in the level of attractiveness of multichannel pay TV in terrestrial countries. The interest associated with pay TV decreases with age. Two-parent households with children are typical subscribers to pay TV for numerous reasons (children's request, attraction of thematic channels, limitation on outings, etc.)

The motivations expressed by people who state that they seriously envisage taking out a subscription to multichannel pay TV prominently include picture and sound quality and the wish to access a wide diverse range of channels. These motivations scored 88% and 86% respectively in the above French survey recently.

Figure 16: Motivation for subscribing to pay TV (France as an example)

	Sept 2001
Digital quality of picture and sound	88%
Variety of programmes/channels	86%
Quality of programmes	87%
Access to pay-per-view	39%
Documentary channels	87%
Movie channels	90%
Sports channels	60%
Information channels	61%
Kids channels	51%

Source : IPSOS/Strategies barometer

Why migrate? The free digital "driver"

In "cabsat" countries, where households are used to receiving 20 to 30 channels in the basic package by cable or free-to-air by satellite, it is difficult today to see what could encourage them to invest in equipment which enables them to receive the *same* channels with simply a slight improvement in quality.

In countries where reception is largely terrestrial, where households often only receive 4 to 5 general channels, basic multi-channel could be the novelty associated with free-to-air digital television.

It has not been possible so far to *measure* the attractiveness of multichannel digital television insofar as (i) many free-to-air satellite channels are broadcast in the two formats and the transition to digital does not considerably increase the viewer's choice, and (ii) DTT experiments carried out so far have tended to focus on pay TV.

However, we have no doubt that as the attraction of pay TV essentially resides in the wish to have an extended range of channels, *a fortiori* there will be a demand for a solution which can extend the choice *without* a subscription and this will be even more true if the investment to be made by the consumer does not exceed the equivalent of a few months' subscription to multi-channel pay TV.

However, this can only manifest itself fully when **several conditions** are met:

- The end of aggressive promotions by pay TV operators (due to the maturation of markets and reduced competition due to horizontal concentration between pay TV platforms).
- The presence of numerous attractive free-to-air channels, which should be new if possible and *exclusively* in digital if possible.
- A large variety of connection solutions (external converters, integrated digital televisions, etc.) and broad information about their existence.
- The existence of simple low-cost connection packages (sell-through "adapters", turnkey installation service, etc) to reach the mass market.

2.3.4 Consumer segmentation

We suggest segmenting consumers into four categories according to their position in the DTV migration :

1. Already subscribers to pay TV
2. Ready to become subscribers
3. Non-subscribers, who do not wish to become subscribers, but who are ready to equip themselves to access free-to-air DTV
4. Non-subscribers, who are reluctant to accept either subscription or equipment, in particular because they do not seek an improvement on the analogue TV service[37]

The multichannel pay TV subscriber (category 1) has been, is being or will be converted by their service provider, via the provision of a digital decoder and perhaps a change in pricing. The examples of migration organised by satellite pay TV operators (*BSkyB, MTG/Viasat*) show that only a few subscribers cancel their subscriptions.

[37] This category includes the famous "Aunt Emily", who has no interest in football and cinema, is satisfied with her 5 free channels and is reluctant to accept any change.

The vast majority of subscribers accept the upgrade, as the costs of change are kept low (digital STBs rented at a subsidised price) and the added subscription cost appears to be justified by the improved service.

Category 2 includes households which are sufficiently interested in the advantages of pay digital packages to be likely to subscribe in the short/medium term. Categories 1 and 2 therefore represent subscribers *in the longer term*. Category 2 gets smaller gradually as the pay TV market matures. The last Ipsos barometer showed that no more than 18% of French people who were not yet pay TV subscribers envisaged becoming subscribers in the short or medium term (compared with 22% in the previous year), while 42% stated with certainty that they would *never* become subscribers (as against 30% one year earlier).

Figure 17: The four categories of consumers vis-à-vis digital TV

	Aversion to equipment	Aversion to subscription	Interest in digital advantages
1. Pay-TV already	*		***
2. Pay-TV ready	*	*	**
3. Pay-TV averse, equipment-ready	*	**	**
4. Change reluctant, digital-resistant	***	***	

Source: BIPE

Three key moments must be considered in the behaviour of each category of consumer.

A. What will they do at the time of the natural **renewal** of their main TV equipment (approximately every 7/8 years) (-> purchase an analogue or digital television?)

B. What will they do ***during* a television set's lifetime**, when changing the set prematurely out of the question, whereas new programmes or services are available on digital (-> subscribe to a pay service *or* acquire a converter?)

C. What will they do at the approach of the planned turn-off date (-> acquire equipment or do nothing?)

Categories 1 and 2 are by definition converted to digital through their acceptance of pay TV. The uncertainty therefore relates to categories 3 and 4.

Households which are reluctant to accept pay TV and re-equipping (category 4) can be segmented into two sub-categories.

- Some come from economically and culturally disadvantaged environments. Television represents a major share of their leisure time and is important for their social inclusion. Announcements of turn-off, even accompanied with safeguards, which are often difficult to understand, will probably create sufficient concern for them to take precautions against this risk at the time of natural renewal, by paying the added cost of a DTV-compatible equipment. These households will probably be more likely to move to an *integrated* digital reception solution, rather than a modular, external one which requires greater technical understanding. A problem would then exist if, as is the case today, only high-end digital televisions were available.
- The remainder of the "digital-resistant" viewers will include those who, due to a lack of interest in television, consumer militancy, or a simple wish to take a perceived opportunity of obtaining a free receiver, will consciously choose to let the deadline for turn-off arrive while counting on government bluff ("they will not really dare to turn-off my analogue television; they will pay me for my converter").

We shall focus on category 3, which is the most critical category for the transition to an all-digital environment under market forces. Although reluctant to accept pay TV on principle or lacking interest in thematic/premium multichannel TV, households in this category are more or less likely to be attracted by the advantages of non-subscriber digital, with the easiest to understand being: access to extra free-to-air channels (particularly attractive in terrestrial countries with a small range of existing free-to-air channels), indoor reception or enhanced picture and sound quality (in other countries).

These households will then have a choice between three possibilities:

- **Purchase of an integrated digital television,** at the time of replacement
- **Purchase of a converter**, during the television's lifetime
- **Rental of a converter**, which makes it possible to limit the risks associated with purchasing (such as an unpleasant surprise concerning actual reception)

A certain number of factors will contribute to their decisions.

- The consumer's **general level of information**.
- **Electronic retailer advice**. The existence of a turnkey connection facility from video installers: converter + antenna/dish package, etc.
- The existence or absence of **plans for renting free-to-air decoders**, without a subscription, whose promoters could be free-to-air digital TV operators, pay digital TV operators (betting on a pay "upgrade" over time) or chains of leisure/electronics retailers
- **The difference in price** between the digital models and analogue models.
- **The existence of a large range of digital televisions.**
- **The existence of** attractive **free-to-air digital channels**.
- **A visible difference in picture and sound quality**.

- Possible **regulatory measures** aimed at encouraging consumers, distributors and producers to develop the digital equipment market. The most radical would be to grant a tax incentive to households to acquire digital TV equipment or to prohibit the sale of purely analogue televisions[38].

To conclude, categories 1 and 2 do not cause a problem from the point of view of digital migration; category 4 should probably form the subject of targeted "social" treatment at some point if operators and/or policymakers wish to conclude conversion within a reasonable time frame; category 3 is characterised by a wide range of uncertainties: they may migrate under market forces, provided a certain number of conditions are met.

Figure 18: The critical segment in digital migration

		Ready for equipment ?	
		Yes	No
Ready for subscription	Already	**1. Pay DTV**	
	In mid-term	**2. Future pay DTV**	
	Never	**3. Equipment ready.** Market forces can convert most of them under certain conditions	**4. Digital-reluctant.** Need of policy action on them for analogue close-down to be reached.

Source: BIPE

2.3.5 Conclusion: consumer paths to digital TV

Ultimately, what determines the extent and pace of migration to digital television reception ?

We must bear in mind that **consumers are indifferent to technology.** They do not care whether television signals are received in analogue or digital form. They will find themselves in a digital reception mode *because* the service which they are looking for requires this technology and *happens to be* supplied in digital (technology/service bundling).

Consumers mainly seek three types of features to improve their audiovisual experience: exclusive contents (football and cinema to simplify), a variety of thematic contents to "please all of the family", and enhanced picture and sound quality.

a) When the desire for **exclusive content** dominates, viewers have to move to subscription-based premium channels or to VOD. In any case, a pay TV relationship will be established. Pay TV today is almost solely available in digital[39].

[38] See the range of foreseeable measures and a critical examination of these in the "Costs/benefits" section of the public policy chapter.

[39] Which is represented in the following figure by a thick line from PayTV to digital in contrast to a thin line between PayTV and analogue.

Subscribers to analogue pay TV services from *Sky* or *Viasat* have been almost seamlessly migrated to digital. Thus, wishing to access exclusive contents means moving automatically to digital TV.

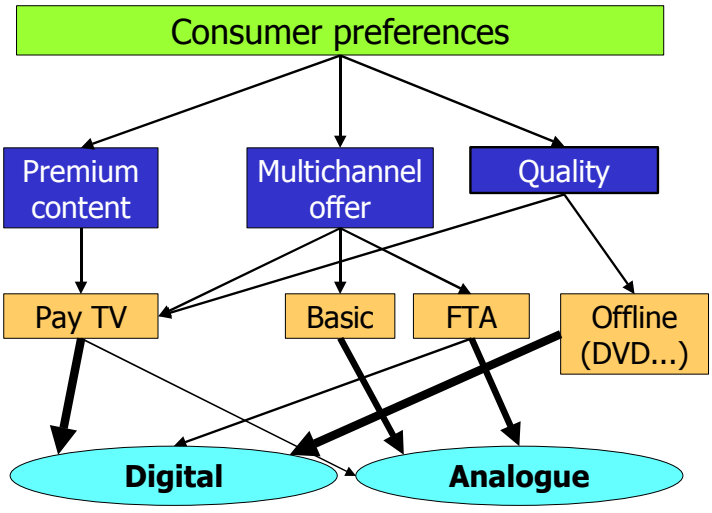
b) When they mainly wish to benefit from an **extended choice of channels** (multi-channel TV), consumers have *several* possibilities, depending on their willingness to take out a subscription to acquire new equipment. They can then:

- Purchase a dish and a decoder and receive a certain number of free-to-air channels by satellite. They can then receive analogue as well as digital channels, as free-to-air channels are generally broadcast in the two formats.
- Subscribe to "basic" cable for at an inexpensive price, in which case the programmes are generally transmitted in analogue as the basic payment will not enable the cable operator to subsidise the rental of a digital decoder.
- Subscribe to a pay multi-channel offering.

c) Finally, when consumers wish to obtain **better picture and sound quality**, they can move to Pay TV with its digital quality, or they can equip themselves with *packaged* digital media players (e.g. DVD).

The following figure synthesises these ideas and illustrates the fact that **a certain number of these choices now "lead" partially or exclusively towards digital television**, whereas some other preferences (basic or free-to-air TV) **can still be satisfied in analogue mode**.

Figure 19: Routes to digital



Source : BIPE

2.4 Players strategies

2.4.1 Objectives and method

Having studied the consumer's situation and behaviour (demand side), we must take an interest in the industrial players (supply side). We have carried out a detailed analysis of each category of the players involved in the digital migration. A synthesis of the results is presented here.

We have drawn up a complete list of the relevant categories of players as well as a list of objectives adopted by these players with regard to the digital migration. Each objective may concern one or several players.

Having built these two lists we have systematically assessed what we consider to be (i) the influence of each player on each of the others, and (ii) the degree to which each player is committed on each of the objectives (for or against, and with what level of intensity).

This assessment is based on an in-depth field survey: approximately 80 interviews were held with players from nearly all categories, in 7 different countries ; a workshop was organised in April 2001 ; and about 30 written contributions were received.

2.4.2 The players and their objectives[40]

Figure 20: List of objectives

Global policy and digital migration

No	Short Name	Definition
O1	Universal DTV	Aim at universal access to digital television
O2	Speed DTV migration	Accelerate the migration to digital television
O3	Digital democracy	Universal access to the information society (as opposed to the digital divide)
O4	Stop ACTV	Stop analogue cable transmission as soon as possible
O5	Stop ASTV	Stop analogue satellite transmission as soon as possible

Business strategies, business models

O6	PSB survival	Create conditions for a long term survival for public service broadcasters
O7	Transmission costs	Reduce cost of transmissions
O8	FTA	Increase of the number of free-to-air channels and/or the place of FTA TV within the TV economy

[40] In order to save space, the numerous acronyms used in this part of the report are given in the glossary in the annex rather than here.

O9	Pay TV	Promote a global switch towards payTV as opposed to advertising-based television
O10	Interactivity	Promote interactive services through TV screen and STBs

DTT implementation

O11	Introduce DTT	Introduce digital terrestrial television
O12	Speed DTT	Encourage the take-up of DTT (broadcasting and reception)
O13	Stop ATT	Stop analogue terrestrial transmission as soon as possible
O14	Universal DTT	Aim at universal access to digital terrestrial television
O15	Indoor reception	Make technical choice allowing a “portable” DTT (indoor reception)
O16	T-ATO announcement	Announce a terrestrial analogue turn-off
O17	Forced ATO	Announce a mandatory T-ATO
O18	SFN vs MFN	Switch to SFN frequency planning

Reception

O19	Digitise receivers	Accelerated upgrade and digitisation of the TV receivers installed base
O20	Mandate digital sets	Mandate digital-compliant sets
O21	Interoperability	Promote standards in order to secure interoperability of receiving equipment and avoid lock-in situations
O22	IdTVs	Development of integrated digital TV sets (IdTVs)
O23	Converters market	Cheap solutions for digital FTA access (sell-through market)
O24	Converters rental	Cheap solutions for digital FTA access (rental schemes)
O25	DVB-MHP	DVB-MHP
O26	Obsolescence risks	Protect consumer against technological obsolescence risks

Spectrum

O27	Spectrum optimisation	Achieve a more efficient use of the VHF-UHF band
O28	Monetise Spectrum	Merchandising the released capacity in the UHF-VHF bands (through fee or auction)
O29	De-specialise UHF-VHF	Launch new non-TV services in the broadcast bands

Regulation objectives and principles

O30	Platform Neutrality	Avoid competition distortions between access platforms
O31	Public neutrality	Avoid competitive distortions between private and public players
O32	Access competition	Foster competition at TV access level to ensure television viewers/consumers a large choice and a better value
O33	De-verticalisation	Foster competition at access level to ensure *content providers* a better position in the value chain
O34	Broadcast competition	Foster competition on the broadcast market level to ensure a better position for broadcasters facing TSPs (access to terrestrial broadcasting sites).
O35	Investment security	Provide regulatory certainty and safeguard previous investments in existing digital TV platforms
O36	Lock-in	Protect consumer against lock-in, notably by increasing interoperability of receiving equipment

O37	Culture	Protect Cultural diversity
O38	Sovereignty	Keep some national control on television
O39	Must carry	Secure universal access to the main FTV channels by programming and carriage obligations
O40	Innovation	Promote technological and business innovation
O41	Avoid piracy	Secure conditional access and control *copyright protection*

Figure 21: List of players

	Player category	Examples
1. Regulation (regulators and policy makers)		
1	National Governments	DDM (F)…
2	National Cultural Authorities	Ministries of Culture, DCMS (UK)…
3	Economic/finance authorities	BMWI (D), DTI (UK)…
4	Telecom and spectrum regulators	DGPT (NL), CMT (ES)…
5	TV regulators	ITC (UK), CSA (BE)…
6	European Commission	
7	Local authorities	Municipalities
2. Consumers		
8	Consumers	CA (UK), BEUC (Eu)…
3. TV content, service and access		
9	FTA broadcasters – PSBs	BBC (UK), RAI (IT), ZDF (D)…
10	FTA broadcasters – Commercial incumbents	TeleCinco (ES), TF1 (F), SIC (P)…
11	Independent channel publishers	AB (F), Pathe (F), Prensa Espanola (ES)…
12	Terrestrial payTV operators	Quiero TV (ES), Digitenne (NL), ITV Digital (UK)...
13	Satellite payTV operators	Sky (UK), Viasat (SE), D+ (IT), TPS (F)…
14	Cable broadband operators	UPC (NL), Noos (F), NTL (UK), Cabo TV (P)…
15	Content providers and producers	Endemol (NL), Telfrance (F), Pearson TV (UK)
4. Equipment		
16	TV set manufacturers	Thomson Multimedia (F), Sony (J), Philips (NL)…
17	STB manufacturers	Sagem (F), Pace (UK)…
18	Technology Providers, Software Players	NDS (UK), Canal+ Technologies (F), Netgem (F)…
5. Transmission		
19	TSP – Terrestrial incumbent	Retevision (ES), Teracom (SE), Nozema (NL)…
20	TSP – Terrestrial challengers	Towercast (F), Emettel (F)…
21	TSP – Satellite	Astra (LU, Eu), Eutelsat (F, Eu)…
6. Other spectrum users		
22	Mobile telecommunication operators	Orange (F, Eu), Vodafone (UK)…

7. Other players

23	Electronics Retailers and installers	Dixons (UK), Darty (F), independent dealers…
24	Advertisers	Procter & Gamble (W)
25	Apartment building managers	SAGI (F)

The following table shows the main stakes (objectives) and the principal players involved in each of the "battlegrounds".

Figure 22: The 10 battlegrounds for digital migration

Battlegrounds	Stakes	Main players involved
The spectrum	To optimise the utility of a public asset – Access to a sufficient portion of it is an indispensable business resource	Governments, TSPs, TV players, other spectrum users (mobile telcos)
Access to homes	Possibilities of households – Urban planning (administrative authorisations to roll-out dishes, aerials, cable..) – LAN home networks	Pay-TV operators, Local public authorities, Collective housing authorities
PayTV market	Maximise the number of subscribers and/or the ARPUs	Consumers, Pay-TV operators, Technology providers, Consumer Electronics Manufacturers
Audience market	Maximise viewership and its value	FTA players, pay-TV operators, advertisers
Hardware market	Maximise volume or value of sales – Leverage from hardware to service	Consumers, Consumer Electronics Manufacturers, Technology providers
Competition	Promote fair competition, which is in the interest of consumers	Governments (competition authorities), European Community, TV players
Pluralism	Promote cultural pluralism and national content creation, which is in the interest of consumers	Governments (cultural authorities), European Community, TV players
Information society and universal access	To accelerate and enlarge access to IS services	National Governments, European Community, TV players
Innovation	To promote innovation as a factor of welfare, economic growth and employment – To create new needs through new products/services	National Governments, European Community, manufacturers, technology providers
Sovereignty on audio-visual regulation	To maintain national sovereignty on cultural matters and cultural industries	National Governments

Source: BIPE

2.4.2.1 Players' involvement with the objectives

With the help of information gathered during phase 1 of the study in the form of discussions, documents, responses to our questionnaire and the workshop, the BIPE team assisted by external experts systematically **assessed whether each player is for or against achieving each objective** and the level of intensity (-3 totally against; 0 neutral and indifferent; +3 totally in favour)[41].

The following table shows how many different objectives the various players are involved in (i.e. where they are non-neutral). For example, we see that according to our information, television manufacturers are concerned by 33 of the 40 objectives listed.

Figure 23: The most involved players (score out of 40)

National TV regulators	38	TSP – Terrestrial challengers	25
National Governments	34	TSP – Satellite	24
National Cultural Authorities	33	National Economic Authorities	23
Terrestrial PayTV operator	33	Independent Channel publishers	22
TVset manufacturers	33	Electronics Retailers	22
FTA commercial broadcasters	31	Consumers	18
PSBs	29	Technology Providers	18
Content providers	28	National Telecom Authorities	16
STB manufacturers	28	Other spectrum users (Mobile)	15
Satellite payTV operators	27	Local authorities	14
Cable broadband operator	27	Advertisers	14
European Commission	25	Collective housing authority	11
TSP – Terrestrial incumbent	25	Spectrum regulators	5

Source: BIPE

Symmetrically, we can see which objectives most often enter into the players' strategy. For example, only 15 of the 26 players have a position other than neutral concerning the objective of de-specialising UHF-broadcast band (opening it to new, possibly non-TV uses). In our view, 15 of the 26 players have reasons for being "for" or "against " a prospect of this nature, considering their own missions or strategies ; the 11 others are totally indifferent. In contrast, almost all of the players listed have their own reasons to promote within the perspective of the introduction of terrestrial digital television (24 out of 26).

[41] It does not matter whether the player is active or passive in the process: a player can be in favour or against the implementation of an objective which is driven by *other* organisations insofar as the outcome is likely to impact on the player.

Figure 24: The most "involving" objectives (score out of 26)

Introduce DTT	24
Speed DTT	22
Universal DTT	21
T-ATO announcement	21
Interactive TV	20
Forced T-ATO	20
Promote innovation	20
Stop ATT	19
Speed DTV migration	18
Digital democracy	18
Promote FTA	18
Digitise receivers	18
Interoperability	18
TV Access Competition	18
Broadcast competition	17
Universal DTV	16
Promote PayTV	16
Portability	16
IdTVs	16
De-verticalisation	16

Investment security	16
Monetise Spectrum	15
De-specialise UHF	15
Stop AST	14
DTT Converters market	14
Reduce transmission costs	13
DTT Converters rental	13
Platform Neutrality	13
Prevent lock-in	13
Sovereignty-Subsidiarity	13
Must carry	13
Stop ACT	12
DVB-MHP	12
PSB survival	11
Obsolescence risks	11
Spectrum optimisation	11
Avoid piracy	11
Label digital sets	10
Public neutrality	9
SFN vs MFN	7
Culture	7

Source : BIPE

2.4.2.2 Influence and dependency among the players

		O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	O13	O14	O15	O16	O17	O18	O19	O20
		Universal DTV	**Speed DTV migration**	**Digital democracy**	**Stop ACT**	**Stop AST**	**PSB survival**	**Transmission costs**	**FTV**	**PayTV**	**Interactive TV**	**Introduce DTT**	**Speed DTT**	**Stop ATT**	**Universal DTT**	**Portability**	**T-ATO announcement**	**Forced T-ATO**	**SFN vs MFN**	**Digitise receivers**	**Label digital sets**
1	National Governments	2	1	3	1	1	2		1		2	2	1	2		1	3	2		2	
2	National Cultural Authorities	3	1	2	1	1	3		3		2	2	2	1	2	1	2	-1			1
3	National Economic Authorities		1	1						1			1	1	-1		2	2		2	
4	National Telecom Authorities		1	1								2	2	2			1	1	2		
5	National TV regulator	3	3	1	1	1	2	1	2	1	1	3	2	2	2	1	2			1	2
6	European Commission	2	1	3							2				-3	1	-1	-1		3	
7	Local authorities			3	-1	-1	1		1		2	1			2			-2			
8	Consumers			3	-2	-1	1		3	2	1	1		-3		1		-3			
9	PSBs	2	2	2			3	1	3	-2	1	3	2		3		1	-2			
10	FTA commercial broadcasters	2			-1	-1	-1	2	-3	-1	-2	-2	-2	-1	-1	2	-2	-3	1	-2	-1
11	Independent Channel publishers		1	1				2	2	2		2	2				1			1	
12	Terrestrial PayTV operator		3		-1	-1		1	2	2	1	3	3	3	2	3	3	2	-1	3	2
13	Satelllite payTV operators	2	3			3		2	-3	3	3	3	-3	-3	-3	-1	-1	-3		-1	
14	Cable broadband operator	2			2		-1	1	-3	3	3	-3	-3	-3	-3	-3	-2	-3		2	
15	Content providers	2	1	2	1	1	3			3	3	2	2	1	2		1			1	
16	TVset manufacturers	3	3	1	1	1		1	3	-1	2	3	3	2	2	2	3	2		3	3
17	STB manufacturers	3	1	1	2	2			2	3	3	3	3	2	2		3	2		3	-2
18	Technology Providers	1	3	2						2	3	1	1		1	1				3	
19	TSP - Terrestrial incumbent						2	2	2			3	3	2	3	-1	3	2	-3	2	2
20	TSP - Terrestrial challengers	1		1				3	1		1	3	2	3	3	2	3	2	3	2	2
21	TSP - Satellite	2	1	2		1		1			3	-2	-1		-2		-1	-2		1	
22	Other spectrum users (Mobile)		1	2		1					2	1	2	2		2	2	3	2	1	
23	Spectrum regulators											1	1	1							
24	Electronics Retailers	2	1	3					2	3	3	2	1	1	1	3	2			3	-1
25	Advertisers	1	1				1	1	3	1	1	2	1		1		1	1			
26	Collective housing authority				-1	-1			1			1		-2	1	1		-2			
	No of players commited	**16**	**18**	**18**	**12**	**14**	**11**	**13**	**18**	**16**	**20**	**24**	**22**	**19**	**21**	**16**	**21**	**20**	**7**	**18**	**10**

		O21	O22	O23	O24	O25	O26	O27	O28	O29	O30	O31	O32	O33	O34	O35	O36	O37	O38	O39	O40	O41	Total
		Interoperability	IdTVs	DTT Converters market	DTT Converters rental	DVB-MHP	Obsolescence risks	Spectrum optimisation	Monetise Spectrum	Unbundle UHF	Platform Neutrality	Public neutrality	TV Access Competition	De-verticalisation	Broadcast competition	Investment security	Prevent lock-in	Culture	Sovereignty-Subsidiarity	Must carry	Promote innovation	Avoid piracy	No of commitments
1	National Governments	1	1	1	1	1	1	2	1		1		3	2	1	1	2	2	3	2	2	1	**34**
2	National Cultural Authorities	2	1	1	1	1			-3	-2	-1	-1	2	3			2	3	3	3	1	2	**33**
3	National Economic Authorities	2				2	1	2	3	2	3		3	1	1	3	2				2	1	**23**
4	National Telecom Authorities							2	1	2	1		1		1	1					2		**16**
5	National TV regulator	3	1	2	1	2	2	1	-3	-2	1		3	2	1	2	3	3	2	3	2	2	**38**
6	European Commission	2				2	1	1	1		3	3	3	2	2	3	2	2	1		3	1	**25**
7	Local authorities												1				1	1	2	2			**14**
8	Consumers	3		1	2		2						3				2			1			**18**
9	PSBs	2	2	2	2	3	1		-3	-3		-3		3	1		2	3	3	3	2		**29**
10	FTA commercial broadcasters	1	1	1	1	1			-3	1		3			3	3			-1	1	1		**31**
11	Independent Channel publishers	1	1	1	1				-2		2	1	2	3	1	1	2					2	**22**
12	Terrestrial PayTV operator	3	3	2	3	2	1	2	-3	-3				1	2	3	3			-2	2	3	**33**
13	Satelllite payTV operators		-1				1		-3		3	3		-3	1	3			-3	-3	2	3	**27**
14	Cable broadband operator	2	2			1				1	3	3		1		3			-2	-3	1	2	**27**
15	Content providers	1	1	1	1				-2		2		2	3	1			3	3	1	1	3	**28**
16	TVset manufacturers	2	3	-1	-2	2	1			-1	2		2	2	1	3	2			1	1		**33**
17	STB manufacturers	2	-3	3	1		2			-1	2		3	2	1	1					2		**28**
18	Technology Providers	3	3			2							2	2		2					3	3	**18**
19	TSP - Terrestrial incumbent	1	2	2	2			1	-1	-2			1		-3	2			2		1		**25**
20	TSP - Terrestrial challengers	1	2	2	2			2		1			1		3	3					2		**25**
21	TSP - Satellite							2	-3	1	3	3	2	1	-1	3			-2	-2	2		**24**
22	Other spectrum users (Mobile)							3	2	3													**15**
23	Spectrum regulators							3													1		**5**
24	Electronics Retailers	3	2	2		2							3	1			2				3		**22**
25	Advertisers														1				-2				**14**
26	Collective housing authority						1						2				1						**11**
	Players committed	**18**	**16**	**14**	**13**	**12**	**11**	**11**	**15**	**15**	**13**	**9**	**18**	**16**	**17**	**16**	**13**	**7**	**13**	**13**	**20**	**11**	

		1	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
		Gov	EC	Local	TV viewer	PSB	FTA leader	Publisher	payTV-T	payTV-S	Broadband	Content	TV sets	STBs	Techno	TSP-T	TSP-T chal	TSP-S	Other users	Spectrum reg.	Retail	Advertiser	Housing	**Total influences**
1	National Governments		2	3		4	2	2	4	1	2	2	1	1	2	3	4	1	2	4		1	1	**42**
6	European Commission	2		1		1	1	1	1	2	1	1	1	1	1	1		2	1			1		**19**
7	Local authorities				3					2	3					2	2	1			1		3	**19**
8	TV viewer	2		2			4	3	4	4	4	2	2	2							3			**32**
9	PSBs	2	2									3				3	3	2		1				**16**
10	FTA Commercial incumbents	1	2			1						3			1	3	3	2		1				**17**
11	Independent Channel publishers	1				3	3		2	2	3	2			1	2	4	3						**26**
12	Terrestrial payTV operators	1	1					2		2	3		2	2	1	2	4				2			**22**
13	Satelllite payTV operators	1	2		1	2	2	4	4		4	2	2	4	3			4			2			**37**
14	Cable broadband operator	1	2	1	1	1	2	3	4	4			1	3	3	3	3	1			1			**34**
15	Content providers and producers	1	2			3	2	3	1	2	3			2	3				2					**24**
16	TVset manufacturers	1	2						2					4	2						2			**13**
17	STB manufacturers								1	1	1		4		2						1			**10**
18	Technology Providers	1	2		1		3		2	3	4	2	3	4								3		**28**
19	TSP - Terrestrial incumbent	2					2		3								4		2					**13**
20	TSP - Terrestrial challengers	1	1						1							4			2					**9**
21	TSP - Satellite		1				1			2						4	4		2					**14**
22	Other spectrum users	1	2															3		1	1			**8**
23	Spectrum regulators										2					2	1							**5**
24	Electronics Retailers	1			2			2	4	4	2		4	3	3									**25**
25	Advertisers	1	1			1	4																	**7**
26	Collective housing authorities			1	4				3	2	4					3	3	2			3			**25**
	Total dependences	**20**	**22**	**10**	**12**	**16**	**26**	**20**	**36**	**31**	**36**	**17**	**20**	**26**	**22**	**32**	**35**	**21**	**11**	**7**	**16**	**5**	**4**	**445**

Based on the previous matrix in which the influence exercised by each player on the other players was "scored"[42], multiplication of the matrix by itself makes it possible to take account of *indirect* influences (A influences B, which influences C). This leads to a synthetic indicator of the global influence which a player exerts on other players in the system: 0 means that the player is totally subject to influence, while 2 means that the player is very influential.

Thus, for example, consumers, who exercise a power in pay TV services markets, the free-to-air market, the equipment market and upon politicians' electoral prospects appear to be among the most influential players in digital migration. Governments and regulatory authorities are also powerful players. They are capable of making crucial choices in spectrum management or television regulation. Among the commercial players, satellite pay TV operators are powerful and play an important role for several reasons: they can influence the consumer's behaviour via the "umbilical cord" of their decoder ; they can migrate their subscribers to an all-digital TV more or less rapidly; as the "first-movers" on pay TV markets, they can act as an obstacle to the launch of another, notably terrestrial, pay-TV platform and they can escape from the influence of national and local regulators more easily than the more "territorial" players (cable operators, terrestrial broadcasters).

Figure 25: The most influential players in the game (scale from 0 to 2)

	Ri
Techno-ready consumers	1,98
National Governments	1,94
Digital-resistant consumers	1,92
PayTV ready consumers	1,77
Local authorities	1,77
National Cultural Authorities	1,69
Satellite pay TV operators	1,55
Collective housing authorities	1,53
Electronics Retailers	1,29
Cable broadband operator	1,28
European Commission	1,22
National Economic Authorities	1,18
Content providers and producers	1,17
Technology Providers, Software Players	1,12
Thematic Channel publishers	1,03

	Ri
Terrestrial payTV operators	0,97
National TV regulator	0,79
National Telecom Authorities	0,77
FTV broadcasters – PSBs	0,77
TVset manufacturers	0,68
FTV broadcasters – Commercial incumbents	0,58
TSP – Terrestrial incumbent	0,32
Advertisers	0,32
Mobile telecommunication operators	0,28
National Spectrum regulators	0,25
ITU	0,25
TSP – Satellite	0,21
STB manufacturers	0,19
TSP – Terrestrial challengers	0,16

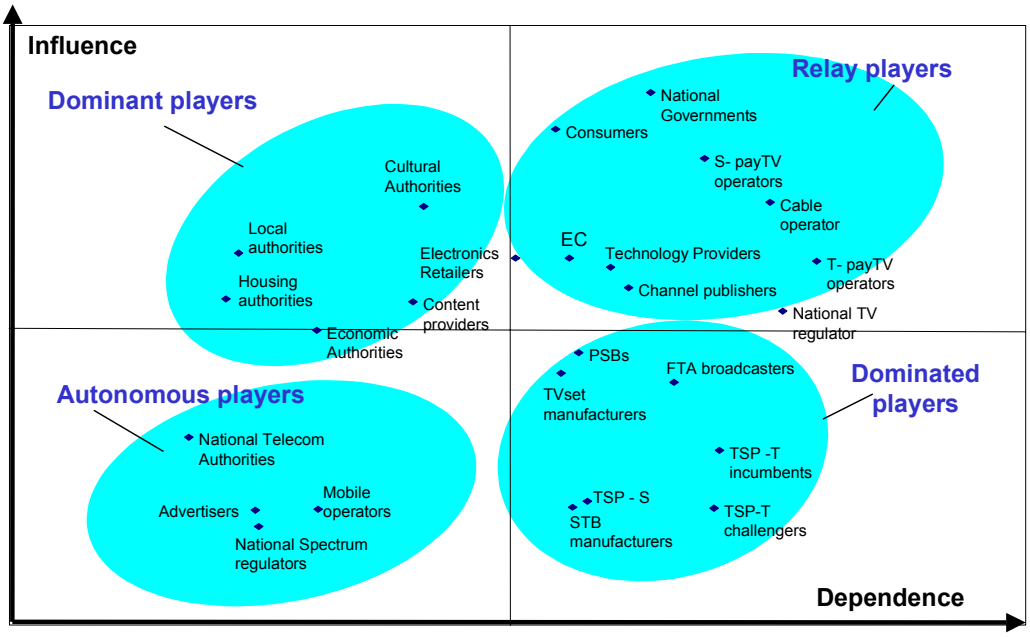
Source: BIPE

The following mapping, which reveals four categories of players according to their influence and dependency, is even more interesting than the synthetic indicator of influence.

[42] It should be recalled that we consider all kinds of influence/dependence: lobbying on policy-makers, the administrative or regulatory power of policy-makers over industry players, bargaining positions in the supply chains between clients and suppliers (BtoB or BtoC).

- **The dominant players**: these exercise a certain influence on other players without being subject to others' influence themselves. For example, the local authorities exert power over cable operators and, indirectly, on satellite pay TV operators (via urban planning regulation which can hinder or prohibit the use of satellite dishes in some cases).
- **The independent or autonomous players**: these are the marginal players which exert little influence on the others, but are equally relatively independent from them. In total, they have few strong interrelationships with the other players in the game.
- **The dominated players**: these are the players who are subject to administrative control or public ownership (public broadcasters) or sector regulation (commercial terrestrial broadcasters), or who heavily depend on the behaviour of a different player (electronics manufacturers vis-à-vis the consumers), without exerting strong influence themselves on other players. They do not have the initiative. They are not fully in control of their own destiny.
- **The relay players**: these are the players which are simultaneously influential *and* dependent. For this reason they appear to be the most important in the global strategic balance. They include: consumers, governments, pay TV operators and technology suppliers.

Figure 26: Mapping of influence/dependency: the four categories of players

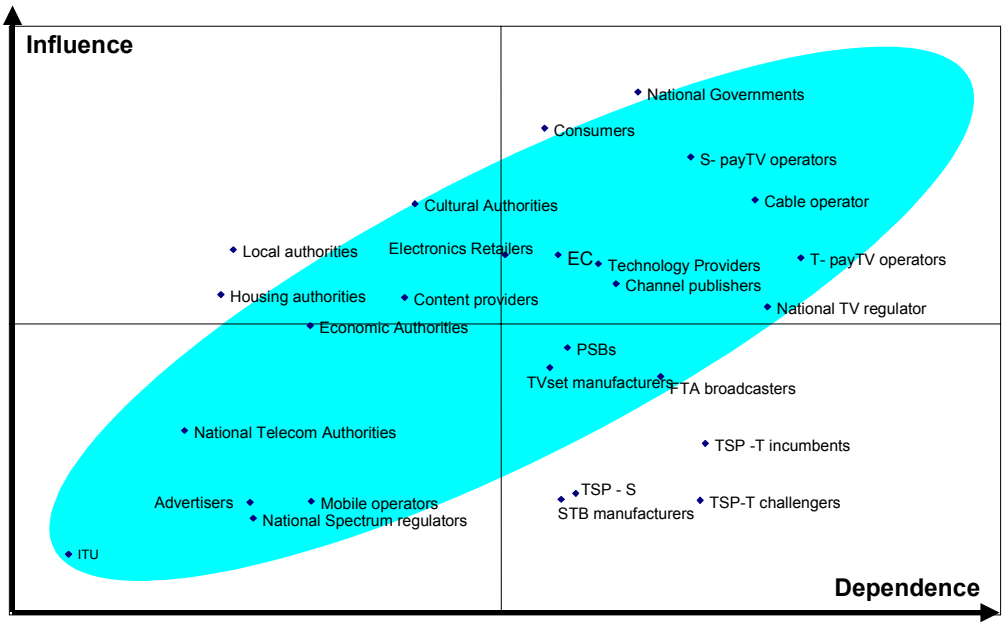


Source: BIPE

Furthermore, we see that the majority of players are oriented towards the first diagonal (relay and independent players), which is generally a sign of a certain **instability in the strategic system**. In contrast, a stable system is characterised by a concentration of players around the second diagonal.

There are relatively few players who are clearly dominant or dominated; the matrix is characterised by a situation where each one is more or less dependent on the other and at the same time exerts a market or administrative power over other players. This confirms the complexity and **interlacing of the relationships at work**.

Figure 27: Mapping influence/dependency shows an unstable system



Source: BIPE

2.4.2.3 Involvement and dependency

Now crossing each player's global level of involvement on objectives (not only the number of objectives but also the *intensity* of commitment to each one) and its degree of influence in the game, we obtain another interesting mapping. It is possible to identify five types of behaviour deriving from the players' positioning in this mapping.

- **The outsiders**. Some players are relatively uninvolved overall in the outcome of the process, without exercising a strong influence on its development. They have neither the motivation nor the means to play a more active role in the current state of affairs. For example, the mobile telecom operators could theoretically be impacted by the turn-off of terrestrial analogue broadcasting because of the subsequent release of frequencies it would imply, but the layers of uncertainty before its achievement and the time frames for implementing a prospect of this type are so great that the telecom operators have neither the reason nor the choice to be anything but outsiders at present.

This could change if the public authorities decided to oblige the operators to demonstrate their interest for the "releasable" frequencies at the top of the broadcast UHF band. And, anyway, the telecom operators are not concerned by many of the other stakes involved in the migration.

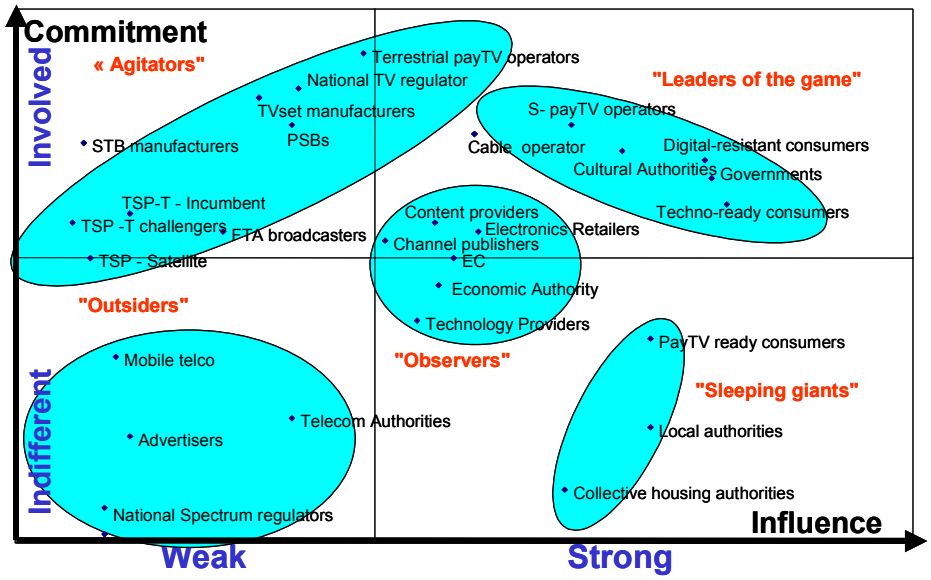
- **The sleeping giants**. These players are little involved as the process is too far removed from their most vital pre-occupations, but they do have a strong power over other players. The local authorities are in this situation. These players' lack of involvement means that they react little and are rather predictable. They create an inertia factor in the system. They have a significant, but well-known role which does not develop quickly.
- **The observers**. Moderately involved and moderately influential, these players are in a wait-and-see position in the middle of the system. They are induced to play a role in migration, although probably not a decisive one.

The two final groups are the most important.

- **The "agitators"**. These players have major reasons for being involved and active in the process. The achievement or non-achievement of certain objectives or future states of the world can impact on the fulfilment of their missions and even their very existence, but they are not masters of events. They are heavily involved but globally dominated. They are faced with major risks and opportunities such as the risk of losing a situation rent[43] for example or of "taking a dive" due to a major change in their environment. The most active players are generally found in this category. The agonising uncertainty in which they find themselves forces them to establish strategic partnerships and to carry out intense lobbying. This category includes public and private broadcasters, consumer electronics manufacturers, terrestrial digital operators and transmission operators which share the position of being the most directly impacted by the main uncertainty of the system: the roll-out and positioning of DTT. In terms of modes of action, some of these (public or private) players are used to live and act in a traditionnally heavily regulated analogue terrestrial environment and thus tend to continue calling on regulatory intervention to regulate competition in the transition to digital.
- **The leaders of the game**. As involved as the preceding group, they have levers or are in market situations which allow them to "see what is on the way". This category includes the Government players, traditional pay TV operators and consumers.

[43] Situation rent: revenues obtained by a market player (usually in a monopoly or oligopoly situation) from the fact that there is no perfect competition on the market considered.

Figure 28: Commitment*influence mapping



Source : BIPE

2.4.3 Position of the main players concerning migration to digital TV

After having studied all the players in detail (see annex) and having illustrated above the main relevant positions, we will focus now on **the 9 most decisive players** (who are almost all “relay” or “leader ” players) and on **their positions on the key questions inthis study**, i.e. the introduction of digital television, analogue turn-off and action by public authorities in this area (notably as regards terrestrial broadcasting).

More precisely we shall examine whether:

(i) The players are for or against organising their *own* migration and their own analogue turn-off (“own ATO”), which could lead them to influence or even subsidise their customers in order to achieve such an objective as soon as possible (e.g. TSP-S influencing broadcasters, pay TV operators influencing subscribers).

(ii) The players are for or against public policies encouraging migration/turn-off (“planned ATO ”).

Then, in the next section we will focus on a rather controversial issue in the switchover debate: the sustainability of DTT.

2.4.3.1 Government

Own ATO	Not applicable (NA)	Planned ATO	+3

Most Governments' strategic objectives are met by the mere *introduction* of digital broadcasting : better service, a larger market, and hopefully a shortcut to the information society.

In this regard a complete digital switchover and analogue turn-off may provide only one additional benefit : more efficient spectrum management (and maybe some expected revenues from auctions). Furthermore, the very *announcement* of a turn-off objective, whether forced or just "targeted " is viewed as a way of accelerating the switchover and maybe the advent of turn-off (self-fulfilling announcement). Though many did so (Spain, Italy, Germany, the UK), **not all national governments have issued a planned turn-off announcement** (France, Sweden). Were it not for the **political risks** associated with the move (as television forms the citizens' major source of entertainment, information and culture and is therefore a politically sensitive issue), we think that more governments would be much more pro-active.

Current or planned public intervention raises concerns of risks of competitive distortion between technologies/platforms and between players, especially if it was non technology-neutral and platform-neutral. Economic theory teaches us that announcements or anticipation of public measures can discourage market forces and create a inhibition effect : neither operators nor consumers are likely to invest now if they feel governments are likely to do so later.

In these cases, some operators such as pure terrestrial players or STB manufacturers might be tempted to base their strategy on the hypothesis of public policy incentives and then try to push Governments in this direction.

2.4.3.2 Manufacturers

Own ATO	+1	Planned ATO	+3

Consumer Electronics manufacturers are committed to migrating to digital in order to maintain their share of market value, which otherwise could be jeopardised by middleware providers or pay TV operators with their proprietary STBs. Under current trends, they may be afraid of becoming providers of low-value displaysin the long run, while the interfaces with other audiovisual devices and all the built-in"intelligence" would be supplied through STBs by service providers such as pay TV players. They also want to benefit from digital convergence in consumer electronics by offering expensive premium products that support multiple services. Although they will push integrated digital sets in the long term, they (and retailers) do not see the point in disturbing the current boom in analogue widescreen sets[44].

As large pan-European companies with long R&D cycles, manufacturers need stable technical standards, European single market prospects and co-ordinated migration timing. This is why **manufacturers favour planned turn-off processes** and announcements that can help all players (content providers, hardware providers and consumers) to synchronise their migration and investment decisions. Given that manufacturers basically wish to sell products, a forced massive renewal of receivers would be a dream scenario. They also want interoperability of equipments to avoid market fragmentation. This facilitates both lower costs (economies of scale) and better market prospects (consumer will buy products that allow access to various providers). They are likely to try to influence policy-makers in this direction.

2.4.3.3 Public Service Broadcasters

Own ATO	+1	Planned ATO	+1

All PSBs have plans to broadcast digital versions of their channels on all networks.

PSBs favour turn-on and digital switchover as they see it as an opportunity to explore **new ways of fulfilling their general interest missions**. They also view planned turn-off policies as a good way of encouraging a fast switchover. On the other hand, they do not want to "force " their viewers too much.

In terrestrial countries, they often support public policy encouraging terrestrial switchover, because this is their most traditional way of serving citizens. For the same reason they would tend to support universal *terrestrial* coverage. The fact that it may be less cost-effective than a terrestrial/satellite policy mix is less relevant for these non-profit organisations.

[44] See about technological/product cycles in the migration section.

2.4.3.4 Terrestrial service operators

Own ATO	NA	Planned ATO	+3

Owners and operators of terrestrial broadcasting networks know that the future belongs to digital. The dilemma is that if they want terrestrial broadcasting to survive, they must digitise this delivery mechanism, although in the process they might be obliged to give access to their facilities to competitive third-party transmission service providers. Once digital broadcasting is introduced, they do **not necessarily welcome rapid analogue turn-off**. Analogue simulcasting is indeed a big and profitable source of revenue, as it involves a mature, amortised network asset. On the other hand, the sooner they turn off, the sooner they will be able to develop an all-digital, value-added business.

Terrestrial transmission operators favour public turn-off plans, especially when digital terrestrial television is encouraged as a way of achieving turn-off.

2.4.3.5 Consumers

Own ATO	NA	Planned ATO	-2

As already seen in the consumer section, consumers can convert or be converted to digital TV via three different paths: (i) by subscribing directly to a pay TV service which happens to be delivered in digital form, (ii) by obtaining a digital STB rented or given away from by a pay-TV service provider to former analogue pay TV subscribers, (iii) by spontaneously acquiring digital reception equipment in the absence of a TV subscription system.

Pay TV customers are neutral: their digitisation is subsidised by their service provider. However, they are locked in when STBs are rented or let, since their ability to receive a digital signal depends on their service provider.

Other customers **may benefit from the turn-on but have no clear direct benefits to expect from turn-off**. On the contrary, they bear some risks and switching costs: premature equipment renewal, new generation of equipment with perhaps shorter duration, and the risk of being “turned-off ” (i.e. deprived of TV services, if renewal is not made in time or if they do not live in a covered area). As a result, even when conservative criteria are set to safeguard consumers’ interests (e.g. no ATO until 95% of population have been converted), as in the UK, a turn-off announcement can be badly received by some consumer organisations.

This could deter other Governments from communicating about turn-off (as in France) or compel them to announce financial support for switching costs.

2.4.3.6 Cable Operators

Own ATO	0 or -1	Planned ATO	-3

Cable operators have no particular interest in systematically turning off analogue transmission over their *own* networks.

Digital turn-on and switchover are a matter of survival for cable operators. They have to upgrade networks and have their clients equipped with digital set-top boxes if they are to offer the whole range of digital services (pay-TV, VOD, high-speed Internet and telephony) which is necessary to recoup their infrastructure investments. When networks have been upgraded, bandwidth is almost infinite. As a result, there are neither opportunity costs nor many technical costs associated with maintaining analogue TV. And since there are many households that are simply not ready to pay more than the basic fee for a basic service, it may not be economical to equip them with "subsidised " digital set-top boxes. Hence cable operators are likely to serve part of their customers with basic television for quite a long time in analogue, even on digital-ready networks. This might change in the long term, as low-cost sell-through converters become available, and bandwidth is needed in order to deliver broadband services.

Cable operators may suffer from interference from digital terrestrial broadcasting.

Cable operators oppose a public turn-off policy that would encourage terrestrial digitisation (and incidentally terrestrial broadcasting) in order to achieve a partial terrestrial turn-off to recover frequencies. If policy-makers' final goals were simply to promote the information society and spectrum efficiency, cable operators have observed that this could be achieved more quickly and more dramatically through encouraging digital *cable* and digital *satellite* penetration, while simply turning-off terrestrial broadcasting itself. A cable turn-off policy could make sense for them if it meant public subsidies for digitally connecting all targeted homes, but no such plans exist so far in this area[45].

2.4.3.7 Commercial broadcasters

Own ATO	+1	Planned ATO	-3

Many commercial free-to-air broadcasters have stakes in pay TV platforms, and historically in satellite-based TV platforms. Being often also publishers of thematic channels, they understand the interest of digital pay TV.

[45] See also the "cable switchover policy" section in the Policy chapter.

However, as licence-holders of one of the very few nation-wide analogue terrestrial frequencies in terrestrial countries, they see digital switchover and terrestrial turn-off plans as threats: in the short term it may allow new free-to-air entrants into the advertising market, while in the long term the commercial broadcasters may lose their current 99% coverage (which is important for mass media advertisers). Similarly, turn-off may trigger a regulatory process that could end up with *paying* frequencies. These **terrestrial broadcasters only support the DTT process when they are associated with it** (e.g. *ITV* in the UK, *Digitenne* consortium in the Netherlands).

2.4.3.8 Satellite pay TV operators

Own ATO	+1	**Planned ATO**	-3

Pay TV players operating through satellite transmission have virtually all completed digital switchover and turned off analogue transponders. These "private " turn-offs have been financed by the operators on the basis of the following economic rationale: offer a larger better service to increase ARPU and profitability and decrease transmission costs. As a result, a turn-off policy would not be necessary as far as pay satellite television is concerned.

Satellite pay TV operators are the fiercest opponents to incentive policies aimed at promoting terrestrial switchover and turn-off. They do not oppose the turn-off itself (which they have already undertaken) but the way some policy-makers expect to achieve a terrestrial turn-off, i.e. by encouraging digital terrestrial reception. They particularly oppose any form of public subsidisation of switching costs (both on the broadcasting and reception sides) that would not be "technologically neutral " (and would therefore risk distorting competition), as they consider that they have invested in digital satellite reception with their own funding. The problem may be how SWO/ATO policies can really be neutral in effect when satellite switchover has *already* happened and was financed by pay-TV operators. The only remaining switchover to deal with happens to be terrestrial and cable. Satellite pay TV operators also fear that switchover and turn-off policies may not be "business-model neutral ", by benefiting free-to-air broadcasting. Some incumbent pay TV operators who already use satellite or cable have been banned from DTT licensing schemes because regulators wanted to take the opportunity of extending actual competition in the pay TV market via this new delivery mechanism. Like transmission service providers, satellite-based pay TV operators oppose any idea of public subsidisation of the broadcast network intended to achieve national coverage, as they consider that the exponential costs of covering remote areas terrestrially would not be economical.

If the network upgrade were encouraged or subsidised, the price of terrestrial transmission could be artificially low, which would bias competition in favour of terrestrial operators and free-to-air channels.

Because DTT would directly challenge satellite TV in low-density population areas, and because satellite pay TV operator core business is still television, satellite pay TV operators are even more worried about DTT than cable operators. They oppose the idea that terrestrial turn-off justifies public intervention.

Satellite transmission operators

Own ATO	-1	**Planned ATO**	-3

Satellite transmission operators have no particular interest in turning-off analogue transmission over their own infrastructure. Since they have enough bandwidth to simulcast TV channels when they are asked to by their clients, they have no reason to stop simulcasting and taking the additional revenues related to it.

They are not suggesting any particular plan to accelerate household digitisation.

They strongly suspect that the current switchover and turn-off public plans could encourage terrestrial broadcasting. A key objective for them is to ensure that a multi-platform access is considered when Government decide on turn-off criteria (otherwise again, it would encourage digital *terrestrial* penetration). They also oppose switchover plans aiming at *universal* digital terrestrial coverage, as satellite is a much more economical and competitive way of serving remote areas.

2.4.3.9 Summary of positions

The following figure recapitulates the main results. It can be read as follows:

> e.g. "Cable broadband operators (line 6) are heavily involved in the roll-out and turn-on of digital services on their own networks (+3), but they do not see the medium-term interest in ceasing broadcasting analogue services totally on all their networks (-1). Furthermore, they are strongly opposed to any public incentive to the introduction and acceleration of terrestrial digital television (-3)."

Figure 29: Positions of players in the "top 9"

	Their own digital policy		Their views on public policy
Main players	**Turn-in**	**Turn-off**	(terrestrial turn-in and ATO)
1. Governments	+2	NA	+3
2. Manufacturers	+2	NA	+2
3. PSBs	+2	+1	+1
4. TSP-T	+3	0	+1
5. Consumers	+3	NA	- 2
6. Broadband cable operators	+3	-1	- 3
7. Commercial broadcasters	+1	NA	- 3
8. Sat Pay-TV	+3	0	- 3
9. TSP-S	+2	-1	- 3

NA : Not Applicable - Source : BIPE

2.5 The issue of the « sustainability of DTT »

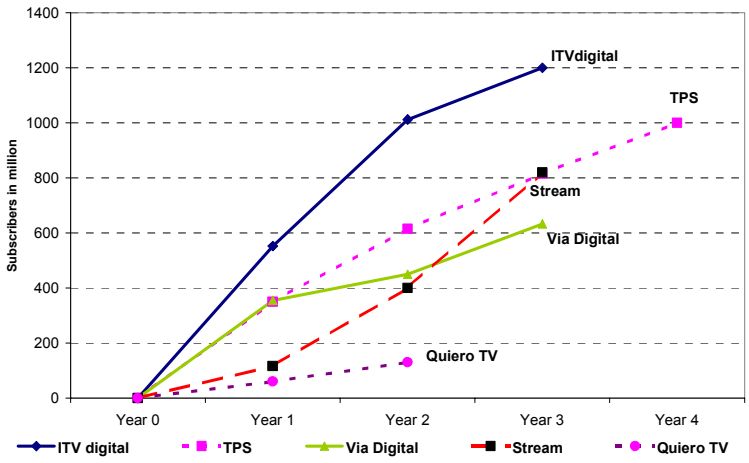
The criticism received from incumbent broadcasters and pay-TV operators, the results that fall short of expectations and the commercial and/or financial difficulties experienced by the "DTT operators" in the three pioneering countries (Spain, Sweden and the UK) have generated much concern about "the sustainability of DTT". But what are we talking about ?

2.5.1 DTT operators

Licensing and business models have been very much alike in the UK and Spain, Governments have licensed about 3 full multiplexes to one pay TV operator, enabling it to launch a mini multichannel offering.

ITVdigital has been launched on a payTV market that was already maturing, and in direct competition with *Sky*, which was going digital at the same time and was able to lead a very effective promotional war. ITVdigital penetration has been faster than all the other second-mover pay TV platforms in other countries (*TPS* in France, *Stream* in Italy, *Via Digital* in Spain – though the latter operates in a smaller market). In such very difficult conditions (a maturing market, faced with technical problems and a fierce competition from *Sky*), we could even consider *ITVdigital*'s 1.3 million subscribers in three years to be a *commercial* success.

Figure 30 : Early years of second-mover pay-TV players



But, as investors might say, business is not about acquiring customers but about making money out of it. And the problem for DTT-based pay-TV operators (like with some *other* pay-TV operators) has been the cost of acquisition of these subscribers. *ITVdigital* shareholders, *Granada* and *Carlton*, have invested a cumulated £800m, and a further £300m would be necessary to finance operations before breakeven.

Some financial analysts from the City of London advocate closure of the business rather than additional investment.

Quiero TV has been launched in Spain on a smaller, and almost as mature Pay TV market, with no less than two DTH-based payTV competitors (*Via Digital* and *Canal Satelite*). Like *ITVdigital*, *Quiero TV* succeeded in obtaining access to pay channels and premium content (football, bullfights) that are necessary to compete on the premium pay TV market, but like *ITVdigital*, they paid a too heavy price considering the number of subscribers they could expect.

Swedish case

In Sweden, the situation is fairly different from the UK/Spain one. The "difficulties" of DTT may first derive from probably *too high* initial expectations, considering the already high penetration of both cable and satellite in the country. The structure put in place resulted from political compromises. The semi-horizontal platform (*Teracom/Senda* as a unique technical distributor, but independent channel-by-channel licensing) offered an access to all types of players and business models (FTA or premium). The main problems have been a too complex structure ; marketing and technical mistakes, especially at the (premature?) beginning[46] ; fragility of the scheme facing licensees with conflicts of interest ("Trojan horses"). As no real new pay-TV operator was created to take place on the platform, the "difficulties" of DTT in Sweden would probably not harm the whole digital TV sustainability, but only that of the network operator *Teracom*.

2.5.2 Why the difficulties of DTT pay operators?

Technical aspects

DTT pioneers' difficulties have come from immature infrastructure : the networks were not ready enough for a nation-wide marketing launch ; technology was not predictable enough to be able to make indoor reception to be a real incentive ; though coverage areas were theoretically known, a limited broadcasting power did not enable absolute certainty that a house in a particular area could correctly receive the signal (many customers were disappointed) ; set-top-boxes were frequently delivered with delays and did not always work when first installed.

[46] For example too expensive decoders, no rental schemes at the beginning, flexible yet too complex pricing ("basic' subscription needed to receive the free-to-air channels).

Strategic aspects

- **Time to market**. DTT-based pay-TV platforms may have been launched *too early* if we consider the need for effective implementation in order to address mass markets in a sustainable manner. With hindsight, they may have been *too late* to conquer a sustainable market share in maturing pay TV markets and to cover significant fixed operating costs. This combination of business model and delivery mechanism may have simply missed its historical window of opportunity.
- **First-mover advantage**. DTT-based payTV platforms have underestimated the competitive strength of satellite and cable-based first-movers on the market ; much of the huge spendings of *ITVdigital* are due to the unexpected promotional war led by *Sky* (free STBs in exchange for one year subscription).
- **Strategic marketing**. On top of that, and in the first place, *ITVdigital* and *Quiero TV* perhaps should not have been positioned as premium offerings in direct competition with existing, larger multi-channel offerings but rather as low-end proposals to low-income households, or to those unable or unwilling to access satellite or cable.
- **Operating and marketing mistakes**. *Carlton* and *Granada* wasted much time and money trying to install a brand new brand when they could have used the much popular *ITV* brand. *Quiero* was also a new brand which had to be established in people's minds.

Economic aspects

ITV and *Quiero TV* developed new exclusive channels, at an expensive cost, instead of acting as mere distributors of existing products. Their difficulties are not due to the technology but the result of a pay TV market structured through vertical integration (publishing+distribution+delivery). The difficulties are not different in nature from the failure of *Via Digital* and *Stream* : competing for exclusive rights, with "me-too" strategies, duplicating thematic channels and given the high level fixed costs (transmission, marketing, deals with Hollywood studios), competition is *not* sustainable. Except for *Canal Satellite* in France, no payTV platform in Europe has achieved breakeven. First-movers and – obviously – second-movers remain far from profitability.

2.5.3 What solutions ?

There are several answers to these problems: mergers, downsizing and co-opetition[47].

- **Mergers** between platforms in order to downsize fixed costs (merging redundant "me-too" channels) and acquire a better bargaining position vis-à-vis copyright holders
- **Business model re-engineering**. The platforms must stop direct competition and focus on different segments of the market. One could remain a mere distributor of existing channels and/or focus on a market niche, while the other would supply premium channels and added-value service.
- **Co-opetition**. An alternative to merger would be to relax the race for vertical integration and exclusive content. *TPS*'s Patrick Le Lay recently stated that there were many redundant channels on the French market. Although they still envisaged a merger, *TPS* and *Canal Satellite* have decided that in the short-to-medium term, they would co-operate by merging channels, sharing PPV kiosks, sharing rights, making purchasing pools, while remaining competitors on the distribution level.

These three strategies to make satellite TV platforms profitable while maintaining sustainable competition wherever possible, can also apply to DTT platforms.

Sustainability vs. competition ?

In France, as the licensing scheme has left market forces to decide on the structure of DTT distribution, *C+* and *TF1/TPS* both envisage becoming commercial distributors through DTT too, possibly through a joint-venture. They would be able to use existing cabsat channels and rights, existing know-how, existing assets in subscriber management etc. They could become a DTT distributor at almost marginal cost, thus achieving economies of scale and scope. Even if they only acquire a few new subscribers through the new delivery mechanism, these would have been acquired at a marginal cost, so that the operation would be sustainable.

[47] « Co-opetition » refers to some degree of co-operation between otherwise direct competitors.

Of course if this happened, it would increase the market power of *C+* and *TPS*, even more so if they ultimately merged. There is no denying that there is a policy dilemma between sustainability and competition. Existing pay-TV operators were prevented from using DTT in pioneer countries, precisely in order to increase the level of competition. A solution that could eliminate this dilemma might involve reducing vertical integration (rights/production/publishing/distribution) in order to allow sustainable horizontal competition.

As far as pay TV is concerned, consolidation seems to be the solution to DTT platform troubles. In Spain and the UK too, DTH platform operators and cable operators are said to be interested in taking over operations.

As we can see **the so-called "failure of DTT" is mainly the failure of new pay-TV operators using DTT only**. But what about DTT itself as a new delivery mechanism ? In what conditions could it be economically efficient ?

What sustainable positioning for the new delivery mechanism ?

The **sustainability of the DTT delivery mechanism itself** is nothing else than its competitiveness in the other available delivery mechanisms, from a broadcaster's and a pay-TV operator's point of view. It depends on : (i) the existing reception infrastructure (how many households and receivers do use terrestrial reception), (ii) the cost of transmission through DTT, compared with cable and (digital) satellite TV.

The latter derives from the operating costs and the amortisation of the broadcasting network, the size and topology of the country and the possible fees payable for terrestrial licences and/or frequencies. A number of commercial aspects come into play.

- Many **major commercial broadcasters** have built their business model on revenue from major advertisers which needs a universal audience. It is more than probable that these broadcasters will continue to use all three delivery mechanisms, in analogue *and* digital, to maximise their accessibility and to let the viewer decide which one is more convenient for him/her.
- **Public broadcasters** also consider their general interest mission to be available through all existing delivery mechanisms, whatever the cost.
- But for the **publishers of subscription-based channels or niche free-to-air channels**, the fixed transmission cost of a nation-wide DTT broadcast is much higher than the satellite one. A typical budget for a thematic channel is in the range of 5 to 10 million euros, €20m for the top ones ; a year of digital transmission through satellite typically costs 0.5 million euros, whereas the cost with nation-wide DTT transmission is about 5 million euros.

One can wonder if the incremental advertising or subscription revenues brought by DTT reception could match the incremental transmission costs involved. In some situations, the fact that nearly all major channel publishers (very often pay TV distributors too) have bid for a licence every time they had the opportunity (in Sweden, Spain, and very soon in France) does not prove that the delivery mechanism is economically viable/sustainable in the long term. Some of them indeed, while publicly claiming DTT was unsustainable, ask for a licence just to prevent competitors from getting them.

Hence, if public broadcasters and major commercial broadcasters are likely to continue to use terrestrial broadcasting i.e. DTT in the future, it is less than sure that it will make sense for *other* TV players. It will depend on market and regulatory conditions.

Besides, on the **supply-side**, terrestrial transmission service providers are being progressively privatised everywhere in Europe. Therefore they are more likely in the future to look at the real profitability of each activity and stop cross-subsidising non profitable activities by other profitable ones. As a result, one could imagine that beyond one multiplex to carry public broadcasters (for universal access reasons, against subsidies) and major commercial broadcasters (for business reasons), other multiplexes might not be needed out of high-density population areas.

To help supply-side players (transmission service providers) and demand-side players (broadcasters) to find an optimal, sustainable use of DTT, they should be allowed to find the best trade-off between number of multiplexes, coverage, broadcasting power, penetration of indoor reception, etc. In some countries DTT might end up being sustainable only as a niche or universal-service delivery mechanism while in others it might be sustainable as a low-end multichannel access.

2.5.4 Four conclusions concerning "DTT sustainability"

1. We must distinguish between the concepts of "sustainability" of the pay-TV players using DTT (and in particular the sustainability of DTT pay-TV players) and the long-term sustainability of (digital) terrestrial broadcasting as a delivery mechanism.
2. The difficulties and risks of failure of DTT pay-TV players is above all the failure of vertical, "me-too" business models on maturing markets. Satellite TV second-movers experience similar difficulties.

3. The competitiveness/attractiviness/uselfulness of the delivery mechanism for commercial players has yet to be proven. Only major free-to-air broadcasters have a clear reason to pay for a near nation-wide digital terrestrial broadcasting. For all other players, this will depend on national/local conditions and business models.
4. Policymakers should perhaps not try to promote this delivery mechanism at any cost in the short-mid term but licence broadcasters and then let market forces (TV players, network operators and transmission service providers) decide how and to what extent DTT should be used in order to make their *own* businesses sustainable. And it might be necessary to correct some market failures so that market forces can take economically efficient decisions.

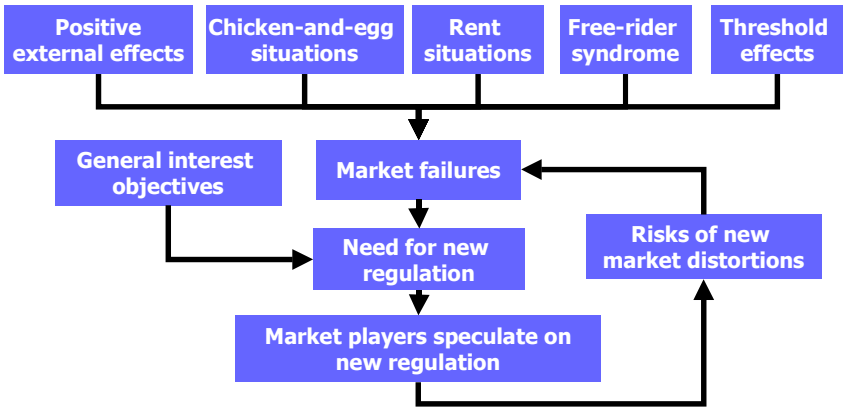
2.6 Conclusions of the chapter

The analysis of past migrations, consumer behaviour and players' strategies enable us to provide some answers to two fundamental questions: "what influences are exerted on public decision-makers within the framework of the digital migration? ", "what can market forces alone achieve? " and as a result "where should the public intervention be needed to palliate possible shortcomings in the market forces?".

We find ourselves in a classic dialectical situation:

1. Observation shows that certain market characteristics might produce market failures. More specifically, a complete switchover and ATO might not occur soon enough under market forces action alone.
2. These shortcomings seem to justify a certain amount of regulation and public intervention to encourage SWO and to facilitate ATO.
3. The market players are all exerting pressure to ensure that public intervention occurs in a direction which favours their own interests.
4. Some of the market failures are imputable to the fact that players *anticipate* public intervention and are modifying their market behaviour in a direction which is favourable to them.

Figure 31: The dialectics of market failures and distortions



2.6.1 What can (will) be achieved by market forces alone?

To answer this question, it is necessary to segment households into categories.

The analysis of players' strategies and the services economy leads us to think that **all pay TV households will be converted quite rapidly to digital by their service provider**. This notably covers satellite and pay cable (premium). For the moment, this merely concerns the household's main TV set, even if certain operators are beginning to offer ranges of decoders for *secondary* sets.

As regards **basic cable subscribers** it is unlikely in the short to medium term that operators will supply or even rent digital decoders to all of these subscribers. In the long term, the prospect of freeing up bandwidth for value added services could encourage them to cease analogue broadcasting. As it would be legally, politically and contractually impossible in this instance to simply stop providing the television service, they could then be motivated to contribute financially to equipping these households. However, it is possible that cable operators, STB manufacturers and consumers alike will first expect Governments to take over some of the cost of digitising households (inhibiting effect).

As regards **analogue households which are reluctant to accept pay TV**, we should not count on "incumbent" commercial operators to finance migration (at least in the majority of terrestrial countries). Public broadcasters probably do not have the resources and may request State aid. Nor will the new entrants to free-to-air terrestrial broadcasting have the resources to finance household equipment either.

The prospect of accelerating switchover and saving transmission costs after turn-off will probably not suffice to ensure that the market forces on the broadcaster side will contribute massively to the digitisation of terrestrial households, at least in countries where this mode of access is dominant. Here, we can talk of **"market failure"** relative to the SWO/ATO objective as follows:

Private players in the free-to-air sector are not encouraged to contribute to achieving digital equipping of households, whereas this could be a profitable long-term investment *for themselves* in certain cases. This is because they prefer to keep their analogue situation rent (as incumbents) in the short term or to avoid free-riding, i.e. paying for others (PSB and new entrants). It is necessary to wait for a certain critical mass of customers for the investment to become profitable; otherwise free-riding becomes tempting. Finally, they are led to anticipate public financing. We therefore have a **triple problem of a situation rent, co-ordination and inhibiting effect**.

1. Collective external benefits can be expected from a rapid switchover and rapid turn-off, but they do not reach any of the operators in the different markets in particular. These therefore do not have any motivation to internalise these benefits in their market behaviour. In particular, as use of the spectrum of terrestrial licences is neither monetised nor taxed, the players do not have any incentive to be sparing of this public resource and to act to optimise its collective utility. We therefore have a problem of **positive externality which cannot be internalised** in the current state of market operations.

There is also the **market force represented by free-to-air television users** themselves, in the face of electronics manufacturers. The **degree of households spontaneously equipping** with external converters or integrated digital televisions will depend on the interest created by the free-to-air digital services on offer, plus the attractiveness and the price of equipment supplied by manufacturers.

2.6.2 Who is likely to try to influence regulation ?

We have seen that, like in any other market, *all* the main players are likely to try to influence regulators and public authorities both at national and European levels.

- Consumer associations may exert pressure against any analogue turn-off, on behalf of the status quo in terms of access mode and protection against TV equipment obsolescence due to turn-off, and to ensure public subsidies for acquisition of converters.
- Public service broadcasters (PSBs) may exert pressure in certain countries to ensure that the terrestrial platform is considered a priority in the digital migration and to obtain the budgetary resources needed to develop their activity of thematic channel publishers.

- In certain countries (Italy, Spain, France and Sweden), the existing analogue terrestrial broadcasters (incumbents) who are often allied to satellite pay platform operators may exert pressure to delay the arrival of new free-to-air channels or new pay TV platforms in the digital broadcasting sector, or lobby so that they can control the process.
- In contrast, new entrants, in publishing or distribution, may exert pressure to ensure that the terrestrial digital platform starts up and would like incentive measures (planned turn-off, subsidies for converters, obligation to have digital tuners…)[48] to induce the consumer to migrate as easily and quickly as possible.
- Cable network operators may exert pressure to prevent terrestrial broadcasting from competing with them as a universal access mode (Benelux, etc.) or delivery mechanism for pay TV (France, Sweden, etc.). They also try to warn public authorities about the possible financial consequences of DTT radio interferences on cable subscribers. They may also exert pressure to ensure that digital conversion of basic cable subscribers who are reluctant to accept pay TV is subsidised by the public authorities.
- Television set manufacturers, whose interest today is to sell wide-screen analogue televisions, will find it in their interest at a later stage to sell wide-screen *digital* televisions, in order to increase the market in value (more high-end products) and horten the renewal cycles. They may then be likely to exert pressure to ensure that this equipment is subsidised or mandated by the public authorities on behalf of the switchover objective, and/or that non-compatible equipment is prohibited (in order to guarantee their position vis-à-vis free-riders).
- For their part, it is now in the interest of technological operators and STB manufacturers to ask for advertising, subsidies and public information campaigns to encourage consumers to equip themselves.

[48] See the Policy chapter for a detailed analysis of the range of policy measures that can be envisaged in order to accelerate the migration.

2.6.3 So where is there room for public intervention under general interest considerations ?

The market failures described above are making market players move more slowly towards digital and turn-off than what would be optimal for themselves and society as a whole. In practice, we believe that market forces can only digitise the *majority* of households in the medium term, but not *all* of them. However, as we shall see in the following chapter, policy-makers see the **general interest benefits of a fast(er) and more universal migration**.

In this type of situation, economic theory suggests the usefulness of intervention by the public authorities, aimed at modifying the organisation of the market to correct the "failure". More precisely, this intervention can take the form of (positive or negative) incentive measures targeting the different market players, to lead them to adjust their individual behaviour to become in line with the general interest. The analysis of the various forms which the incentive can (or should) take will form the subject of the next chapter.

How far market forces alone can go – How to read the following summarising tables :

The number of + shows the likeliness/willingness of the player to invest in the digitisation of reception. For example in "terrestrial " countries pay TV is likely to reach about 50% of homes on average in the long term. Households digitisation is financed by pay TV operators themselves (+++). 100% of pay TV homes (i.e. 50% of total home) will be digitised this way. For the other 50% (non pay TV homes), pay TV and broadband operators (satellite or cable) might one day contribute to home digitisation in order to recover bandwidth and TV channels, so as to save analogue transmission costs, but this is not certain and will not happen in the short term (+). But in these countries, as the FTA analogue supply is scarce, consumers themselves are likely to invest in digital equipment to access FTA multichannel (++). All in all, about 50% of FTA homes might be converted in the mid-long term. Overall, we can assume that about 75% of homes could be converted due to market forces alone. The policy-makers will thus be likely to have some general interest motivations in contributing to the process (+).

If we engage in the same prospective exercise for a "cabsat" country environment, some elements change: the long term potential for pay TV is lower (25%). TV channels might have more incentives towards contributing to turn-off (as the cost of it is lower and there are less strategic dilemmas) (++ instead of +), but on the other hand, consumers have fewer incentives towards contributing (because most of them already have multichannel in analogue, via satellite or cable) (+ instead of ++).

In conclusion, the table illustrates our opinion that **(i) market forces alone probably cannot "digitise" more than 80% of households in the mid-long-term,** and **(ii) the potential is probably higher in "terrestrial/pay TV" countries than in "cable basic/ satellite" ones.**

Lastly: we could draw up a similar table incorporating *all* receivers and not only the *main* receiver in the house. Then the results in terms of digitisation would be **much lower**, as digital pay TV "subsidisation" addresses only main sets today.

Figure 32: Likely digitisation drivers and digitisation rates in mid-term under market forces alone (synthesis)

Terrestrial/PayTV countries : 75%

	Pay TV subscribers	Other households (FTA or basic)
% of homes	50%	50%
Pay TV and broadband operators	+++ (digitisation key to premium/broadband strategy and financed by ARPU)	+ (save bandwidth for more value-added services)
FTA channel broadcasters		+ (save transmission costs after ATO but market failures and strategic dilemmas)
Consumers	+ (implicit through subscription fees)	++ (attractivity of FTA digital services and equipments)
% of reception digitisation in each category	100% of the 50%	50% of the 50%
Total homes	**50%**	**25%**

Cabsat/basic countries : 62%

	Pay TV subscribers	Other households (FTA or basic)
% of homes	25%	75%
Pay TV and broadband operators	+++ (digitisation key to premium/broadband strategy and financed by ARPU)	+ (save bandwidth for more value-added services)
FTA channel broadcasters		++ (save transmission costs after ATO - less market failures and strategic dilemmas)
Consumers	+ (implicit through subscription fees)	+ (attractivity of FTA digital services and equipments reduced – lower attractivity : analogue multichannel)
% of reception digitisation in each category	100% of the 25%	50% of the 75%
Total homes	**25%**	**37,50%**

3. Spectrum

3.1 Synthesis

3.1.1 Main findings

1. One of the benefits over time of the digitisation of broadcasting and reception of terrestrial television is a **potentially major release of spectrum capacities** (several hundreds of MHz) once analogue broadcasting is definitively turned-off. This is made possible by the improved spectral efficiency of digital compared with analogue, notably thanks to possibilities for compressing and multiplexing binary information.
2. However, it also appears that this situation of abundance will be **preceded by a situation of relative scarcity during the 'simulcast'** (period of simultaneous digital and analogue broadcasting), which is particularly difficult to manage in border areas.
3. This raises the question of optimising spectrum management at European level as uncorrelated management by countries could reduce this global efficiency in terms of time frame, coverage, quantity of spectrum available. Co-ordination requirements derive from two necessities : (i) avoiding interferences at international borders, and (ii) allocate the same band(s) to a given service throughout Europe (and beyond) in order to promote an open, dynamic internal market for consumer electronics and digital services.
4. The way spectrum is made available to its users if **a determining factor of efficiency**. In particular, the historical technical-administrative approaches followed, which are often taken-upby international spectrum authorities, do not correspond to an **economic optimisation** of spectrum and economic efficiency if the operators' oligopoly rent is not recovered.
5. It can be observed from historical and current examples that this way to allocate spectrum presents a **risk of competitive distortion.** In particular, the incumbents use technical planning rules or demand substantial bandwidths to reduce the quantities of spectrum made available to other operators or services, thus reducing the level of potential competition.
6. Furthermore, there is a second inertia and possible inefficiency factor in spectrum management due to the **installed base of receivers**. As such, the operators with an installed base using a certain frequency are not favourable to a modification of this band which would generate substantial costs, unless they can anticipate new revenues which would absorb this cost.

7. Mobile telecom operators could become new users of some of the "broadcast" frequencies in the UHF band, when they would be released after ATO. Indeed, using these low frequencies could make perfect technical and economic sense for them in low-density areas. Nonetheless, **they do not express a clear interest for these frequencies**. They have already secured and paid the bandwidth they are going to need for UMTS in mid-term, and they also have already taken official positions in order to access additional frequencies, in higher bands, for their longer term needs.

3.1.2 Recommendations

- In order to optimise spectrum management and to harmonise certain aspects of migration at European level, we believe it is necessary to formalise each country's objectives. This requires each of them specifying **spectrum access arbitration rules and makes explicit actions dureing the migration phases in a long term view** (launch of digital, simulcast, analogue turn-off, reorganisation of the spectrum at analogue turn-off). Such rules cover arbitration of the spectrum between national/regional/local programmes, between T-DAB and DVB-T and between terrestrial/cable/satellite access to guaranteed coverage, between the different mobile/audiovisual applications, between MFN and SFN planning, etc.
- Improving the management of spectrum efficiency is also achieved by implementing new mechanisms to:
    - determine the value of the spectrum from the point of view of operators with the aim of recovering the oligopoly rents inherent in allocating a limited number of licences. This estimation does not prejudge the means of recovering such rents (direct payment of the revealed value of the spectrum or compensation by general interest obligations, notably for public operators). It is possible to imagine the implementation of a **value revelation mechanism** via a system of options [49] or even auctions.
    - facilitate the refarming of bands which would change use (frequency **band re-allocation mechanism** for new entrants and incumbents), particularly when analogue broadcasting has stopped and it is necessary to reorganise frequency bands to optimise them.
    - improve spectrum efficiency with the use of statistical multiplexing for all of the programmes and all of the operators, and the use of better compression algorithms and network planning methods. These technical elements have a direct influence on the number of channels available to the public but also on the intensity of competition among providers. They should therefore be taken into account in view oftheir economic impact.

[49] A purchase option enables a buyer to acquire a right to purchase an item or asset in the future on a certain date and a set price, the exercise price. However, an option is not an obligation to purchase. In case where the asset does not reach the exercise price by the deadline, the buyer does not exercise his option, which enables him to limit risks (and symmetrically for options to sell). Options theory and fixing option prices have been studied and developed in particular by Black & Scholes, the 1997 Nobel prizewinners for economics (The pricing of options and corporate liabilities, Journal of Political Economy, Vol.81, 1973).

3.2 Spectrum management and terrestrial broadcasting

The radio spectrum is an essential resource for broadcasting television and radio terrestrially in many European countries where this is the majority form of access. In total, 49% of European households access analogue television for their main terminal by terrestrial access in VHF-UHF bands. But even in countries where access via cable is dominant, there are mixed cable/terrestrial accesses for the main TV set and other sets in the household (cf. profile of Germany).

At present, **terrestrial access to analogue television remains dominant in Europe in terms of** the installed base of receivers**.** Furthermore, the spectral implications for satellite and cable broadcasting are much less important than for terrestrial broadcasting. This is why this section on spectrum essentially deals with terrestrial analogue and digital television broadcasting[50].

Furthermore, considering that spectrum is considered as a scarce resource, the public authorities allocate these frequencies directly or have set up a regulator to define allocation conditions. This **allocation mode** is a major factor in the dynamic of the markets and the benefit to the consumer. In fact, assigning the spectrum to a mobile operator or arbitrating between television channels has direct consequences on the types of services available, on their quality (in accordance with the quantity of spectrum allocated), on competition between players, on the service coverage, etc.

Therefore, during the **simulcast period,** when analogue and digital broadcasting exist side by side, the way spectrum is allocated will be a determining factor in establishing a market and more globally in the success of digital television.

We shall therefore pay particular attention to analysing the stakes involved in managing the terrestrial spectrum, its efficiency conditions, the problems which are specific to the simulcast period and the prospects for releasing bands after the simulcast, which represents the major expected benefit.

Furthermore, the need to accelerate or not migration to digital by public policy measures relating specifically to radio spectrum is dealt with elsewherein this report (Cf. cost-benefit analysis). Finally, the following 2 paragraphs concerning spectrum issues for cable and satellite confirm that spectrum issues essentially concern terrestrial television broadcasting.

[50] Technical and specific aspects of radio spectrum are described in greater detail the Annex.

3.2.1 Satellite broadcasting

Satellite broadcasting uses the 10.7-12.75 GHz band in Europe (Ku band) with 2 reception modes: direct broadcasting to the household and SMATV (*Satellite Master Antenna Television*) for collectivereception.

According to Article S9.1 of the ITU (*International Telecommunication Union*) Radiocommunication Regulation, the right to access the orbital belt segmented into 180 orbital positions spaced out by a 2° angle (*GEO Belt*, *Geoestationary Earth Orbit*) is assigned by the ITU through the medium of national frequency agencies. The allocation of the slot and frequency is free of charge and is based on the 'first in first out' principle (FIFO). As a result, the GEO Belt is currently fully reserved, but not necessarily used. Moreover, it is also worth noting the sound European practice of having a pan-European broadcasting licensing mode which enables an operator to obtain a European broadcasting right through a single application to a national frequency agency ('one-stop-shopping' principle, see http://www.eto.dk/oss.htm).

According to the providers, the transition from analogue broadcasting to digital broadcasting does not pose a major problem on the transponders of current satellites. The digitisation of transmission and broadcasting are very advanced in practice.

The **scarcity of the spectral resource is relative for satellites** as there is a plan to make new bands available and current broadcasting is already very comprehensive in terms of number of channels and coverage.

3.2.2 Cable broadcasting

The majority of cable networks use the VHF-UHF frequency band, the same as in terrestrial broadcasting, via a network infrastructure called Hybrid Fiber Coax (HFC) which in particular enables a simulcast of analogue and digital broadcasting by widening the broadcast band (up to 860 MHz). This permits broadcasting of the same analogue TV programmes (generally thirty), the broadcasting of digital TV programmes (100 to 150 channels in general) and possibly the introduction of new services (interactivity, Internet access and telephone) [51].

[51] HFC architecture evolution for high bit rates, J.C. Point at DVB World 2001, Dublin.

Using the same bands for terrestrial and cable broadcasting **risks provoking some interference problems** among consumers if no precaution is taken, as cable operators have up to now used certain channels which analogue terrestrial broadcasting could not use (taboo channels) but whose use becomes possible with digital terrestrial broadcasting[52]. The impact of this interference on users has been debated. Relatively low cost technical solutions can be found for this technical question. This argument, which is often put forward, seems to be a means of limiting or slowing down competition between cable and terrestrial broadcasting. In particular, it can be observed that the countries which launched digital terrestrial broadcasting have not experienced major problems concerning cable reception. This point is set out in detail in the section 'Interference from cable and terrestrial broadcasting' in the annex.

On the other hand, in contrast to terrestrial access, **cable is not a public resource** shared between different operators. Intervention by the public authorities is limited to issuing franchises, rights of way and the 'must-carry[53]': cable is actually designated economically as an essential resource and not a scarce resource. In the absence of precise specifications, the question of access to the resource is therefore arbitrated by the operator on a purely commercial basis.

The regulator´s decision on **must-carry will have an impact** on cable´s available **spectral resource** as well as an economic and commercial impact (introduction of competing programmes with cable operatorown programmes in an internal range and notably loss of revenue vis-à-vis 'premium' services, frequent non-remuneration of the signal delivery, possible increase in the price of decoders due to the addition of certain functions, etc.). This difficulty was confirmed in the United States during the introduction of digital terrestrial television: the cable operators strongly opposed must-carryof digital terrestrial programmes. It should be remembered that in Europe must-carry is covered by Article 31 of digital terrestrial programmes in the new Directive on Universal Service and Users' Rights.[54]

To conclude, it is worth noting the **appearance of new broadcasting modes,** such as ADSL which makes it possible to use the telephone cable with a bandwidth of approximately 1.1 MHz or wireless local loops based on LMDS or MMDS technologies which would use microwave bands (over 2.5 GHz).

---

[52] This is for reasons linked to a digital signal's lower sensitivity to interference relative to an analogue signal, and to a lower power level required for digital broadcasting in particular.

[53] Compulsory broadcasting of certain programmes or audiovisual services on cable networks, notably due to their general interest.

[54] OJ (http://europa.eu.int/information_society/topics/telecoms/regulatory/new_rf/index_en.htm#us).

3.3 Policy options in spectrum management

As stated in the introduction, the spectral problem concerns terrestrial broadcasting in the VHF and UHF bands as a matter of priority.

Historically, the **essential purpose of spectrum planning has been to limit interference between States and to guarantee broadcasting coverage** per State**,** and not to optimise economic value directly. However, the spectrum segmentation practised in this planning and the designation of services for each of these bands have made it possible to create scale effects for the receiver market**.** In certain cases, it has also made it possible to create a pan-European services market (e.g. roaming for mobile telephones in Europe).

At a practical level, terrestrial broadcasting is governed by **four essential agreements in Europe** (the 1961 Stockholm Agreement for analogue television[55], the 1984 Geneva Agreement for analogue radio, the 1997 Chester Agreement for digital television, the 1995 Wiesbaden Agreement for digital radio) which define the planning rules (channels which cannot be used because of interference, conciliation procedure along borders and maximum broadcasting power levels).

It should be noted that these **technical agreements have major economic consequences,** as limiting levels of broadcasting power reduces the quantity of usable spectrum and consequently the number of channels and the level of service to a corresponding degree. Several players, frequency agencies and operators have commented that the theoretical levels defined in these agreements are very conservative and that negotiation between the Member States becomes necessary for practical implementation.

A **review of the 1961 Stockholm agreement** is on the agenda for the CEPT (*Conférence Européenne des Postes et des Télécommunications*) with the aim of adapting it to digital terrestrial broadcasting, during and after the simulcast phase, as a substitution for the Chester and Wiesbaden agreement. To do this, a *Regional Radio Conference* (for Europe and possibly for neighbouring countries) is planned from 2003 as a preparation for the ITU *World Radiommunication Conference* in 2006, which should approve a new agreement.

Beyond these administrative and technical considerations, the real problem remains spectrum policy, the economic and social objectives attached to it and the best possible use of this resource which thus forms the subject of public regulation.

In its new Decision on radio spectrum[56], the European Commission proposes to render explicit the objectives pursued in industrial, economic and social terms and to establish a European spectrum policy.

---

[55] Initially it also covered analogue radio until it was replaced for this aspect by the 1984 Geneva agreement.

[56] OJ (http://europa.eu.int/information_society/topics/telecoms/radiospec/radio/index_en.htm).

3.3.1 The alternatives for spectrum management

While **terrestrial spectrum management policies in the majority of cases retain an administrative character in Europe** deriving from the authorities' wish to combat interference, it can be observed that some countries or certain applications are making a greater call on regulation and the market in their arbitrations (examples of auctions for UMTS mobile telephony in the United Kingdom and in Germany).

It should be remembered that spectrum management policies are characterised by the degree of involvement of the public authorities and the mode of allocating the spectral resource to public and private users[57]. In a more practical manner, the public authorities can act on:

- **The level of regulation**, in particular the number of licences issued to operators, the degree of exclusiveness awarded (franchise monopolies for cable, licence oligopolies (television and mobile telephones), authorisations (e.g. so-called ISM band for *Industrial, Scientific and Medical at* 2.5 GHz), the duration of the operating right and its renewal mode, the level of ownership which can lead to a right to resell use of the spectrum to private third parties (secondary market), the quantity of spectrum made available, the time when this spectrum is made available, the services and applications which can use this spectrum, the technologies and norms to be used and the allocation price.
- The spectrum **allocation mode** to designate its users, the tool selected depending on the options chosen and described in the previous paragraph: first in, first out (FIFO), drawing of lots, 'beauty contests' and different varieties of auctions ('English' or 'upward' auctions, 'Dutch' or 'downward' auctions, first price sealed bid auction and second price sealed bid auction, which are the 4 essential families of auctions[58])

Taking the case of terrestrial digital television in Europe, the standard has been selected for transmission (DVB-T), while the frequency band is also pre-determined (UHF).

[57] IEEE Communication, Prof. IEEE Communication, Prof. Peha from Carnegie Mellon University.

[58] A theory of auctions and competitive bidding, Milgrom & Weber in Econometrica, Sept. 1982, Vol. 50, number 5 1982, Vol. 50, number 5

The services will essentially be audiovisual within a dynamic of digitising the current range on offer; no secondary market will exist and the allocation mode is and will be a 'Beauty Contest' in the majority of cases. The remaining degrees of freedom are the number of licences (and the number of operators), the duration of the licence, the quantity of spectrum made available to a certain degree, the time of availability, the price and the allocation mode.

3.3.2 Spectrum technical efficiency and spectrum management efficiency

Dealing with the question of spectrum management also means tackling the question of its efficiency and optimisation. In particular, there are several technical factors (described in the annex) which influence the spectral efficiency (measured in Mbits/ MHz / m²) of a band of frequencies, but this aspect is only one of the parameters of global efficiency and in particular, it does not reflect the efficiency of the assignment and allocation of frequencies. We shall therefore make a distinction between spectrum management efficiency and spectral technical efficiency.

The organisation of the spectral band currently reflects the chronology of appearance of radio applications: the bands have been exploited progressively in step with technological advances which made it possible to use them in economically acceptable conditions. This sedimentation is obviously not a gauge of efficiency: in particular it does not highlight the necessity to free up bands whose use is becoming obsolete and generates the idea that once access to the spectrum has been awarded, this right cannot be withdrawn.

Furthermore, there is a 2nd inertia factor in the development of the spectrum and its re-allocation: this is the stocks of receivers. As such, operators using a certain frequency are not favourable to a modification of this band which would generate substantial costs, unless they can anticipate new revenues that would absorb this cost. The regulator will be sensitive to this demand from operators because it translates into an obligation on consumers to invest in new receivers/antennas, an investment which can only be justified in the event of a significant added value in quality or service.

In an environment where on the one hand the commercial stakes of the spectrum are becoming major via applications such as mobile telephones, commercial television, Internet access, and on the other hand during a simulcast where the spectrum risks becoming a bottleneck or at least a limiting element, **spectral efficiency will be a success factor in the analogue/digital transition**, particularly for terrestrial digital. This is why the following paragraphs sum up the economic bases of the spectrum and its management with a view to optimising it.

3.4 Economic efficiency of spectrum management

3.4.1 Interferences

Interference is a key question in spectrum management. A debate exists between those who recommend *ex ante* planning and others who prefer arbitration by the market.

From an economic point of view, **interference has been classified as a negative externality by economists**[59]. This means that the utility (number of programmes, picture quality, etc.) for **consumers and operators** is reduced by the existence of interference, a phenomenon which is external and which they cannot master: either the signal received is disturbed by interference, or the channels which are disturbed are not used, in which case the quantity of spectrum available is reduced accordingly in practical terms.

Two economic approaches are proposed to solve this question of negative externality:

- The first, initiated by **Pigou** and developed by Baumol, Buchanan and Bator[60], is based on the principle of a **tax reflecting the marginal cost due to interference** suffered by the victims. This is the so-called "the polluter pays" principle within the framework of environmental policy. In practice, this means taxing transmitters whose power exceeds a certain threshold from which the regulator deems that the consumer's utility is reduced (as power increases, the radio coverage also increases along with the areas subject to interference). The existence of this tax should encourage operators to invest in resources to prevent interference (filter, smart antenna, optimum deployment of the network, etc.). A system of this type requires central management which collects taxes and redistributes subsidies. On the other hand, this tax increases the production costs borne by operators, who in a monopoly or oligopoly situation could pass them on to the consumers.

[59] This historical approach is challenged in the case of the digital *Single Frequency Network* (SFN), as the management of interference in this broadcasting architecture improves signal reception; it is therefore a positive externality for users of this network but negative for other networks. This point is explained in the Annex.

[60] Pigou, The Economics of Welfare, London 1920. Baumol, Oates, the Theory of Environmental Policy, Cambridge University Press, 1988. Buchanan, Stubblebine, Externality, Economica 1962. Bator, The anatomy of market failure, Quarterly Journal of Economics, vol LXXIII, 1958.

- The second approach, proposed by **Coase**, Nobel prize-winner for Economics in 1991 and discussed by others (Foster, Melody, Benzoni[61],) is based on direct negotiation between producers and the victims of interference. In this solution, it is assumed that the **rights to the spectrum are exclusive and transferable in nature and are classed as private asset**, with their ownership right therefore determining a unique legal responsibility. Victims of interference (consumers and other operators) can therefore formally oppose the producer of the interference, which in a situation of 'pure and perfect competition' is bound to negotiate compensation with the victims. This approach adopts the hypothesis that the negotiating costs are zero, which is possible when there are few victims and producers of interference, but is difficult to operate in oligopoly situations such as television (a few operators but millions of users) without representation for consumers. Nor does the dissymmetry of information in an oligopoly situation enable consumers to negotiate prices subject to the same conditions as highly informed producers. As regards this approach towards reducing interference, Coase showed that minimising interference did not equate with optimising the resource**.**

The current solution in Europe is relatively close to Pigou's proposal in the sense that the regulation and international agreements are based on the principle of reducing interference and that private ownership of the spectrum does not exist. In contrast to other domains, this principle of 'the polluter pays' is not implemented to the limit however, as no right to 'pollute' is currently demanded.

3.4.2 The relative scarcity of the resource

It is commonplace to assert that the spectrum is a scarce resource for terrestrial broadcasting. Economically, a resource becomes scarce when demand for it largely exceeds supply, with price being a measure of the scarcity of all goods or services. At present, the price of the TV/radio spectrum is zero or valued at administrative costs, apart from 5 exceptions described in the following paragraphs. In fact,

- At present, the value of the spectrum is not quantified for television and radio, to such an extent that it is impossible to know the value which it is assigned by commercial operators.

[61] Coase, 'The Federal Communications Commission', Journal of Law and Economics vol.2, Oct. 1959. Foster, 'Selling the Air-Waves', Communications International, 1989. Melody, 'Radio Spectrum Allocation : role of the market', American Economic Review Papers and Proceedings, vol 70, 1980. Benzoni, 'Le spectre hertzien : bien public or bien prive ?', 1990.

- To obtain a clear view of supply and demand and therefore the value of the spectrum, **a transparent mechanism to reveal demand, supply and willingness to pay should be implemented**, which does not prejudge for or against a direct or indirect payment based on general interest or public mission, notably for public operators. The establishment of a public European database listing spectrum requests (quantity, schedule, spectrum requester) would be a first step in this process. It is conceivable that an option mechanism would be a more dynamic extension. The application of options theory to spectrum management would make it possible to limit buyers' risks to the option price and to manage the spectrum over time. In this hypothesis, the option mechanism would also be a mechanism for revealing operators' interests and the value which they assign to the spectrum. This options system would also make it possible to re-allocate the spectrum between entrants and incumbents, while the revenues from options could cover the costs of migration in particular. (Cf. Also see the footnote in the recommendations chapter).
- As the spectrum is apparently 'free', every operator will claim it and will **tend to occupy the maximum portion of it, which will limit the number of competitors** it faces and create an apparent scarcity situation on the spectrum.
- Management of the analogue TV spectrum in Italy and in Greece, or even in Germany shows that it is possible to receive more than 10 terrestrial channels per household, which challenges the conventional orthodoxy of scarcity in countries, i.e. a maximum of 5 national terrestrial channels would be possible. This suggests that the level of power and interference strongly affect scarcity.
- Gains in technological productivity will make it possible to improve spectral efficiency substantially between analogue broadcasting and digital broadcasting, which will create so much potential 'space' for new uses/entrants/services.
- Two thirds of the 50 MHz - 2.9 GHz spectrum are used for non-commercial purposes (notably defence and aeronautical communications) and therefore without any competitive incentive, which offers the advantage of optimising use of the resources. In this case of non-commercial use, everything is based on the efficiency of the regulator or the assignor. In particular, scarcity may be the result of restriction on commercial bands to the advantage of the historical occupants.

- While all the bands appear to be occupied, they are not all used to the same level of intensity. This is the case with UHF and VHF television bands for example. Scarcity is therefore not homogenous when it exists. This situation is partially the result of the principle of segmenting the spectrum into frequency bands whose use (services) is designated by the ITU.

Spectrum scarcity is therefore associated with a situation where there is no strong incentive to optimise, in other words to a lack of spectral management efficiency.

On the other hand, the scarcity phenomenon will be a sensitive matter on the TV UHF band during simulcast, but the spectrum availability may return to a surplus at the turn-off of analogue broadcasting.

3.4.3 Spectral rents of television oligopolies

The fact of sharing the spectral resource among a more or less limited number of services and operators creates an oligopoly situation which benefits the licencees. Radio spectrum forms the subject of 2 types of economic rents for an operator [62]:

(i) The '**differential rent'** which exists between 2 operators who operate the same service, although at different frequencies. For an operator, a band which is less suited to its services translates into higher investment in its network and terminals and lower margins relative to a competitor benefiting from a band which is less expensive to operate. The standard example is GSM at 900 MHz and at 1800 MHz: with equal coverage, the infrastructure costs are higher in the 1800 MHz band, but the market price is the same for voice services. A difference of this type is also perceptible between the UHF and VHF bands in television. The VHF band actually makes it possible to cover territories with fewer transmitters, with consequent lower costs than those associated with the UHF band. For digital television broadcasting, the VHF band (DVB Band III) could prove interesting for mobile broadcasting and national broadcasting of programmes without a heavy coverage obligation (typically Pay TV programmes). However, the VHF band is characterised by some disadvantages such as sensitivity to parasites, a longer range which generates more interference problems, particularly at borders, disadvantages which are less perceptible in UHF.

[62] Thesis by Dr Eva Kalman, L'Analyse Economique du Spectre Hertzien, Ecole Nationale Superieure des Telecommunications, Paris

The UHF band also supports more programmes as it is wider and it is easier to use for proximity broadcasting. The regulator, which allocates these bands to their operators, must be able to compensate for this difference if it wishes to guarantee equal competition conditions.

In fact, this rent takes account of the quality of a frequency band vis-à-vis a particular use.

The '**scarcity rent'** which reflects the quantity of spectrum available at a constant quality. This scarcity leads to a limitation of the number of operators and the creation of oligopoly situations (a few vendors and millions of purchasers) and therefore the absence of 'pure and perfect' competitive conditions. The question for the regulator is then how to recover this rent to optimise the consumer's utility. This recovery can be direct via a tax or compensatory in exchange of a general interest mission rendered by an operator.

In practice, this scarcity rent has been highlighted by the valuations of broadcasters in the United States, as R. Coase[63] showed, during the sales and purchases of these companies: the price paid by the buyers does not correspond to the valuation of the production assets in the companies being sold but to the right to access the spectrum awarded to these companies, a right which materialised in a a spectrum access licence. Another index is the high profitability of these companies (EBITDA of 20 to 25%). A scarcity of this nature also has consequences for the high advertising space marketed by some free-to-air channels.

The establishment of a mechanism to reveal private operators' willingness to pay would make it possible to determine the value which operators assign the spectrum and the oligopoly rent.

3.4.4 Oligopolies and spectral valuation

The problem of valuing the spectrum is raised for the regulator/government when it wishes to maximise the advantages of the spectral resource for the community and to recover the oligopoly rent. The evaluation of the spectrum price should therefore be compared with the marketable value which an operator attributes to the terrestrial resource (a value which is not revealed by these potential users, as they wish to pay the least possible). This valuation does not prejudge a direct or indirect (obligations to provide coverage, services, content financing, etc.) means of paying for the licence.

[63] Coase Ronald, The Federal Communications Commission", Journal of Law and Economics vol.2, Oct. 1959.

Economists identify **several methods for estimating the spectral value**:

(i) **valuation of the spectrum at its administrative management cost**. This management mode is suited to non-commercial uses and is the most common form of valuation in use today.

(ii) valuation with the help of formulas which take account of different parameters (population, bandwidth, coverage, etc.). This valuation has an economic approach whereas the first option is purely administrative. However, this method requires the setting of arbitrary coefficients. The details of these formulas is given in the annex.

(iii) **value based on spectrum users' revenues**. This formula is suited to operators using the spectrum directly for commercial use, although it is difficult to value an indirect use (terrestrial contributions links, taxis, etc.);

(iv) **valuation by simulating the market** which makes it possible to determine how much users are ready to pay (mechanism to reveal willingness to pay).

This latter method is theoretically the most exact as it makes it possible to estimate the value of the operator's oligopoly rent. Nonetheless, it is the most difficult to implement as the market model has to be accepted by all the players and it is difficult to gather and update the data which feeds a model of this type.

The question for the regulator is how to make the spectrum available at a price equivalent to the rent in the operator's eyes. This optimum case will enable the regulator to recover all of the possible rent. Economists have shown that to reach this position of equilibrium, a system of regulation by price is the most effective. The allocation procedure corresponding to this objective is the auction procedure. Considerations clearly defined as being of general interest, in particular for public broadcasters, could adjust this theoretical result but this implies clarifying these interests in a transparent and quantified manner. In particular, the Directive 'Authorisation of electronic communications networks and services' (Article 5 and, in connection with Article 6, point 6 of annex A and point 1 of annex B)[64] takes account of the specificities of broadcasting audiovisual services.

[64] Directive on Authorisation of networks and communications services (Article 5 Rights of use for radio frequencies and numbers et 6-Conditions attached to the general authorisation and to the rights of use for radio frequencies and for numbers, and specific obligations). OJ (http://europa.eu.int/information_society/topics/telecoms/regulatory/new_rf/index_en.htm).

In practice:

- historical examples show that the spectrum is valued at between 0.04 and 0.36 Euro/MHz/ inhabitant/year (Cf. Annex) ;
- payment for the spectrum for digital television has become a reality in Europe: 5 countries (United Kingdom, Greece, Ireland, Spain and Finland) charge or will charge commercial television operators a fee (the Annex gives details of these examples).

3.4.5 Oligopolies and consumer well-being

During transition periods or at the appearance of new technologies, all the historical and current examples (cable networks compared with terrestrial digital broadcasting, FM versus AM radio, cellular communications networks in TV bands, as described in the Annex, or MMDS, CATV, DARS[65] as described by T. Hazlett[66]), have shown that the incumbents systematically alternately invoke technical arguments (e.g. interference with the new systems) or socio-political ones (e.g. the public service provided) so that the established situations will not be altered and greater competition will not be introduced (Cf. description of historical cases in the Annex).

For example, the fact of increasing restrictions on interference (these levels are indicated in the Stockholm 61 type agreements) would limit the bands available and consequently the number of competitors. This would lead to a continuation of the **oligopoly situation which is not optimal for the consumer** if the oligopoly rent is not recovered through tales.

As regards the public interest, a distinction must be made between the interpretations which are characteristic of the players' positions and the economic definition which proposes to maximise the consumer's well-being and by overall integration, the social well-being. This classic macro-economic analysis shows in particular that the **consumer's well-being is maximised in the most competitive markets**, i.e. without a monopoly or oligopoly. In the case of an oligopoly (frequent in the event of a scarcity of resources), the recovery of the oligopoly rent by consumers through the regulator in general, becomes a condition for optimising the overall well-being. As regards the spectrum, this recovery can be direct through the sale of licences or indirect through obligations on operators to provide services of general interest, obligations which must equal the surplus generated by the oligopoly rent in value or the lower value for consumers and *in fine* for society.

65 MMDS Multichannel Multipoint Distribution Service(s), CATV : Cable TV, DARS : Digital Audio Radio Services.

66 T. Hazlett in, "*Airwave Allocation Policy*", Harvard Journal of Law and Technology, Spring 2001.

3.5 Spectrum management during terrestrial simulcast

The previous sections highlighted the fact that the spectrum problem was essentially terrestrial and on the other hand that the main question was spectrum management efficiency in a global sense and not on a purely technical or administrative level.

The aim of this new section is to analyse this efficiency in the more precise conditions of the terrestrial simulcast.

3.5.1 The different migration solutions

Up to the arrival of multichannel television carried by cable and satellite, the terrestrial broadcasting solution was the least expensive way of covering 80% of large territories in terms of the technologies available. Population density and the demand for more numerous channels facilitated the economic development of cable in certain countries, along with a possibility which appeared more recently, i.e. satellite which therefore benefited more from digital technology.

Based on this initial situation, migrating towards digital broadcasting could be undertaken on an absolute basis by:

(i) switching the terrestrial population to existing multichannel accesses (cable or satellite). This assumes that these accesses form the subject of full digitisation;

(ii) the establishment of new digital terrestrial broadcasting networks outside currently occupied bands, i.e. VHF-UHF ;

(iii) digitisation of different existing networks in the analogue VHF-UHF bands.

In the first case, the '**cabsat way'**, the spectrum would not transport the digital programmes and content, which would be available solely on cable or satellite. Migration of this type assumes that these cable and satellite networks are digitised or can be digitised easily. The quantitative analysis of this option is dealt with in a different section of this report (the cost/benefit model). In particular, it is shown that this solution is particularly interesting in countries where cable is already deployed heavily.

In the second case, migration may involve **deploying new terrestrial digital networks at other frequencies**. These would generally be higher to support more channels and new services which would economically justify an investment of this type. It is also possible to imagine using lower frequencies, e.g. the VHF band, which is often under-used, to benefit from the properties of this frequency band (e.g. for portability or mobility).

In both cases, the UHF band would continue to be used for broadcasting analogue programmes and could be "turned off" at the end of the simulcast, although with the risk that it would never be turned off. However, use of a new band is linked to ITU agreement for such use, which has not been explicitly given for the moment. Technically, this option is made possible by the use of technologies such as MMDS at 2.5 GHz, for example. Ireland is the only European country to have deployed an MMDS network commercially to broadcast TV content, although in analogue for the present (250,000 subscribers to Chorus for a hundred Pay TV programmes).

In the third case, **the existing networks would each be digitised independently**. This would essentially involve cable and terrestrial networks, as satellite broadcasting and reception are already heavily digitised.

In this case, 2 options remain possible for terrestrial networks: MFN digital broadcasting or SFN digital broadcasting. The 2 choices would re-use the existing UHF band via the use of 'taboo' analogue channels which become usable with digital broadcasting. The difference lies in the quantity of spectrum used: SFN theoretically only uses 3 channels over a large territory whereas MFN utilises at least 5/6 channels to broadcast a programme in this same territory[67].

MFN and SFN make it possible to reuse the same broadcasting sites as in analogue broadcasting (by re-equipping the broadcasting sites with digital transmitters/antennas), which enables more rapid deployment of national-scale networks by updating existing networks. Similarly, collective or individual antennas are supposed to be re-usable, something which has nonetheless been challenged in countries which have selected this path. MFN also makes it possible to insert local programmes more easily whereas an SFN programme would be broadcast over all of the territory covered (generally national).

While SFN permits a substantial saving of frequencies, it requires the release of the same channel on all of the territory being covered, which is not easy on a UHF band organised initially via analogue MFN-type segmentation and on the other hand, exhaustive coverage (beyond 80%) increases the technical difficulties and therefore the costs, as the synchronisation conditions become difficult to achieve.

67 According to the EBU/UER B/CAI-FM 24 report, March 2001.

It is noted that Spain has managed to deploy SFN by re-allocating national military channels but that the coverage will not be exhaustive, which remains compatible with national Pay TV clusters which do not seek to fulfil this territorial exhaustiveness condition.

In smaller countries with a flat landscape relief (e.g. the Netherlands, Belgium and Denmark), SFN broadcasting for portable or mobile services also seems appropriate.

SFN broadcasting also offers the advantage of requiring a lower broadcasting power than MFN (with all other things being equal) as the probability of coverage is higher at a reception point thanks to the diversity of the signal received from several transmitters, according to the Institut für Rundfunktechnik, which tested this within the framework of the Validate project (ACTS AC106 project). The difference is of several dB in the cases tested.

To characterise the spectral efficiency of the different solutions, the following table can be drawn up:

Figure 33 : Spectrum used (with equal utility) in the different SWO approaches

Migration solution for the spectrum ->	Cabsat way (i)	MMDS (ii)	MFN (iii)	SFN (iii)
Simulcast period (analogue and digital broadcasting)	UHF	VHF-UHF+ another channel	VHF-UHF	UHF + 2 or 3 channels (VHF)
Digital broadcasting period	0	Another channel	VHF-UHF	2 or 3 channels

It should be highlighted that **the MFN solution consumes the greatest amount of the band over time even if it is one of the most efficient solutions during simulcast.**

With a concern for optimisation, in the case of MFN migration, and at the turn-off of analogue broadcasting, it will become necessary to reorganise the spectrum to regroup digital broadcasting channels. Otherwise the released analogue channels will be distributed across the entire band, as interwoven digital channels. A minimum reorganisation would involve regrouping MFN channels in a section of the band or using an SFN /MFN combination more effectively.

Not undertaking this reorganisation would implicitly close the spectrum to other uses by establishing an entry barrier via a spectrum which is little usable except with MFN, i.e. essentially for television and radio broadcasting, as these other uses require channels of different widths and adjacent bands rather than ones distributed at random across the spectrum. A situation of this type would lead to major costs for an operator which does not use MFN for television. As a result, it would be an economic barrier to the arrival of other services.

MFN and SFN solutions also create a competitive pitfall which is specific to terrestrial broadcasting. They lead to digitisation of existing broadcasting sites under the control of the incumbent broadcaster which generally has a monopoly (with the exception of the United Kingdom with a duopoly), particularly for the MFN option, whereas SFN also requires the creation of new sites.

Opting to digitise this network therefore provides the incumbent broadcaster with a competitive advantage over alternative broadcasters which would be obliged to negotiate with this player holding a practical monopoly to access its broadcasting sites. The same situation as with monopolies deriving from fixed-line telephony is found. Separating network operation and ownership may be a solution, while publication of 'interconnection prices' is also a means of ensuring more transparent competitive conditions.

In the absence of a credible broadcasting alternative, the channel publishers will enter into contracts with the incumbent broadcaster. More generally, **by selecting a digital MFN migration, there is a risk of returning to the present situation with a single player broadcasting without any competition** except for competition from other accesses (cable, satellite and others). The broadcasting prices would therefore not drop, which could hinder new, initially more modest, publishers from being broadcast in view of the prices charged for analogue terrestrial broadcasting, (several hundreds of millions of francs in France or Germany for nation-wide broadcasting). This could therefore reduce the competition in terms of numbers of channels by creating an entry barrier for new entrants. As a result, it is in the interest of incumbent publishers and broadcasters to maintain high broadcasting costs to limit the arrival of new entrants.

It would similarly reduce the numerous advantages promised by digital (number of accessible programmes, drop in broadcasting costs, etc.).

3.5.2 Member States' migration choices

3.5.2.1 Spectral migration choices in the EU

From a range of initial options possible the 'cabsat way' has not been chosen by any country and a frequency band swap (MMDS type) is only partially found in Ireland. All of the countries have therefore selected MFN/SFN solutions using the VHF-UHF band in the different configurations described in the table below:

Figure 34 : Member States' approaches to terrestrial migration

	Number of national analogue terrestrial channels	Number of multiplexes[68] planned during simulcast	Total MFN multiplexes	Total SFN multiplexes	Portability
Austria	2	1	N/a	N/a	N/a
Belgium	2 (per language Community)	3 to 5	-	3 to 5	Planned
Denmark	2	4	-	4	N/a
Finland	4	3	3	-	Not planned
France	6	6	6	-	Not planned
Germany	2	6 (per Land)	-	6	Planned
Greece	**13**	6	6	-	N/a
Ireland	4	4	4	-	Not planned
Italy	**9**	4	-	4	Not planned
Luxembourg	1 (in local language)	N/a	N/a	N/a	N/a
Netherlands	3	5	-	5	Planned
Portugal	4	4	Yes	Yes	Not planned
Spain	5	8	2	6	Not planned
Sweden	3	4	4	-	Not planned
United Kingdom	5	6	6	-	Not planned

Source : Country profiles annex.

[68] A (digital) multiplex involves assembling different audiovisual programmes and services on an 8 MHz wide channel. This bandwidth is also the width of an analogue television channel carrying just one programme. This identical width would make it possible to substitute an analogue channel which only carries one programme.digital channel carrying a multiplex of several programmes (4 to 8 in practice)

Greece, Italy, Spain and Germany also have many local or regional terrestrial channels (160 in Greece, 700 in Italy, dozens in Spain and a dozen in Germany).

- It can be observed that the number of analogue channels is higher than the European average in Italy and Greece where the analogue spectrum was little regulated or 'pirated', cf. 'the Italian Far West'. This de facto deregulation has had the advantage of offering a greater number of channels to viewers, although admittedly in conditions which were not always satisfactory in terms of reception.
- Concerning the largest terrestrial countries (United Kingdom, France, Spain and Italy), 2 have opted to orient themselves towards the more efficient SFN rather than MFN as the constraint imposed by the spectrum consumed by local television stations led to find the most efficient solution. Globally, the SFN solution is used as much as the MFN solution.
- To the extent that SFN is the most efficient in spectral terms, it may be asked why some countries do not have any SFN multiplex, as a situation of this type can only be temporary in a medium-term perspective of improved use of the spectrum.
- The most cabled countries (Germany, the Netherlands, Belgium) have opted for portability, which is not the case with Denmark and Sweden, which are also heavily cabled.

3.5.2.2 Assignment methods for broadcasting in the EU

Figure 35 : Assignment methods for broadcasting in the EU

	Current assignment method for analogue terrestrial broadcasting	Assignment method for digital terrestrial broadcasting	National policy on switchover and turn-off	National policy on terrestrial spectrum refarming
Austria	BC/FOC		No switchover plan for cable or satellite. Terrestrial switchover.	Nothing announced.
Belgium	BC/FOC			Nothing announced.
Italy	BC/FOC	BC/FOC	No switchover plan for cable or satellite. Terrestrial switchover. Terrestrial analogue turn-off set by law for **2006.** Financial incentives to support switching costs.	Little spectrum to be released. Digitisation will primarily help optimise spectrum management and allow new broadcasting entrants.
Denmark	BC/FOC	BC/FOC	No switchover plan for cable or satellite. Terrestrial switchover but no analogue turn-off policy so far.	Nothing announced.
Finland	BC/Pay	BC/Pay	ATO expected in **2006.**	
France	BC/FOC	BC/FOC/SBS	No switchover plan for cable or satellite. Terrestrial switchover but no analogue turn-off policy so far.	Nothing announced.
Germany	BC/FOC		Multiplatform switchover and turn-off set by law in **2010**.	No project to release spectrum after ATO.
Greece	BC/mix Pay+FOC			
Luxemburg	BC/FOC			
Ireland	BC/FOC	BC/Pay/P	No switchover plan for cable or satellite. Terrestrial switchover but no analogue turn-off policy so far.	Nothing announced.
Netherlands	BC/FOC	BC/FOC/P	No switchover plan for cable or satellite. Terrestrial switchover. No ATO announced.	No project to release spectrum after ATO.
Portugal	BC/FOC	BC/FOC/P	No switchover plan for cable or satellite. Terrestrial switchover. Turn-off expected **2007.**	Nothing announced.
Spain	BC/FOC/**Pay**	BC/MBM+SBS /Pay	No switchover plan for cable or satellite. Terrestrial switchover. Terrestrial analogue turn-off set by law for **2012.**	Little spectrum to be released, since all current analogue broadcasters will be assigned additional digital multiplexes after turn-off

Sweden	BC/FOC	BC/FOC/SBS	No switchover plan for cable or satellite. Terrestrial switchover but no analogue turn-off policy so far.	Nothing announced.
United Kingdom	Tender/ Pay	BC/FOC/MBM/ Pay	No switchover plans for cable or satellite. Introduction of Digital Terrestrial TV. Terrestrial turn-off announcement : expected to happen between **2006 and 2010**, under penetration criteria.	Released frequencies shall be auctioned. Auctions may be open to all users. Valuation studies are launched. (official Treasury Statement but no more details so far)

Source : Country Profiles Annex

Legend: BC : Beauty Contest, FOC : Free of Charge, MBM : Licensing mux by mux, SBS : Licensing service by service, P : Licensing of a unique platform operator for DTT, Pay : private operators have to pay a direct license fee

All European countries have selected allocation by 'Beauty Contest' up to now. In contrast, the principle of paying for the spectrum for television is a criterion which differentiates 5 countries (United Kingdom, Spain, Greece, Finland and Ireland) out of the 15. Furthermore, the allocation of a licence service by service is relatively under-represented relative to the allocation of licences by multiplex or by platform.

3.5.2.3 Planning of transition in the main countries:

Some countries (the United Kingdom, Italy and Germany) have published a migration plan which analyses and justifies their choice of spectral planning in terms of broadcasting.

- Italy : Il Libro Bianco Sulla La Televisione Digitale Terrestre (http://www.agcom.it)
- Germany : Startszenario 2000 - Aufbruch in eine neue Hörfunk- und Fernsehwelt
  (Dokumentation 481, September 2000), http://www.bmwi.de
- United Kingdom: Digital TV Action Plan, http://www.digitaltv.culture.gov.uk/.[69]

These migration plans describe the different tasks to be undertaken, the time frame for their implementation and the responsibilities borne by the various players in terms of spectrum in particular.

[69] We can also cite the " Independent Review of Radio Spectrum Management" carried out by Prof. Martin Cave for the Department of Trade and Industry and which is not limited to broadcasting. Available at http://www.spectrumreview.radio.gov.uk/.

This 'project management' type of approach is interesting for the players in the countries considered as it obliges them to take account of spectrum optimisation and its long-term management, but is also interesting at European level as this **transparency facilitate the planning of frequency plans and their co-ordination** over time.

3.5.3 Spectral problems which are specific to the simulcast

The following sections deal with questions which are specific to the simulcast and terrestrial broadcasting, again vis-à-vis spectral management efficiency and its economic consequences in terms of competition, in particular concerning sharing access to the spectrum in view of general interests.

3.5.3.1 Interference at borders

Within the framework of the 1961 Stockholm agreement procedure, analogue terrestrial broadcasting reached a balance in terms of interference by iterations and bilateral agreements in border broadcasting zones. In this context, each country makes efforts to broadcast its programmes in its territory while minimising interference for neighbouring countries. Consultation is organised around this idea of limiting the level of interference.

In the digital terrestrial broadcasting simulcast period, this balance risks being challenged as new frequencies have to be exploited. For example, the south of England cannot be covered correctly by digital broadcasting due to interference caused by analogue broadcasting in France.

Scarcity of frequencies during simulcast will be most critical for digital terrestrial broadcasting at borders. **The most difficult situation would be to have 3 (or more) bordering countries broadcasting analogue and digital television for portable or mobile services** (e.g. the borders of Germany/Belgium/the Netherlands). Moreover, this is one of the reasons why these countries have developed cable platforms.

This constraint has repercussions on local but also global planning for frequencies or services available to users, depending on the means used. Possible solutions may involve:

- limiting the number of multiplexes (and therefore of programmes) ;
- delaying deployment until the neighbouring country has migrated itself;
- reducing the power of existing transmitters (and therefore reducing the coverage) ;

- deploying a complementary network of small transmitters rather than broadcasting from a powerful site (and therefore increasing costs);
- using smart antennas (difficult for portability);
- deploying alternative networks (cable or satellite) ;
- using possibly remaining military bands to increase the range of frequencies on offer.

The case of Germany, which occupies a central location in Europe, appears to be particularly complex as the different Länder (which intervene directly in spectrum planning) have to agree among themselves, with the federal level and negotiate with bordering countries. Deployment of portable or mobile services would increase the difficulty as these services transmit at stronger powers. The chain reaction from different strata and administrative time-frames may propagate (positively or negatively) to neighbouring countries. Thus, it is noted that Denmark wishes to know its neighbour's situation exactly so that it can organise its deployment. As regards this point, the turn-off of analogue broadcasting planned for 2010 in Germany reduces the uncertainty.

The schedules for digital terrestrial television, launched independently by the different Member States may therefore be delayed by the last migrant country. **A minimum of European co-ordination concerning timing and the levels of broadcasting power seems to be necessary** on this point, while an overview is maintained. Otherwise, migration by countries should at least take account of possible delays or alternative accesses due to this 'border effect'.

The case of new entrant countries

Terrestrial planning in the new entrant countries is often constrained by additional factors: the presence of enclave countries which are thus subject to a range of interference from various neighbouring countries and 2 military communication systems (former Warsaw Pact frequencies now used nationally and new NATO frequencies) using the VHF and UHF bands. For these different reasons, the VHF band is more used in these countries than in the current European Union. It is also noted that cable and satellite accesses have become the majority form of access. For example, Hungary envisages introducing only 2 digital multiplexes during its simulcast period according to the Hungarian broadcaster MTV and some national programmes have already been placed on satellite to release the terrestrial spectrum.

More generally, **questions can be raised concerning the economic relevance of introducing DVB-T in these countries** in view of these constraints and the resources available.

3.5.3.2 Trade-off between picture quality and number of programmes

With the help of multiplexing, digital broadcasting makes it possible to assemble a certain number of programmes on an 8 MHz broadcasting channel with a 20 to 24 Mbit/s bitrate. With current screen definition, a digital programme requires between 2 and 6 Mbit/s at consumer level according to the current state of the art (MPEG 2 compression) and the type of programme (films, cartoons, picture definition, etc.).

Assignment of the different streams (audio, video and data) in real time can be optimised by use of statistical multiplexing (VBR : variable bit rate[70]). This permits the possibility of inserting an extra programme per multiplex for the consumer.

A **surplus of this type can be used for purposes other than increasing the number of programmes** such as enhancing the picture and sound quality (e.g. High Definition TV, HDTV) to broadcast films or sports programmes. Moreover, it is noted that high definition, which seems to interest some consumers (particularly the most averse to multichannel), is not attracting sufficient interest on the part of the players concerned, who have not supported the appearance of a uniform improved screen definition format up to now. However, there is a need to avoid a 'spectrum freeze', as shown by the United States case, where the incumbents sought and obtained bandwidth to launch HDTV, although admittedly it has not been implemented. Some American analysts explain this by the incumbents' interest in capturing a large section of the spectrum which is potentially releasable by digitisation, which reduces the possible competition accordingly.

This picture quality/number of programmes compromise is decided either by the multiplex operator if the licence is allocated by multiplex or by the regulator if the licence is allocated by programme/service.

- In the first case, it will be up to content providers and publishers to be attentive to the broadcasting quality of their pictures and sounds within the framework of their private agreements with multiplex operators. Moreover, it can be noted that the 'Universal Service'

  Directive takes account of this qualitative dimension (e.g. Article 11)[71]. Regular open publication of quality indicators, as happens with mobile services, would make it possible to encourage the quality of the pictures and sounds. A measure of this nature would be even more efficient if it encompassed all of satellite, cable and terrestrial accesses by geographical zone and operator.

---

[70] VBR uses statistical multiplexing (time-based optimisation bitrate among programme stream) whereas with Constant Bit Rate (CBR) the bitrate remain constant even if all of the bandwidth is not being used.

[71] Directive on Universal service and users' rights relating to electronic communications networks and services. Article 11, Quality of service provided by the designated companies.
(http://europa.eu.int/information_society/topics/telecoms/regulatory/new_rf/documents/2000_0183_fr.pdf).

- In the second case (licence per services), this minimum level will be appreciated directly by the regulator.

It should be remembered that general use of **statistical multiplexing** and encouragement to improve **coding and compression performances** would permit a gain in productivity equivalent to at least one channel per multiplex.

3.6 Spectrum management after ATO : frequency release and refarming

Taking a long-term perspective, i.e. after the simulcast period, whose stakes have been described previously, one of the benefits of digitisation is the release of spectral bands while at least retaining current applications.

How much bandwidth could be freed and to do what? Could the choice of migration compromise the releasable spectral band? These questions are dealt with in this section.

3.6.1 Quantity of bandwidth which is theoretically releasable

It should be recalled that analogue broadcasting has 49 channels of 8 MHz available in the UHF band (i.e. 392 MHz). 9 channels are needed to broadcast a programme at *national* level, which *theoretically* allows broadcasting of an average of 5.4 programmes (5 in practice). Each programme therefore consumes 392/5.4 = 72 MHz.

In the simplest case, if these same 5 programmes were broadcast digitally, they would fit on a single multiplex and would need 48 MHz with MFN planning. The possible gain would therefore be 392 – 48 = 344 MHz, which represents a considerable potential which requires optimum spectrum management according to the economic efficiency principles described above.

Estimating the quantity of spectrum which is releasable over time precisely *(by country*) remains a difficult exercise as which involves in numerous technical parameters (type of modulation, safeguard intervals, etc.) as DVB-T allows many variants and European countries are in different situations. However, it is a useful exercise in the sense that it is independent of players' immediate interests.

The CEPT-EBU (*European Broadcasting Union*, which brings together a large number of European public broadcasters) has carried out a theoretical study of this quantification[72]. This study quantifies the number of 8 MHz channels needed to broadcast an MFN or SFN multiplex digitally for a defined territory.

We have taken 3 results (set out in the Annex) from this technical study which correspond to the main cases encountered.

Case n° 1: MFN broadcast transmission with fixed reception (rooftop antenna). By inserting 6 multiplexes during the simulcast (British and French cases), it will be possible to deploy 2 other muxes after the analogue turn-off, i.e. the equivalent of 2*48 MHz = 96MHz.

Case n° 2: portable MFN broadcasting (indoor antenna)

15 channels are needed to broadcast a multiplex with a portability option nationally. In these conditions, 3 multiplexes would use up the entire UHF band. Choosing this option during migration would reduce the releasable bandwidth to zero.

Case n° 3: SFN digital broadcasting with a rooftop antenna or an indoor antenna.

3 channels are needed (4 for indoor portability) for an SFN national multiplex and 16 multiplexes are possible on the UHF band. With 6 multiplexes broadcast during the simulcast, 248 MHz would be available at turn-off.

From these typical cases, it can be deduced that:

- a priori there is a **major potential for possibly releasable bands** (several hundreds of MHz) ;
- there is **no single answer to the question of the quantity of releasable bandwidth** over time as the situation differs in each of the countries concerned;
- in particular, the choices made for the simulcast will determine the quantity of releasable spectrum over time, which in certain cases may amount to zero.

[72] Report from ad-hoc group EBU B/CAI-FM24, March. 2001.

The lack of homogeneity in national migration plans a priori reduces the possibility of isolating the same frequency band throughout all European countries at the same time, which reduces the possibility of developing European services and reduces scale effects for terminals, which limits the interest for applications other than television.

Release of a band of this type at European level could justify public intervention.

3.6.2 How should the released bands be used?

3.6.2.1 Demand from mobile operators

The central UMTS band (1.9 GHz to 2.2 GHz) was adopted by European administrations via an ERC/DEC(97)07 decision reached by CEPT.

A re-evaluation of the need for frequencies, undertaken by the UMTS Forum in March 1999[73] estimated that extra blocks would be needed by 2010. In practice, a total of 582 MHz would be necessary by 2010 (403 MHz before 2005), of which 155 MHz have been reserved since 1997 and 240 MHz of GSM bandwidth will be re-used. 187 MHz therefore remains to be found.

The future UMTS operators are looking for continuous blocks of 40 MHz[74] which are as close to the central band as possible. These bands must also be identical at European or global level to economies of scale for terminal manufacture.

In the 470-806 band (UHF), the UMTS Forum sees a possibility of recovering a 40 MHz block thanks to the partial release of the TV band with its digital migration, and another with releases from military use at the top end of the UHF band. This is therefore an interesting band, as it is adjacent to GSM (880-915 and 925-960 MHz). However, the Forum notes that there is no guarantee of the simultaneous availability of these 2*40 MHz throughout European territory.

Yet, the band sought as a priority by the UMTS Forum is not the UHF band: it is the 2520-2670 MHz band, as this is still little used in Europe. This is a higher frequency which is favourable for high-traffic local communications, the band is wide (150 MHz) and there is less uncertainty about the possibility of using this band than with the UHF band.

This point of view has been confirmed by operators' interviews and conferences and by frequency agencies. European operators actually have the majority of bandwidth needed, are heavily indebted and therefore **do not have reasons for acquiring UHF spectrum** for many years to come.

---

[73] Report n°7 on candidate extension bands for UMTS/IMT-2000 terrestrial component, 2nd edition published in March 1999.

[74] A UMTS duplex (or two-way) channel is 10 MHz wide.

3.6.2.2 The hypothesis of convergence by UMTS-DVB networks and services

Some hypotheses for convergence between UMTS and DVB-T networks are envisaged by certain (essentially DVB) players.

In this possible convergence, 3 technical and economic elements have to be taken into account:

- the broadcasting function is native to UMTS like DVB via the *UMTS Terrestrial Radio Access* (UTRA) radio interface and its *Time Division Duplex* (TDD) mode for asymmetrical services (typical of broadcasting). The UTRA interface also has a *Frequency Division Duplex (*FDD) mode for symmetrical services (e.g. communications). It is therefore possible to supply broadcast services in UMTS without an added investment.
- UMTS will have to be compatible with GSM to lead GSM subscribers to migrate to the new services on offer. This assumes the development of bi-mode terminals and compatible infrastructure. This will increase the cost of terminals. The fact of adding a DVB card will increase the cost of the terminal and at present, mobile telephony operators are indicating that they are not prepared to pay this added cost which is not at the heart of their concerns. However, this added cost could be borne by Pay TV operators.
- The advantage of DVB broadcasting over UMTS broadcasting is the throughput per user: some hundreds of kbits/s for UMTS and several Mbit/s for DVB. This advantage is reduced by the size and definition of UMTS terminal screens, improved compression algorithms and the fact that DVB is not a native IP technology, which assumes the development of gateways with IP networks and creates architectural and added cost problems, for example. Nonetheless, DVB is currently working on this question.

In the perspective of offering new multimedia services, a mobile telephony operator will certainly be interested in broadcasting content negotiated with publishers or channels on the UMTS network in TDD mode, but this would not require the use of DVB networks and would not have an impact on the cost of receivers.

3.6.2.3 The other possible demands

It may be noted that the organisation Digitag, which essentially represents terrestrial digital TV interests, has carried out a study which indicates that the drivers for a take off by digital terrestrial TV will be (ranked in order): new services, portability, interactivity, wide screens (16:9) and picture quality (results highlighted at the *International Broadcasting Conference* 2001 by the BBC Technology Department, September 2001).

This suggests using the spectrum according to this hierarchy if there is a priori arbitration in favour of digital terrestrial broadcasting of audiovisual services.

But in the absence of an economic identification of spectrum demands (**mechanism to reveal supply and demand**), reuse hypotheses are issued by players according to their viewpoint or interest, e.g. to

- introduce new TV programmes for fixed-line reception and in particular a trade-off between national, regional and local programmes;
- redistribute a section of the spectrum allocated to digital radio among the different systems proposed (T-DAB vs. DVB-T trade-off in Band III) ;
- increase the geographical coverage achieved by terrestrial television broadcasting;
- develop DVB portability;
- develop mobility for TV reception;
- introduce a terrestrial return channel for interactive TV applications;
- improve picture and sound quality (e.g. High Definition TV) ;
- introduce new broadband services (non audiovisual) : Internet radio access, WLL (wireless local loop) on the UHF band, etc.
- fully develop and digitise professional and public applications;
- develop local radio services
- etc.

These choices will be linked to the initial migration choice in each of the Member States and will depend on several technological, economic and social factors including new elements which may appear in a few years' time. Making a general forecast would therefore not make much sense.

However, all of these opportunities suggest that it is the **value revelation mechanisms and the band allocation mechanism (in particular, concerning re-allocation among established and new holders of spectrum rights) which will make it possible to obtain the flexibility necessary to achieve the economic optimum**. Using a mechanism based on economic options theory may be a path for exploring this (see §. The relative scarcity of the spectrum).

4. Public Policy

4.1 Synthesis

1. After having studied the mechanisms (drivers and obstacles) and the strategies of market players in digital migration, and after having examined the spectrum management stakes, this chapter aims at analysing the public policies that are implemented throughout Europe in relation to DTV migration and spectrum management. This chapter describes the objectives and the policy measures that are undertaken, assesses the pros and cons of these measures, envisages which other possible measures could be carried out. Two significant policy choices, on infrastructure and on regulation/timing, are then examined through a quantified cost-benefit analysis.
2. **5 categories of general interest objectives motivate public intervention during the migration** : cultural objectives, social inclusion, competition, innovation and industrial competitiveness and efficient, efficient spectrum management.
3. In some countries public authorities have a special agenda concerning digital terrestrial television. This particular focus is first justified by their responsibility in spectrum management, which is a scarce, public resource. It also derives from the still dominant position of terrestrial reception in a number of countries. Besides, even in other countries, where main sets are mostly connected to satellite TV or cable, terrestrial reception is often used for secondary and tertiary sets in the home.
4. In some cases, though, there might be other motivations for public intervention. For instance, policymakers might be tempted to regulate market forces action so as to maintain the current analogue « reception mix »[75] in the future. In particular this could help to maintain the role of terrestrial broadcasting, just because national regulation of services or contents appears to be easier to implement in the context of a national territorial infrastructure (notably compared to satellite). Such an approach to regulation could be considered a “bureaucratic failure” (public authorities acting not only as neutral regulators but trying to maintaining unchanged their *own* regulatory control over markets, or the position of State-owned companies).
5. We think the differences in national policies come from three main factors : (i) national trade-offs between the different above-mentioned categories of general interest objectives (which sometimes cannot all be achieved simultaneously), (ii) the national TV context (notably the reception mix and the situation of competition), and (iii) the influence of the different national players.

[75] We call « reception mix » the national breakdown of TV accesses between cable, satellite (DTH and SMATV) and terrestrial reception.

6. Focusing on DTT, we observe that among the four technical benefits that can be brought by this technology (more TV channels transmitted in the same bandwidth, less spectrum used, improved picture and sound quality, indoor reception), most European governments have designed their licensing schemes so as to encourage the first one (more channels). However, other structures are and will be possible for DTT, especially after analogue turn-off when new decisions will need to be taken. In the long term, depending on market forces and policy choices on TV and spectrum, terrestrial broadcasting could deliver highly multichannel TV (like satellite and digital cable), or low multichannel TV (like today's DTT), or even focus on niche markets/uses (universal, possibly indoor reception, of public-service channels).

   Focusing on cable we can make some specific considerations.

   Market forces can drive the switchover of cable households to a large extent. We believe, however, that the switchover completion will not be universal under market forces alone, because cable operators won't subsidise digital STBs to low-ARPU households.

7. A non-universal digital penetration in cable may appear less detrimental than in terrestrial, considering that analogue cable subscribers can often access basic subscription multichannel. But if policymakers want digital reception to be really universal some policy options can be envisaged to complete the digitisation of cabled homes.

8. Among this measures, the incentives on consumers to buy STBs should be extended to cable STB. Encouraging indoor DTT reception and fighting undue restrictions on terrestrial and satellite reception would help basic analogue cable subscribers to access free-to-air digital delivery mechanisms if they wish. Besides, it would put competition pressure on cable operators, so that they might be more likely to make "digital propositions" to even low-ARPU households.

9. The roll-out of DTT could harm the cable economy in two ways that could require public authorities' intervention : the risks of interferences on existing cable systems ; the risk that new free-to-air channels on DTT might increase the must-carry obligations on cable operators.

10. There is a dilemma between two general interest objectives. If not co-ordinated, broadband and DTV policies could interfere. Pushing digital TV (including on cable) in the short term, prematurely and under heavy regulation, might discourage investors from rolling-out broadband networks and services, and finally jeopardize the long term development of the information society. However, the opposite could be also true: Concentrating the information society solely on broadband could jeopardise universal access to the information society, as broadband access is more expensive (than narrow band) and therefore less affordable.

    In the framework of the migration towards an all-digital television, two important choices must be made by national policymakers : a choice of infrastructure and a choice of timing.

11. First a choice of infrastructure. With the digitisation of all delivery mechanisms and convergence, capacity scarcity is lower. This raises the question of the role of each delivery mechanism in the future. As they are responsible for spectrum management, Governments and independent regulators will have to decide to what extent the frequency bands currently used for terrestrial broadcasting should continue to be used, exclusively, for television.
12. Should they encourage a migration towards an all-digital world that would use only cable and satellite (which would mean not roll-out DTT systematically)? Indeed cable and satellite are already being digitised by market forces, and are used by TV players which have already identified potentially sustainable business models. We call this scenario the "cabsat way".
13. Should they, on the contrary, deliver DTT licences to market players and thus encourage them to invest in the digitisation of terrestrial broadcasting, with a mid to long-term perspective of keeping the three delivery mechanisms for television ? We call this scenario the « **triple way »**.
14. **We have examined the pros and cons, the specific costs and benefits attached to these scenarios** and policy options in the long term : (i) costs of the roll-out of DTT, (ii) costs of converting analogue terrestrial homes to cable or satellite reception, (iii) spectral "opportunity cost" of keeping all of the VHF/UHF band used exclusively and free-of-charge for television (rather than refarming it to perhaps more economically efficient utilisations), (iv) "competition cost" if TV players have only two delivery mechanisms at their disposal instead of three.
15. We have built quantitative models in order to test, simulate and compare the overall costs of the two scenarios in diverse market configurations. One conclusion is that the most decisive factors impacting the result (and therefore indicating the optimal choice) are : (i) the existing TV landscape and reception mix, (ii) the technical choice for DTT (number of multiplexes, coverage, …) and (iii) the assumptions made on the valuation of potentially "releasable" frequencies.

Governments then have to make some decisions over <u>regulation of the process</u> and the <u>timing of the migration</u>.

16. Should policymakers regulate markets with a view to accelerating the migration process (and if yes to what extent and how?), or should they let market forces act under existing regulation ? An acceleration of the process would of course **allow states to enjoy benefits expected from the digital migration more rapidly**.
17. Among these expected benefits, some are the consequence of the **turn-on** of digital broadcasting and the **switchover** to digital reception : (i) economic growth due to the new digital services, (ii) costs decrease and lower entry barriers resulting in increased competition.

18. Other types of expected benefits specifically derive from the **completion of the reception switchover** (resulting in a universal access to digital television) and from the **analogue turn-off** that becomes possible at that moment : (i) transmission savings (no more analogue broadcasting), (ii) possible release and refarming of some "terrestrial" frequencies for other uses, and (iii) prevention of the risks of "digital divide" [76].

19. When regulating the markets in order to encourage market forces to make earlier investments, to achieve a faster migration, **policymakers increase the global, macro-economical cost of the migration** for the countries. First the investment in digital reception will be higher for two reasons : (i) immaturity costs (The price of digital equipments is expected to go down with time, so acquiring devices today is more costly), (ii) financial costs (the general opportunity of earlier investments). Secondly, new public intervention on markets create risks of competition distortion, market forces inhibition and moral hazard effects which could make the new regulation counter-productive.

20. Therefore we have built a model that enable us to compare the additional cost, for the country, of an earlier investment, and the benefit of achieving earlier the final expected benefits (e.g. additional years of transmission savings and economic benefit from frequency release). The most sensitive variables of this model appears to be, again, the initial reception mix and the hypothesis on spectrum valuation.

21. For example, we based a simulation on an imaginary country with 23 million households and 70% of analogue households, with a spectrum valuation hypothesis at 0.05 euros per Mhz per year per inhabitant. The result shows that it would be macro-economically beneficial to have a complete switchover and a turn-off after 3 to 4 years, rather than after 10 years (which would be the hypothetical duration *without* special public intervention). If the Mhz was valued at 0 instead of 0.05, the positive result would become insignificant.

22. This "platform-neutral" approach is somewhat paradoxical and theoretical in some national contexts because we assume a national investment to convert *all* households to digital, whereas the main benefits that we are able to quantify result from the conversion of analogue *terrestrial* households (transmission savings and spectrum efficiency gains). Indeed, we do not have to assume the switchover completed for *all* delivery mechanisms, to reach these benefits ; it would be enough to encourage terrestrial switchover and turn-off as a first step. But then the risks of competition distortion would of course be much higher.

23. Up to now we have examined the economic rationale of a policy *objective* that would be to encourage a faster migration, but we have not made special assumptions concerning the regulatory tools policymakers could or should use to incentivise market players. Now we have to go through the range of policy measures that can be envisaged, whether or not they are *actually* envisaged or have been implemented by policymakers today, and assess their efficiency and relevance. These incentive measures can apply to various players :

[76] The mere introduction of digital television does not solve the so-called « digital divide » risk. By contrast, a *completed* digital switchover, which corresponds in timing with an analogue turn-off, entails universal digital TV for all, which is supposed to help the « digital divide »if information society applications through are developed.

- Consumers (TV viewers), e.g. : discounts on taxes or licence fees for compensating the migration cost (digital equipment), information campaigns.
- Manufacturers and retailers of consumer electronics products, e.g. : prohibition to market purely analogue receivers (“mandatory digital tuner”), re-enforced labelling obligations (about digital compatibility).
- Television players e.g. : taxation of spectrum use (in order to create an incentive on them to go digital and turn-off analogue)
- Other potential frequency users, e.g. : make them reveal their willingness to use potentially “releasable” frequencies, so as to measure the potential spectrum benefit and, perhaps, make them contribute to bear the cost of a faster switchover
- Lastly, a public action plan indicating the time-frame and framework of the global migration would provide all involved players with common knowledge, enabling them to co-ordinate their expectations and investment cycles, optimise their switchover costs and accelerate the whole process.

We have assessed the pros and cons of some of these measures in greater detail.

24. Although theoretically efficient, a public announcement, timeframe and framework for the migration should remain credible, flexible, indicative rather than compulsory, platform-neutral and not too premature, in order to avoid detrimental and counter-productive effects.
25. The « mandatory digital tuner » measure would of course be effective by automatically converting households when they renew their reception equipment. However we think market forces could be almost as effective, through, for instance, low-cost sell-through converters.
26. On the whole, the justification for of such a measure would depend on (i) the potential of market forces (market forecast for digital pay TV and digital converters) and (ii) the policy assessment of some factors that cannot be quantified, like the risk that such a measure might favour the currently dominant platforms and the free-to-air business models, and thus harm other delivery mechanisms and the pay TV market.
27. The risks of market distortion would be even higher if policymakers considered heavier obligations than strict “digital tuner”, including, for example, APIs or conditional access modules, with greater impact on costs and prices.

4.2 Introduction : the stakes as regards regulating migration

In the framework of the migration towards an all-digital television, public authorities (Governments and independent regulators) should regulate with a view to optimising the process. They have to regulate market forces so that clearly-defined general interests are taken into account, while the possible perverse effects caused by ex ante regulation are minimised. In particular, they have to :

- Maximise the economic and social benefits for the country that can be expected from the digital migration
- Restrict, whenever possible, public intervention to eliminate situations of "market failure" and minimise the risks of competition distortion, business inhibition or moral hazard that are generated by ex ante regulation on market forces action.
- Take account of the European dimension of the markets and of spectrum management, and apply the regulatory principles set in the EU Directives on the new regulatory framework for electronic communication networks[77].

4.3 Why regulate the migration ?

4.3.1 General interests related to the digitisation of television

We have identified five categories of general interest objectives that traditionally justify the regulation of television services and transmission services. *Digital* television changes the perspective on these five aspects.

- **Culture and diversity**. In the analogue environment, characterised by scarcity, it appeared necessary to make sure that consumers-citizens could access some contents that markets forces would perhaps not have provided spontaneously. This was and is still achieved through content obligations imposed on those who receive licences to use radio frequencies or cable networks (programming, production), and through "must carry" obligations imposed on cable operators. In a digital environment, though there is much less scarcity, public authorities still have these cultural objectives high on their agendas.

[77] See Introduction.

- **Social cohesion, democracy and the information society**. Television is a universal and powerful medium. National policymakers are aware of its role in the creation and the dissemination of common knowledge and common values in society. Besides, in "terrestrial countries" where free-to-air analogue television has for long been limited to three or four channels, policymakers see digital television as an opportunity to "democratise" the access to multichannel television.

  And, lastly, the combination of digital television and return-path channels, which enables people to access interactive services, is seen as an opportunity for driving the information society and preventing a "digital divide" (while the access to PC-based internet seems to be of limited potential) [78]

- **Competition and consumer's interests**. By reducing transmission costs thanks to compression, digitisation increases the capacity of networks and puts entry barriers lower. Therefore it increases the contestability of all television markets : free-to-air television, pay television, channel publishing, transmission services. Increased competition could reduce vertical integration in the value chain and place consumers and content providers in a better bargaining position vis-à-vis television operators. At the same time, it is necessary to monitor the emergence of potential new limitations to competition due to new technological bottlenecks and gateways (APIs, EPGs, CAS).

- **Innovation, competitiveness and economic growth**. National and European public authorities emphasise the importance of information technologies for economic growth, employment, and the competitiveness of European industries in the world. The European advance in digital television (in terms of market development and technological development) is viewed as a strategic asset for Europe. At national and European levels, digital television is regarded as a important component of the "digital economy" as a whole[79].

- **Spectrum management**. Digitisation of contents and of the signal are increasing the technical efficiency of radio frequencies. As it is of general interest to optimise the economic and social use of this scarce, public resource, national Governments, as spectrum managers, must encourage extensive use of this technology.

---

[78] To clarify the notion and the issue, it is useful to differentiate between two factors. These are (i) the effects of the information « divide » which results from social inequalities (and also applies in access to higher education for example), and (ii) the effects due to the immaturity of a technology, which leads to limited technical availability and partial penetration because of high price. The *second* cause of « divide », or « non-universal access », is bound to soften with time, under technological maturation and market forces action, while the *first* cause remains. Therefore only the *latter* cause requires specific regulation ; and this regulation should not be premature and universal, but occur in due time and be perhaps targeted towards low-income groups rather than being generalised measures.

[79] See the British plan « Digital UK » for instance (http://www.digitaltelevision.gov.uk/pdfs/draft_digital_TV_action_plan.pdf).

4.3.2 General interests related to the digitisation of *terrestrial* television

Some objective technical features of terrestrial transmission and some legitimate general interest objectives justify public authorities devoting special attention to terrestrial television in the global framework of the digital migration :

i. Contrary to cable television and satellite transmission, terrestrial transmission use publicly-owned Hertzian radio-frequencies which could technically be devoted to *other* uses, and whose utilisation must therefore be optimised in the general interest.

ii. Contrary to cable television and satellite transmission, which require wired connection to an existing network or a roof-top satellite dish, digital terrestrial transmission allows for indoor reception (in some circumstances) with small set-top aerials. This reception mode is relatively cheap and independent of housing conditions, and thus appears to be convenient to envisage the digitisation of *secondary* sets.

Some observers, however, fear that some objectives other than these official ones might interfere in policymakers' decisions ("hidden agendas"). In traditionally "terrestrial" countries, there might be a wish to maintain the prominent role terrestrial broadcasting played in analogue television into the digital era. This could occur for two types of reasons :

i. Because they operate at national level and through territorial facilities, because they need national licences to use radio-frequencies, channels transmitted through terrestrial broadcasting are easier to regulate at national level than, say, the channels that would be broadcast by satellite or cable only.

ii. Policymakers could be tempted to try to help public organisations (State-owned terrestrial network operators, public-service broadcasters) to maintain their competition position - which was traditionally dominant in the analogue terrestrial environment - into the digital future.

Such motives for public policy, if they existed, could be regarded as « bureaucratic failures »[80].

[80] When public authorities, in a given decision, might not only act as neutral regulators of market forces but also try to maintain their own existence or interests as entities, we talk about a « Bureaucratic failure » or « Government failure » situation.

Some observers indeed suspect hidden agendas in favour of terrestrial broadcasting because the two legitimate reasons mentioned above (spectrum efficiency and indoor reception) do not really seem to drive public intervention in most EU Member States.

Although there are theoretical economic benefits to expect[81] from increased spectrum availability thanks to terrestrial broadcasting and analogue turn-off, only a few European Governments have really emphasised the spectral stakes in their digital television policy.

British authorities, for one, have clearly stated that the promotion of spectrum management efficiency was one of the general interest objectives behind the digital migration[82]. Besides if spectrum management had been really prominent in the digital television policy, Government should have more actively raised the issue of maintaining or not the exclusive use of the VHF/UHF bands for television broadcasting.

Much more than spectrum management efficiency, consumer benefits are put forward as a justification of the terrestrial policy. But then among them, the most specific one, i.e. indoor reception, is almost never stated as a priority.

In most **"terrestrial" countries**, Governments have made technical choices aiming at granting as many licences as possible, considering that multi-channel is the main driver for a delivery mechanism. However, multi-channel television is also available through the two other delivery mechanisms, and, in the case of satellite, some multichannel television is accessible free-to-air. If the "democratisation" of free-to-air multi-channel television had been the major consideration, policymakers could also have fought the undue restrictions put on the use of satellite dishes more actively. There remains the specific consumer benefit of being able to access a multi-channel offering with *low migration costs* thanks to re-use of existing reception facilities in most cases. The specific benefit is thus not related to a specific feature of DTT per se, but derives from the *existing* prominent position of terrestrial reception on the *analogue* market.

In some **cable countries,** like the Netherlands, the main objective is to open the market for delivery mechanisms. In these countries, most consumers do not have an actual choice as regards the delivery mechanism ; cable is in a near monopolistic situation, at least for main sets, and there are no longer roof-top aerials in many cases.

---

[81] See Spectrum Chapter.

[82] "The objective for the Government is to ensure the most efficient use of the spectrum. This means ensuring that sufficient spectrum is allocated to DTT, while enabling some of the UHF spectrum currently allocated to broadcasting to be re-used." (Joint DCMS/DTI answer to BIPE/DGIS questionnaire).

Then indoor reception for DTT is not an objective per se, but simply a sine qua non condition to enable consumers to access DTT. The final goal is to put consumers and broadcasters in a better vertical position vis-à-vis cable operators, to increase competition and push prices down.

Figure 36 : Specific advantages of DTV platforms as information services vehicles

	Access	Bandwidth	Interactivity
Terrestrial	Potentially universal (at exponential cost)	Narrow	Mainly modem return-path (could be ADSL modems in covered areas). Download/upload symmetric (two-way) technologies seem far from affordable.
Satellite	Universal at flat cost (but some reception restrictions)	Narrow or broadband	
DSL	Only economical in high-medium density population areas	Broadband	Two-way broadband (but limited interest for point-to-multipoint)
Cable	In passed areas (economical in high-medium density population areas)	Broadband	Two-way broadband (built-in return path)

Source : BIPE

4.4 Switchover policy options across the EU

4.4.1 Policymakers' motivations

Ways of regulating the digital migration in various EU countries are mainly determined by three factors.

- The national **policy trade-off** (or compromise) between the different categories of objectives mentioned above, such as digital democracy, competition or spectrum efficiency, as well as between short-term and long-term views. For instance in terrestrial countries there is a dilemma/trade-off between consumers interests in the short term (to minimise conversion costs, by favouring a switchover via the existing infrastructure) and the country's interest in the long term (to maximise spectrum efficiency by dedicating spectrum capacity use to services that can take the strongest economic utility from it).
- The existing **reception mix** of a given country.
- The **influence** exercise by various interest groups involved.

4.4.2 The policy options : infrastructure and regulation/timing

There are several policy options to go digital, as regards infrastructure.

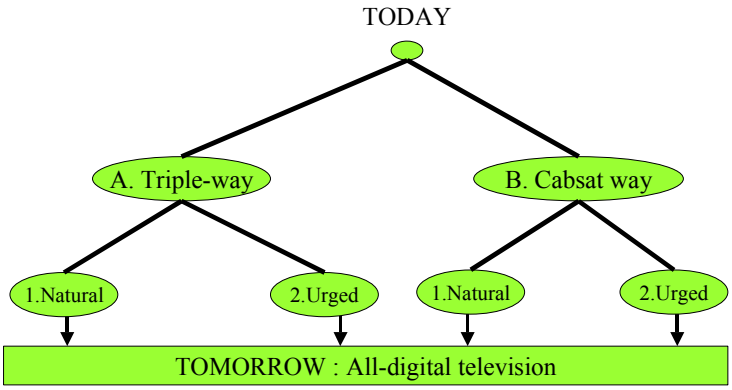
A first policy, that we call **the « triple way »,** involves digitisation of terrestrial broadcasting as well as other delivery mechanisms. Indeed while the digitisation of cable systems and satellite is driven by market forces to a large extent, the digitisation of terrestrial broadcasting depends upon a policy decision, were it only because Governments have to license digital broadcasters for the use of frequencies. This policy A is the way chosen by most EU Governments.

There is nonetheless an alternative policy option that we call the **« cabsat way »** in which the migration to an all-digital television would not encompass terrestrial broadcasting. Analogue terrestrial receivers would be migrated towards digital cable or digital satellite, i.e. two delivery mechanisms that are often *already* digitised, and will be fully digitised in the mid to long term anyway, under market forces action. Indeed, satellite transponders can almost carry television signals in analogue or digital mode indifferently, and the switch to digital does not represent an important additional investment. As for cable systems, most of them are being upgraded so as to become “broadband” networks and to be able to support high-speed internet, video on demand, and, of course digital television. Therefore there is a market-driven scenario in which consumers who seek multichannel television or digital television would progressively migrate to digital DTH or digital cable, without the need to roll-out DTT. After the reception switchover is complete, analogue terrestrial broadcasting could simply be turned-off and abandoned.

If now we suppose that the infrastructure decision has been made, there is another policy choice concerning the **timing and level of regulation of the migration**. What are the pros and cons, costs and benefits involved in a regulation that would aim at accelerating the pace of the migration ? What are the respective advantages of a market-driven-only “natural” scenario (1) and of an urged policy-driven, scenario (2) ?

The **infrastructure alternative** (triple way vs. cabsat way), and the **timing/regulation alternative** (“natural” vs. “urged’), are analysed in a cost-benefit approach later in this chapter.

Figure 37 : The decision tree for policy options for the digital migration (choices of infrastructure and regulation/timing)



4.4.3 What type of terrestrial television in the long term ?

4.4.3.1 Policy and technical considerations

To date, most European Governments have chosen the « triple way » option, even in countries where terrestrial reception is today marginal in terms of analogue reception market share. There is still nonetheless the question of the role of terrestrial broadcasting in the future all-digital world, i.e. *after* analogue turn-offs.

Because terrestrial broadcasting uses spectrum capacity, we have to focus on the future of terrestrial broadcasting in a study on spectrum and television.

There are **several possible visions for the future of terrestrial television**, which are differentiated notably by : (i) the number of channels which will be carried, and (ii) the national coverage of the broadcasting (which is today nearly universal in analogue).

After the analogue era in which 3 to 6 channels were carried, and the transition period in which 30 to 40 additional channels can be transmitted in digital, the first parameter (number of channels) could take several “values” in the future.

1. **No terrestrial channels** at all, in the “cabsat way” scenario.
2. A **basic, “universal-service” DTT**, which would broadcast throughout the territory the public-service channels and perhaps the main commercial channels that have an analogue licence today. Such a situation could for instance result from a regulatory environment in which all commercial users would have to bid for access to frequencies and in which, therefore, only *major* terrestrial broadcasters would be ready to “pay the price” to stay “triple way”.

3. A **low multichannel DTT**[83], with 5 to 6 multiplexes carrying 30 to 40 channels would make DTT a delivery mechanism similar in capacity to today's basic analogue cable, but with limited attractiveness as a medium for pay television. In this scenario and the previous one, after turn-off of the analogue channels, more or less significant portions of the UHF band can be re-allocated and refarmed to other radio services (e.g. mobile telephony).
4. A **highly multichannel DTT**. After analogue turn-off, replanning and a switch to SFN instead of MFN, it would be theoretically possible to broadcast up to 300 channels (fixed reception mode) in the current UHF-broadcast band. This would make DTT a platform as attractive as cable or DTH in terms of channel supply.

Though Governments have not expressed so far a clear vision of what the long-term of DTT might be or should be (and indeed it may be too early to decide), the current DTT positioning in the transition period might globally remain unchanged *after* turn-off. Policymakers seem to favour a medium option on the two parameters, as shown in the following figure : DTT would stay a low multichannel delivery mechanism while some released frequencies would be refarmed for other uses. Spanish authorities, although not envisaging really high-multichannel DTT, have committed themselves to assigning a full new multiplex to every existing analogue broadcaster after turn-off. This would make up to 10 multiplexes available in Spain.

Figure 38 : The main two dimensions in the positioning of DTT

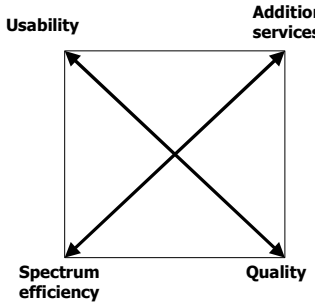
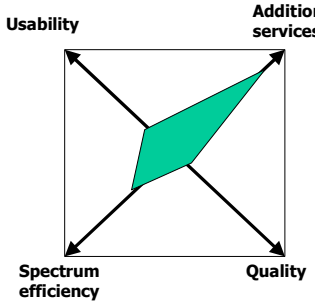
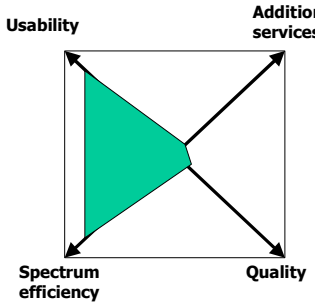
		Supply of bandwidth/channels		
		Same supply as in analogue	**Low multichannel**	**High multichannel**
Territorial coverage	**Near universal coverage (as in analogue today)**	Analogue terrestrial TV		Spain ?
	High coverage (80-85%)		Nearly all EU countries	
	High density areas only (40-60%)	(urban portable/mobile business model)		(WLL model)

Some market players would favour a more drastically different positioning for DTT in the long run. Under market forces, the delivery mechanism could position itself in an niche of sustainability like indoor reception or mobile reception of public-service channels, or a low-end alternative to basic cable in urban areas while low-density areas would be served by satellite only.

[83] "Low" with regards to the width of multichannel offerings through digital satellite or digital cable (200 channels and more).

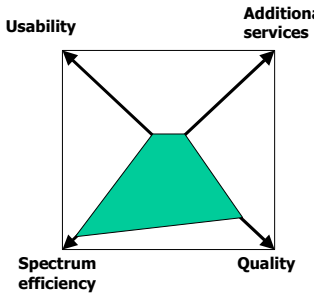
As said before, Governments seem not to encourage very much other features than increase capacity for DTT. Except in the Netherlands or Germany, there is no clear wish to encourage a high level/extent of indoor reception/portability. The quality of picture and sound[84] is not a clear priority either[85], whereas we saw in the Market chapter that consumer surveys show evidence of a growing demand for a better technical quality.

Figure 39 : The trade-off between the four DVB-T technical possibilities

The gain in technical productivity of DVB-T compared with analogue broadcasting can be used in **four different ways** that cannot be totally *simultaneously* implemented. Therefore there is a **trade-off** to make, which results in technological choices. Having a decisive role to play in spectrum management and national infrastructures, Governments can strongly orientate the future trade-off of television players. One or two features can be significantly developed simultaneously but no more : « **usability** » features (indoor reception allowing portability), **number of additional services** (TV channels and data casting), **spectrum efficiency** (ability to release frequencies, possibly for other uses), **quality** of image and sound (high definition, widescreen..).	
Europe : "terrestrial" countries Policy makers tend to maximise the **number of additional services** (TV channels and data casting), while implementing some degree of indoor reception when simultaneously possible. Except in some countries such as the UK, spectrum efficiency after ATO comes far after in the priorities.	
Europe : "cabsat" countries As most households in these countries already access multichannel television through FTA satellite or basic analogue cable, the emphasis for policymakers and broadcasters alike is put on developing specific features like indoor reception, and on spectrum efficiency. Besides, indoor reception is needed to achieve a policy objective to increase competition in cabled areas where no roof-top aerial can't be deployed.	

[84] Although digitally stable and more immune to interferences, the digital image is not necessarily of better definition than the analogue image. It depends on the bitrate which is affected to the broadcast. A low bitrate would result in a quality that would not be visibly better than the analogue one.

[85] For instance the German « Launch Scenario 2000 » only recommends that the DVB-T picture should be « at least comparable to that of PAL », hence not necessarily better.

The USA	
About 85% of US households access cable or satellite. There the main policy focus is explicitly spectrum efficiency, while encouraging broadcasters to increase quality with high definition (but they are allowed to use the extra bandwidth to launch other services, like datacasting, if they prefer).	

This is the vision adopted by policy makers, but then they have to make **market players** share these views. They have to find network operators willing to *invest* in upgrading the network to the extent of their policy vision, and they need broadcasters willing to *use* the networks and *pay* for it[86]. In a majority of countries, terrestrial transmission networks are owned and operated by commercial, profit-oriented players. They are not likely to be willing to roll out digital terrestrial broadcasting *beyond* its economically reasonable scope in terms of coverage (exponential cost) and in terms of number of multiplexes (implying a *fixed cost* whatever the commercial potential of the services). Nonetheless in some countries the dominant (incumbent) terrestrial transmission operator is still placed, directly or indirectly, under State ownership. Here the TSP-T could be encouraged into targeting a coverage that would match policy objectives rather than purely technical or economical efficiency. Nonetheless in Italy, the partly public *RaiWay* (terrestrial transmission company) publicly opposed the rationale of the official plan of achieving near universal DTT coverage, highlighting the exponential cost of the last portion of territory and households. In other countries, the DTT licences include coverage requirements, so that the licence-holder has to negotiate the deployment that corresponds to its needs with the TSP-T, and then the TSP-T has enough business certainty to make the network investments[87].

Policymakers also have to find *service* providers (mainly broadcasters or pay TV operators) willing to use the network and pay for it. One could argue that there has been a demand for such frequencies, which proves that DTT is a market-driven process. Indeed in countries where there have been channel-by-channel tendering schemes, there have always been more bidders than spectrum capacity available (Sweden, Spain), but this can easily be understood, as these tenders were beauty contests and there was no payment asked for the use of frequencies.

[86] In that sense no market development can be completely « policy-driven ». Any policy must find commercial market players willing to play within the regulation.

[87] For instance the Spanish DTT platform licensee must cover 98% of the population in 2008, and the Portuguese licensee must cover 95% after 5 years of operation.

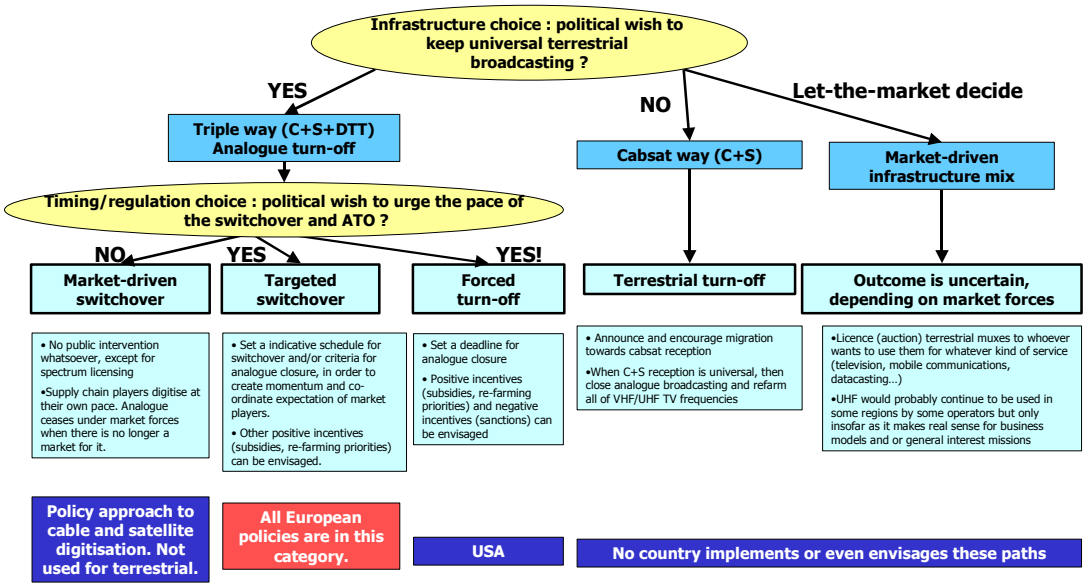
Also, scarcity of spectrum results in an environment which is relatively sheltered from competition, in which operators wish to enter. In countries where a « champion » multichannel platform operator was licensed (Spain, the UK, the NL), anti-trust restrictions often led to a unique bidder. In Portugal, there were two applicants[88].

4.4.3.2 Policy options

If we take the decision tree of policy options, we observe that nearly all European governments have favoured the triple way infrastructure and all have chosen a medium way between a market-driven "natural" process and a forced switchover.

More precisely, they all chose to (i) maintain a priori a terrestrial broadcasting and to encourage its digitisation, (ii) maintain roughly the same organisation as during analogue broadcasting (broadcasters licensed under "beauty contests", free-of-charge access to radio frequencies to licensees), (iii) send indicative signals (timeframe for switchover and turn-off) to market players, in order to help co-ordination of anticipation, and to encourage a fast and less costly migration ("targeted switchover").

Figure 40 : The public choices in infrastructure and timing/regulation



[88] In the UK, NL and Portugal, licences were granted for one platform ; in the first 3 countries, there was only one bidder. In Sweden licences were granted for DTT *channels* on a channel-by-channel basis. In Spain *both* schemes were implemented : a 3-mux payTV platform licence (granted to Quiero TV) plus FTA channel licences granted by-the-channel (to Veo TV and Net TV).

The infrastructure alternative (cabsat way, terrestrial turn-off) would mean "no more terrestrial broadcasting" but this is theoretical. A more realistic and more efficient alternative to both "cabsat way" and the current "triple way" would be to **let market forces decide** what they want to do with those frequencies. Then some might be used by fixed radio services and mobile telecommunications, but some broadcasters would probably *still* be interested in using this delivery mechanism, and even *paying* for frequencies, insofar as it would match their business model or mission. Thus such a policy would probably result in a *partial* turn-off, with probably some but not all the current "broadcast" band being used for television.

Once a decision is made to keep terrestrial broadcasting and introduce digital in terrestrial too, we then distinguish three policy behaviours to accompany/orientate/regulate the process, depending on how far policy makers wish to *accelerate* the process, notably with regard to terrestrial broadcasting, compared with the natural pace it would have had if left to market forces alone.

Market-led switchover. No announcement or incentive about ATO. No incentive to turn-on. Market players switchover at their *own* pace. Then they turn-off one by one, or they do not (each new year they make their own trade-off between losing some analogue viewers and funding the annual bill for simulcast). They would subsidise digital receivers if they want to, etc.

Targeted switchover. Mandatory deadlines for turn-on[89], friendly licensing schemes (free-of-charge against roll-out obligations), announcement and criteria for ATO (not necessarily a date set). This would be established to regulate the process, to provide common knowledge about time scales and to help players to co-ordinate their private switchover. With or without financial incentives (c.f. ITV tender payments lower for digital viewers[90], Italian subsidies for both consumer converters and broadcasters), the announcement alone can work as a self-fulfilling prophecy.

In the targeted scenario, the mere turn-off announcement can work as a **self-fulfilling prophecy**, thus helping players co-ordination and cross-expectations and thus accelerating the switchover. Here Governments introduce incentives that they consider to be proportionate to the benefits that can be expected from a faster switchover and an earlier turn-off. All other things being equal, this is bound to lead to a shorter process.

[89] New DTT licensees, and sometimes analogue terrestrial licensees, are required to start broadcasting in digital at a certain date (cf Spain, USA).

[90] The amount of licence fee annually paid by ITV franchise holders to HM Treasury in the UK are now partly based on the number of digital vs. analogue viewers, in such a way that the decrease of analogue-only viewership will decrease the payments. This creates a financial incentive on ITV companies to accelerate the switchover.

Past switchover case-studies have shown that even a mere public framework with « signals » can help a complex multi-player process. Of course there are many levels of incentives one can imagine here, so that the risks of economic distortion on other TV platforms fall I this category.

All European Governments are somewhere in this scheme.

Forced ATO. Mandatory turn-on and mandatory deadlines imposed on market players, with or without financial incentives. Broadcasters are forced to start simulcasting, and then forced to cease analogue broadcasting at a certain date. If broadcasters do not comply, they risk penalties or having licences withdrawn, or even having their analogue feed turned-off by administrative order (extremely unlikely measure because of political risks). On the reception side, if some households are not ready at the announced date, it is their own responsibility, or that of the programme suppliers that did not helped them, although public measures could be envisaged to support the migration of the last analogue households.

In the forced scenario, the timing of switchover and turn-off is set by definition. Strong positive incentives can be associated with administrative constraints to make the process politically acceptable. If this is not the case, then the forced turn-off can be a complete failure and create a completely chaotic situation. To succeed this policy strategy must be credible. Market players must be convinced that the Government is capable of « doing it », whatever it takes ; and when means to « turn-off » taxpayers and voters, it is very difficult to do, even for an independent administrative authority. No European Government has gone this far to date, but a forced close-down would become more relevant and practicable in the *second* phase of switchover, after an initial « target » policy, when it comes to converting the last percentages of viewers, which turns out to be beyond the reach of market forces.

Let-the-market decide. A totally neutral licensing scheme for DTT in this view would force players to take account of the full economic opportunity costs of terrestrial broadcasting via auctions and/or annual payments ; similarly licences should not be awarded for a fully determined use, letting licence holders maximise the utility of the bandwidth through conventional television, datacasting, telecommunications or other means. Then the final look of terrestrial broadcasting, and its very long-term survival as a television delivery mechanism, would be rather unpredictable and anyway shaped by market forces and economic rationales only.

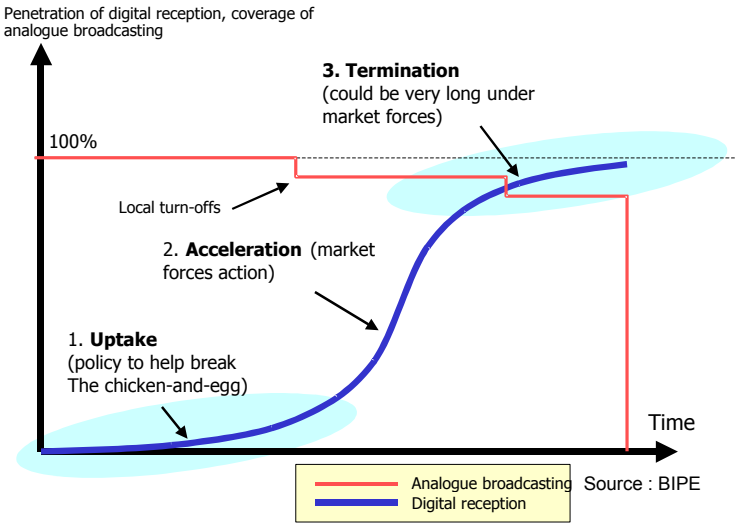
The following figure illustrates the possible impacts of some scenarios.

Figure 41 : The three terrestrial switchover/ATO paths

	Driving forces	Theoretical duration	Possible market distortions	Applied :
(i) Market-driven	**Market forces alone** (broadcasters, TSP, consumers mainly)	Unpredictable, possibly long (or infinite)	None	Nowhere
(ii) Targeted (announced)	**Market forces**, with policy incentives (licensing scheme, subsidies) and an indicative signals/framework.	Shorter than (i) (all things being equal)	Medium to high	Everywhere in Europe
(iii) Forced	**Public constraint**, with positive and negative incentives (administrative turn-off, licensing sanctions…)	Short (if politically credible)	High	USA

Source: BIPE

Figure 42: Special regulation might be needed during the take-up and close-down phases



4.4.4 Cable switchover policy

Policymakers and regulators are less involved in cable digitisation than in terrestrial digitisation, perhaps because they think : (i) cable systems are going broadband and digital anyway under market forces alone anyway, as cable operators develop multi-service business strategies[91] ; (ii) analogue cable subscribers already receive multichannel television so that one of the main incentives for going digital in terrestrial is missing in cable.

Nevertheless **some Governments are promoting an all-network digital switchover** and analogue turn-off, (e.g. Germany and the UK). In the UK, the criteria set for digital technical coverage and actual digital penetration, that are required prior to analogue terrestrial turn-off, are supposed to be platform-neutral.

Analogue terrestrial turn-off could happen in a region even if DTT is not fully available or received, as long as (i) digital cable or digital satellite *are* available, (ii) 95% of households are equipped to access at least one digital delivery mechanism, and (iii) "public service" channels are universally accessible through this delivery mechanisms.

In terrestrial countries where cable business is traditionally payTV-oriented, digital cable take-up is fast, because it is consistent with the broadband business model pursued in those countries anyhow. But in "cable" countries where cable systems have long been a widespread, utility infrastructure, things are less straightforward. Even if networks are made digital-compliant, cable operators are not likely to provide[92] digital STB to basic subscribers, but only to *premium,* high ARPU subscribers. Thus only the latter would access digital television through cable, and low ARPU viewers would continue to receive analogue TV. This implies an analogue/digital simulcast on cable networks for the foreseeable future.

As said before, the fact that a portion of cable households might remain analogue is less of a problem than in the case of terrestrial analogue, because the former already have multichannel television and an analogue cable turn-off has no implication in terms of spectrum management. This means that public intervention here would be justified by general interest considerations, such as the wish that *all* citizens be able to receive television in digital quality and access "interactive" features through television sets, in particular to promote the information society and reduce the "digital divide".

---

[91] Often summarised under the term "triple play", i.e. delivery of TV, telephony and internet services.

[92] Give or rent at a subsidised price.

Market forces action could largely achieve such an objective. Basic cable subscribers that are interested in "interactivity" through TV sets will need to buy sell-through digital STBs with modems. So that low-cost digital cable STBs will probably appear shortly on the market, just as €150 digital terrestrial STBs are being launched in the UK. But **this would probably not be enough to give way to a *universal* digital cable reception**, because (i) most low-income households are perfectly happy with analogue multichannel, (ii) they don't have a clear idea of what digital quality and digital "interactive" services might be anyway, because of the classic chicken-and-egg situation (no specific content/service as long as no equipment and vice-versa). This limit to market-driven digital cable growth applies also to countries with a terrestrial broadcasting background where cable TV has been more recently introduced on a pay-driven basis, without a universal access objective.

Then *if* it was considered of general interest that digital reception be *completely* universal in the mid-term, in particular as part of a digital TV multi-platform strategy, the range of policy measures could include:

- Create incentives or obligation on cable operators to provide all basic subscribers with a digital STB, while still obliging them to keep digital basic service universally *affordable*. This could be envisaged by national or local policymakers in countries where cable is the dominant delivery mechanism and where consumers have little technical alternative to receive television signals. But this would create two problems. Firstly, this might be considered a disproportionate way of achieving the general interest objective, considering the detrimental impacts on cable operators and investors. Secondly, there is a policy dilemma here between universal access to cable digital TV (through obligations imposed on operators) on one hand, and the development of "information society" services (through the market-led broadband model) on the other hand. Trying to achieve the first objective in the short term and at any cost could harm the second objective in the long term, for instance by discouraging investors. However, the opposite could be also true
- Create financial incentives to consumers to buy digital STBs (see next section) (since the objective is social – avoid digital divide – such incentives could be limited to low-income homes).
- Fight more actively undue restrictions on access *other* digital delivery mechanisms (DTT and satellite), in order to give actual choice to every household, increase competition between delivery mechanisms and thus establish indirect incentives for cable operators to subsidise digital STBs.

- Encourage indoor reception for DTT, to increase consumer actual options and put competitive pressure on cable operators (which is implemented in the Netherlands, notably).

More generally, and on top of that, it must be kept in mind that cable systems are heavily regulated at both national and local levels. Cable operators bear "must-carry" legal obligations without financial compensation, plus programming obligations imposed by local authorities based on regulation and/or concession contract. As a result, big must carry tiers reduce consumers' motivation to buy further multi-channel supplements. Pricing is also often regulated by local authorities in some countries like Ireland or Belgium. These conditions can in some cases create obstacles and dis-incentives to corporate consolidation (which is a pre-requisite to the broadband strategy), and the costly investments that are necessary. Cable operators have to be able to recoup their investments if they are to roll-out broadband networks and digital services. They may then need more business flexibility in service design and pricing.

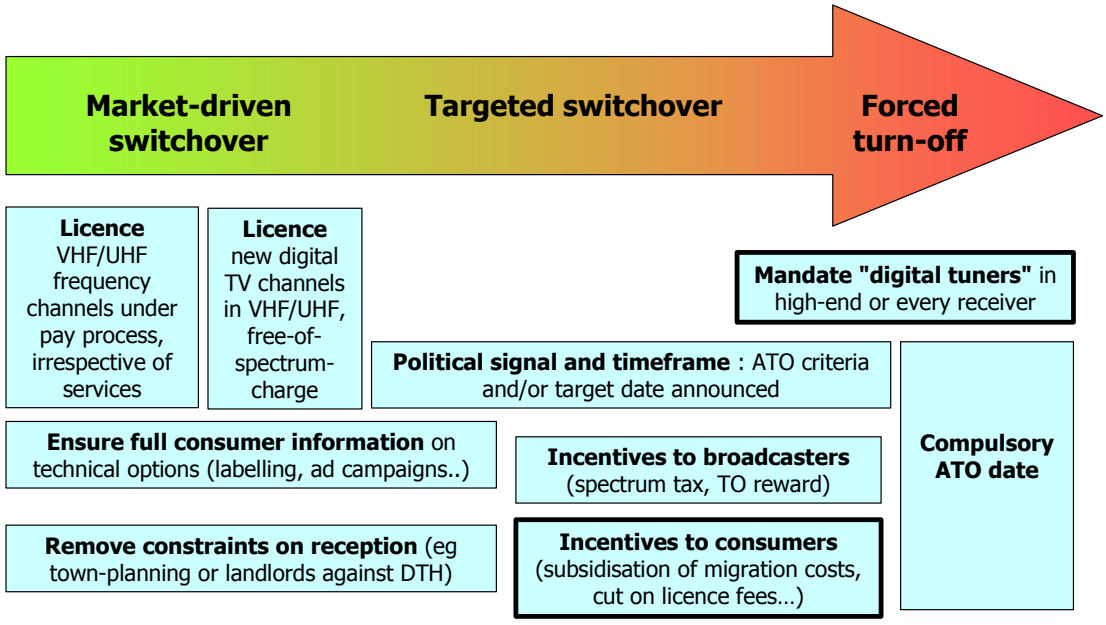
As a result there is a **policy dilemma between the "information society" objectives, and the "universal service" objectives as far as cable access is concerned**, illustrating the challenges of an "information society for all". If more households were able to freely access low-end basic television in digital mode via DTT or satellite too, the cable broadband strategy would become much more compatible with consumer interest considerations and policy objectives.

4.5 The full range of possible incentive measures

Beyond the policies and measures that are being implemented and the big policy choices, we have to examine the full range of possible incentive measures that could be envisaged.

The following figure indicates some of these regulatory measures by situating them on a scale from laissez-faire (market-driven migration) to a dirigist industrial policy (forced switchover and turn-off). On the economically liberal side, public authorities could limit their intervention to (i) granting licences under spectrum payments and letting market forces (broadcasters, transmission network operators and service providers) decide to what extent and how fast they wish to roll-out infrastructure and services ; (ii) correcting market failures such as asymmetrical consumer information and undue restrictions on terrestrial/satellite access. At the other extreme, public authorities would legally impose an analogue turn-off deadline, and thus force the switchover pace, if the threat of an administrative turn-off whatever might be market development, sounds credible enough.

Figure 43 : The range of regulatory measure, by degree of interventionism



Policy options in this chart could be applied on all TV platforms except for references to spectrum which apply to DTT mainly.

Hereafter we focus on these measures and assess their implications and feasibility. We have classified them by the player which is incentivised at first instance.

4.5.1 Consumers

One of the most obvious ways to accelerate the reception switchover is to create incentives for consumers. This can be done by transferring a part of the cost of reception switchover which would otherwise be borne by individual consumers to society in general, i.e. the purchase of a digital converter or a digital television set. Technically, special taxes on private players which would ultimately benefit from the acceleration of the switchover could finance/compensate the expenses/subsidies or tax breaks, and thus lead to a neutral operation for the national budget or through a dedicated fund.

- **Subsidies for the purchase of digital equipment**. Such a measure is envisaged in Italy. Historical precedents in other industries (subsidies for automobile replacement in France and Spain in the 90's[93]) show the feasibility of such a measure. However they would have implications with regard to European regulation on State aids, and could be considered as creating competition distortions between platforms and between business models, by favouring the delivery mechanism which is dominant in analogue, and the free-to-air business models at the expense of the pay TV market.

[93] Intended officially to help withdraw from market old vehicles that were non longer compliant with new security and pollution standards, the measure was also a subsidy for car owners and a State aid to the car industry.

- **Discount on the broadcasting licence fee**. The licence fee could be temporarily or definitively lower for households who have switched to digital. This would be justified by the fact that public broadcasters, which are partly or fully financed by the revenue from licence fees, will save significant amounts of money after analogue turn-off. One can imagine that a discounted rate of licence fee could be applied during the switchover, and that the discount could decrease with time, so that "early switchers" would benefit from a larger discount, and that people who that are going to wait for the "last moment" to switch would pay more. This would compensate the fact that for the price of digital equipment will decrease over time, so that switching early is more expensive for a consumer.
- The technical feasibility of the two last measures, which are, more or less, ex-post subsidies to the individual switchover, might be complex and costly to monitor and implement. Besides some countries don't have a television licence fee. That is why one could imagine instead a (temporary) **reduction on the VAT rate applying to digital equipments** (IDTVs and converters). To keep the measure platform-neutral, it could be extended to digital *subscription* (or at least the component of the pay TV subscription which corresponds to the rental of a digital set-top box).

4.5.2 Consumer electronics players

Regulation could establish incentives for consumer electronics manufacturers and retailers, to prevent the continuous increase of the installed base of analogue receivers. Through a more or less compulsory regulation, they would cease to put on the market purely analogue television sets. They would only market "Integrated Digital TV sets" (IDTVs), which have a "digital tuner" integrated.

- A **« mandatory digital tuner » measure** refers to the prohibition on marketing purely analogue receivers. It would be possible to apply different windows for such a measure in various phases: start with high-end receivers and then extend later the obligation to low-end low-cost receivers, in order to limit the cost/price increase that would result from the integration of the digital tuner and would be proportionately more significant on a low-cost receiver. Some historic precedents show the legal and political feasibility of such measures : prohibition of non 220V-compliant electric devices at a certain time of the switchover from 110V to 220V[94], obligation to integrate a SCART interface in TV sets. Nonetheless, such a measure could create an obstacle to the internal European and the free circulation of goods in the European single market, if it was not harmonised at European level beforehand[95].

[94] See case study in the Migration section of the Market chapter.

[95] See more detailed analyses of this measure in the cost-benefit part of this chapter, and in Cost / Benefit annexe.

- **Re-enforced labelling obligations**. Regulation could require television receivers (TV sets, decoders or VCRs) to be clearly labelled for consumers to be aware of the compatibility with digital signals, in the context of a analogue turn-off which is "expected" to occur some years later. The DVB logo on IDTVs, a voluntary initiative agreed between all industry players in the UK, is a first step in this direction. A compliance/compatibility labelling could prove almost as effective as a legal obligation to include digital tuners, as far as pushing the market towards digital-compatible equipments only.
- Lastly, **awareness campaigns** could be implemented. If there are clear established general interest objectives in accelerating the migration, in addition to the need to protect consumers against unexpected obsolescence, public authorities could encourage or even partly finance advertising campaigns about what digital reception is, explaining and advertising the compliance labelling etc.

4.5.3 Television players

Regulation could create incentives for television operators (free-to-air broadcasters, pay TV operators, transmission service providers) in order to make them accelerate the turn-on (digital broadcasting), encourage the reception switchover, and turn-off the analogue signal as soon as possible.

State aids to finance investments in the digital turn-on. The Italian Government has thus created subsidies to help broadcasters. The legal feasibility of such measures could be questioned because of the risks of competition distortion, the platform-neutrality principle and the European regulation on State aids.

Tax on the Mhz. If terrestrial and satellite[96] broadcasters had to pay a tax based on the quantity of spectrum they use, it would create a clear incentive for them to switch to digital-only and to turn-off analogue transmission. This is simply because digital transmission, whatever the delivery mechanism, uses 6 to 10 times less Mhz to transmit the same signal with about the same quality. Economically, such a tax would be justified by the fact that using airwaves in analogue modulation is a waste of public resources, whatever may be the demand for these frequencies. The tax could be borne by broadcasters and/or by transmission service providers who would then anyway make their clients pay for the cost increase. With such a tax, broadcasters would have a reason to encourage their own consumers/viewers to switch to digital as soon as possible.

[96] Because satellite broadcasting uses much higher frequencies than other uses and there does not seem to be scarcity.

Such a tax would be technically complex to introduce but there are already some measures in Europe can be considered as prototypes : the tax on spectrum use in Spain (to both telecom operators and broadcasters) and the payment imposed on the ITV companies in the UK (calculation mode creates an incentive to go digital as fast as possible).

Political feasibility is even more complex. Many parties (cultural authorities, producers, television players) will consider that the compensation for the right to use public resource should remain "cultural" only (production and programming obligation on licensees).

In principle, it should be possible to impose content-related obligations on channels, *in addition to* spectrum taxes, when they happen to use frequencies for their delivery. But cultural policymakers and the upstream players of the value chain fear that television players might try to re-negotiate their existing cultural obligations downward if a new tax was imposed on them.

Finally, **free access to "digital" frequencies could be conditioned to an early turn-off of analogue broadcasting**. The FCC has offered US analogue terrestrial broadcasters to keep using their new digital frequency for free, *if* they release their analogue frequency before 2006[97]. Under the Spanish DTT plan, Spanish analogue broadcasters the opportunity have the prospect of accessing a full multiplex each after analogue turn-off.

4.5.4 Other spectrum users

Other spectrum users, such as mobile telecommunications operators, could also be encouraged to facilitate the migration.

Because technically they could be alternative users for the frequencies that could be released after an analogue terrestrial turn-off, it would be interesting to have a mechanism that would **make them reveal their economic utility for these "releasable" frequencies**. Economic theory suggests monetary tools are useful to reveal utility. Therefore one could imagine reservation mechanisms such as options to buy.

Such information on the willingness to pay to access UHF frequencies would help policymakers to design *proportionate* measures aiming at accelerating the migration and actual release of the frequencies. And, beyond the information itself, the mechanism could provide cashflow that could be used to finance incentive measures for direct market players (broadcasters, consumers, TSPs).

[97] The initial US approach may fail, as many local stations have not switched yet and do not expect to make it before 2006.

This measure would be complex in terms of political feasibility. It would require a drastic change in the current spectrum management, at national and international levels. It would be opposed by almost all TV players who reject monetisation of "broadcast" frequencies. And lastly, it is unsure whether the mechanism could really reveal the economic utility in the inherited context. Indeed telecom operators have *already* paid to access the bandwidth they are going to need in the 5-10 coming years and they have already made official reservations to access *other* bands for their longer term needs.

4.5.5 All involved players

Public authorities could also send *signals* to all market players. This would help creating a common knowledge and common expectations, and thus help market players co-ordinate their investment cycles.

This could be done by planning an **indicative timeframe for switchover and turn-off**.

A strong version of this would be to impose a fixed turn-off deadline on market players. In that case there would be a real risk for market players if reception infrastructures are not ready at turn-off : broadcasters would lose analogue viewers and viewers would become unable to receive *any* TV signal. Such a regulatory strategy has been implemented in the USA with very limited success, and no European country has followed the example. All European timeframes remain indicative, with no penalty on market players if the migration is eventually longer than expected.

An indicative timeframe is all the more feasible when players themselves commonly ask for more legal certainty. A forced turn-off would be extremely dangerous because if the measure is not politically credible ("they won't dare to force us to turn-off analogue transmitters") plus it could be counter-productive, and lead to chaos as well as increasing uncertainty instead of reducing it.

4.6 Cost-benefit analysis

4.6.1 Objectives and approach

In this section, our objectives are to :

a) Build an **exhaustive list of the categories of costs and benefits** that are related to the digital migration (turn-on, switchover, turn-off) on all platforms.

b) Use these costs and benefits to make **cost-benefit analyses** of some of the policy options mentioned in the chapter. These analyses will involved **quantitative modelling** of costs and benefits whenever possible and relevant.

The cost-benefit analysis of a public decision requires translation of the positive or negative impacts of the envisaged decision into monetary terms. This allows policy makers to aggregate and compare all the costs and benefits, no matter who the economic agents generating the benefits or bearing the costs in the first instance. This stands views matters from a macro-economic point of view.

4.6.2 Costs and benefits involved in the migration

Among the **costs**, some are related to the digitisation of broadcasting infrastructures and thus necessary for introduction of digital broadcasting (turn-on) ; others derive from the digitisation of reception equipments (aerial or satellite dishes) receivers (television sets and VCRs) and thus necessary for the reception switchover and the final analogue turn-off.

Figure 44 : Costs and risks

No	Costs	Platforms (cable, satellite, terrestrial)	Who bears the costs + Comments
C1	**Digitisation of reception**	Upgrade of reception infrastructure (aerials or satellite dishes).	Consumers.
C2	**Digitisation of receivers**	External digital converter (STBs purchased or rented to a payTV operator) have to be associated to every receiver in the home (TV sets, VCRs), or sets have to be replaced by IDTVs. Cost will ultimately be the same whatever the platform.	Consumers. Pay TV operators.
C3	**Digitisation of broadcasting infrastructures**	Upgrade of transmission/access networks to support digital transmission. Cost is marginal for satellite; significant for terrestrial ; significant for cable but shared with other services than TV.	Network operator or transmission service providers.
C4	**Interferences caused by DTT on cable**	DTT specific	Cable subscribers or cable operators (paid back by network operator or transmission service provider or DTT broadcasters).
C5	**Interferences caused by cable on DTT**	Specific to digital cable.	DTT operators (paid back by cable operators).
C6	**Risks of competition distortion**	Risk that public decisions, if they are not platform-neutral, might harm some particular platforms in a way that would be disproportionate with expected benefits.	Network operators. Broadcasters using these networks.
C7	**Risks of moral hazard**	Risk that public decisions, if too premature or too interventionist, might distort market forces' actions and inhibit sustainable innovation and investment.	Global economy, investors. Risk of wasting public resources and private resources (industrial projects made by anticipation of regulation).

Among the **benefits**, are beginning to be reached thanks to the mere introduction of digital television (turn-on) and the extension of its reception (switchover) : B1, B3. Others will only be achieved when the switchover is completed and analogue turn-off can take place : B2, B4, B5.

Figure 45 : Benefits

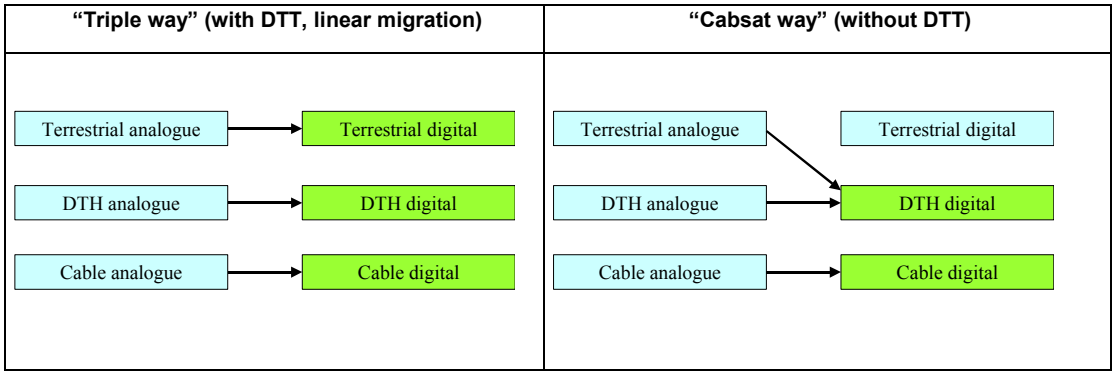
No	Benefits	Platforms (cable, satellite, terrestrial)	Who benefits – Comments
B1	**Positive impacts on markets, information society and economy.**	All.	**Consumers, operators, e-merchants , the global economy and society.** Digital TV is expected to accelerate the entry in the information society, which give way to both economic (growth, employment, competitiveness) and social benefits (education, democracy…).
B2	**Reduction of (savings on) transmission costs** after analogue turn-off.	True on all platforms. Particularly significant for terrestrial broadcasting, where the cost of nation-wide analogue broadcasting can be very high.	Broadcasters and pay TV operators.
B3	**Increase of competition.**	Digital leads to lower entry barriers on all platforms. The benefit is particularly obvious in a triple way scenario where DTT becomes a third multichannel platform at broadcasters' and consumers' disposal.	**Consumer** (more choice in access mode and possibly service providers), **broadcasters and channel publishers** (more choice in the delivery mechanism), **pay TV operators** (if they don't have conflicts of interests in using *all* available platforms).
B4	**Spectrum gains.** Increase of spectrum efficiency.	True on all platforms. Particularly significant on terrestrial, where scarce public frequencies are wasted when used in analogue, and where alternative uses are technically possible.	**The whole economy** (better use of a scarce, public good, and potential new services) ; **potential new users** of released radio frequencies (like mobile telecom operators) ; **Governments** (re-farming of released frequencies could bring new fiscal revenues).
B5	**Prevention of the « digital divide ». Promotion of universal digital access.**	Can be true on all platforms. Policymaker in terrestrial countries, however, sometimes expect the most widespread platform, which also happens to be carrying mostly free-to-air services, to play a special role in the achievement of this objective.	**The access of all households, including low-income households, to "information society" services (iTV, internet, email…) is supposed to strengthen social cohesion.** The benefit is achieved when digital switchover is almost completed and digital access is near universal, which are also the conditions required to turn-off analogue broadcasting. While B1 refers to the extension of the digital access (e.g. 60% to 80%), B5 refers more specifically to the conversion of the *last* analogue % (80% to 100%).

Some of the costs and benefits from the above categories have been incorporated in a series of quantitative tests aimed at assessing the impact of market forces action and policy intervention. The methodology used and the results achieved are developed in more detail in the relevant annexe. A summary is presented in the following pages.

4.6.3 Infrastructure policy (test 1)

We have compared (i) the specific costs of a migration through the three platforms (incl. terrestrial, triple way) and (ii) the specific costs of a migration through cable and satellite only (without DTT, cabsat way). We try to aggregate and assess all the costs and benefits for the economy, whatever the economic agents impacted in first instance.

Figure 46 : The two infrastructure scenarios



The costs involved to digitise receivers (C2) are not taken into account here, because they should be similar, whatever the broadcasting infrastructure.

The triple way policy will result in a linear migration, i.e. maintaining more or less the existing reception mix in any given country. Terrestrial households/receivers migrate towards digital terrestrial ; satellite households or receivers migrate towards digital satellite, etc.

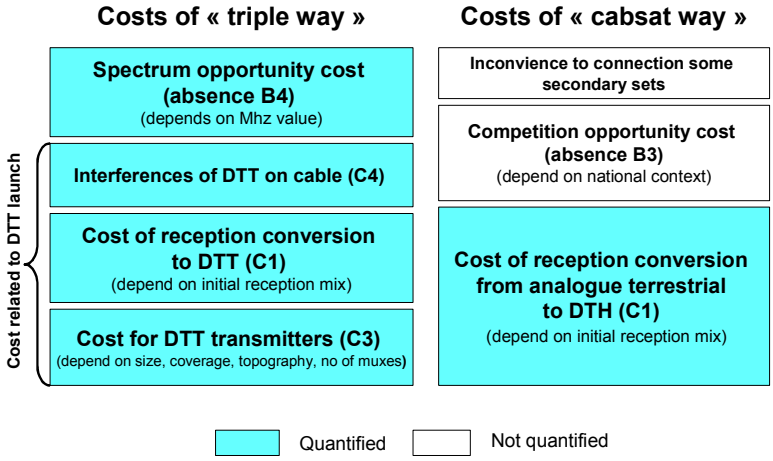
In this option, we consider the following costs :

- **Conversion to DTT**, which includes the costs linked to the roll-out of DTT transmitters (C3), the upgrade of at least of part of existing aerials (C1) and the costs generated by the interferences that can be caused by DTT on some cable systems (C4).
- The **spectrum opportunity cost** resulting from maintaining the « broadcast frequencies » (band IV/V, and III in some countries) for television only, under free-of-charge assignment. It corresponds to the missed opportunity of reaching the spectrum benefit B4. It can refer to a missed financial opportunity to make revenues out of refarming the frequencies, or, more generally, to the missed opportunity of having a wider range of wireless services and perhaps a more efficient use of the radioelectric spectrum.

In contrast, the cabsat way policy is about transferring analogue terrestrial homes to cable or satellite, where broadcasting is assumed to be already digital[98]. It comprises the following main costs :

- **Conversion to satellite reception** (C1, equipment of individual houses and apartment buildings within satellite dishes)
- **Competition opportunity cost**. This is the inconvenience that could result from the reduction of the number of delivery mechanisms offered to consumers and broadcasters, i.e. a switch from three platforms (maximum) to two (maximum). This cost comprises the absence of benefit B3 in the cabsat scenario. It is taken qualitatively in the cost-benefit assessment.
- **Cost of digital upgrade of sets other then the main set**

Figure 47 : Specific costs of the two infrastructure options in test 1



In the above figure, we can see that some of these costs and benefits have been quantified in a model. In order to be able to create simulations based on national contexts, the model takes into account the following variables : (a) **population** (number of individuals and households), (b) **initial reception mix** (breakdown per delivery mechanism, number of receiver per households), (c) **housing mix** (individual vs. apartment buildings), (d) **unitary cost of reception upgrade/switch** in the different housing conditions, (e) **value of Mhz**.

Simulations have shown that the most sensitive variables are the initial reception mix (b), and the assumption of spectrum valuation, which determines the opportunity cost of maintaining terrestrial broadcasting as it is today (e).

[98] In the « cabsat way » scenario, we assume that terrestrial analogue households/receivers are migrated towards cable in areas where cable is *already* available, and to satellite in all other cases.

As an example, we simulated the specific costs of both scenarios for a 20-million households country, with a spectrum valuation that we consider wise (0.01 euro per year and per inhabitant). We obtained the following results by testing the impact of the initial reception mix, all other things being equal.

(i) **In "cabsat" countries, the cabsat option**, i.e. the migration of analogue terrestrial homes towards cable (in cabled areas) and satellite (all other areas), **appears to be less costly** macro-economically. The costs of rolling-out DTT (C1+C3+C4, about €796m in all) are about the same as those involved in migrating towards cable or satellite reception (C1, €570m), but the opportunity cost of the triple way (non-B4, €1440m)[99] makes the difference. In contrast if we assume that "releasable" frequencies are valued at zero, then the outcome is much more balanced.

(ii) **However, two other types of costs, not quantified here, could change the assessment** by increasing the global cost of the cabsat option, and thus justify maintaining terrestrial broadcasting. These costs are : (i) the competition opportunity cost and (ii) the potential inconvenience/cost of connecting secondary and tertiary sets to cable and satellite (compared to DTT, which allows some degree of indoor reception).

(iii) **In "terrestrial" countries, with a pre-existing terrestrial infrastructure, the less costly option is triple way**. The roll-out of DTT (C1, C3 and C4, €1,754m), and the spectrum opportunity cost (absence of B4, €1,440m) lead a global cost of €3,194m, well below the cost of a conversion to cable or satellite reception (C1, €5130m). Taking account of the non-quantified costs of the cabsat way would only result in increasing the gap.

(iv) In hybrid countries, where the three delivery mechanisms enjoy a significant market share today, the two options involve comparable costs. It would be then for policymakers to assess the impact of non-measurable costs.

Figure 48 : Test 1 results – simulations for different initial reception landscapes

	Cabsat country	Medium	Terrestrial country
Marketshare of terrestrial reception	10%	50%	90%
Option Triple way (with DTT)			
Upgrade infrastructure (C1+C3+C4)	**796**	1 275	**1 754**
Spectrum opportunity cost (B4)	1 440	1 440	1 440
Total (1)	2 236	2 715	3 194
Option cabsat way (no DTT)			
Upgrade infrastructure (C1) (2)	**570**	2 850	**5 130**
Difference (1-2)	**1 666**	**-135**	**-1 936**
Best (less costly) option	**Cabsat way**	**Equivalent**	**Triple Way**
Non quantified costs, potentially increasing the cost of the cabsat option			
Connection of secondary sets	+		
Opportunity cost resulting from the competition effect of having 2 delivery mechanism instead of 3	++		

[99] Whatever the reception mix, most of the broadcast UHF band is used for television only, in all member states. As we assume the amount of spectrum potentially released, the population and the value of Mhz is the same, the "opportunity cost" we refer to, is the same in each scenario.

4.6.4 Timing and regulation choice (test 2)

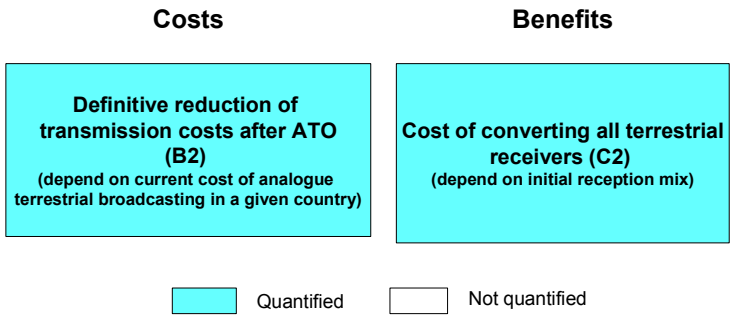
In this section we have analysed the economic rationale of accelerating the digital migration. This was made from a private, commercial point of view (for broadcasters, test 2a) and then from a public, macro-economic point of view (test 2b)

4.6.4.1 Private approach (test 2a)

We have examined in what conditions and to what extent it would profitable, for broadcasters, to finance incentive measures to encourage consumers switch to digital earlier, to facilitate turn-off analogue broadcasting and thus make savings out on transmission costs. Because terrestrial broadcasting is much more expensive than satellite broadcasting (both in analogue or digital), we focused on the terrestrial issue. The savings that could be made out of turning-off analogue satellite feeds are much smaller.

At that point we examine the issue from the strict position of a broadcaster, thus neglecting the *other* external benefits that could result from an acceleration of the switchover.

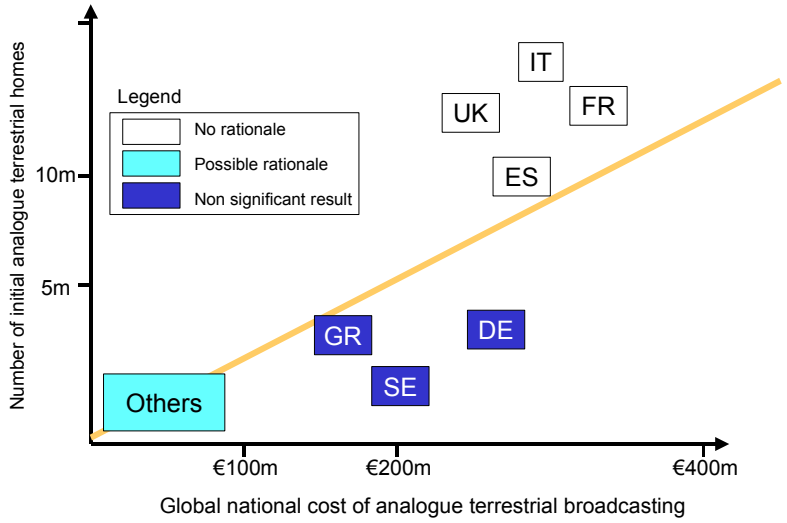
Figure 49: Should broadcasters finance reception switchover ? Costs and benefits in test 2a



The following figure shows the result of simulations made in different national contexts. The justification for such an investment is only clearly established in countries where analogue terrestrial broadcasting is relatively costly and where the number of terrestrial analogue households to convert is relatively low in absolute terms. Only Germany and Sweden seem to be clearly in this situation[100].

[100] Taking into account the number of secondary and tertiary sets using terrestrial reception in « cable homes » and « satellite homes » could significantly change the perspective in some countries. But this statistic is not available.

Figure 50 : Rationale, for national broadcasters, to subsidise digital conversion in order to turn-off analogue transmission



Beyond economic rationale, such a measure would face **feasibility difficulties**. Because no particular broadcasters would be willing to bear the cost alone (as the benefit would be common), a consensus would need to be found on how to share the common investment between existing analogue broadcasters. Besides, commercial players would be likely to wait for public service broadcasters and/or Governments to finance the move themselves, as they know policymakers have their own reasons for being willing to accelerate the process.

4.6.4.2 Public approach (test 2b)

The main cost-benefit analysis has been led from a **public or « macro-economic » point of view**[101]. We have examined in which conditions and to what extent, it would be beneficial for a national economy to accelerate the digital migration in order to gain the benefits that can be expected from switchover and turn-off **earlier**.

Approach - Methodology

Whatever the infrastructure choice that was made, once digital broadcasting has begun, one must wonder whether or not it is desirable to accelerate the pace of digitisation of reception.

[101] In this approach the investments required to accelerate the migration are not borne by a specific economic actor (like broadcasters in test 2a) but by all/any economic actors, indifferently (consumers, Government, operators…). Insofar as investments to accelerate the switchover would be financed from public budgets.

We focus on the digitisation of receivers and consider that the necessary expenses will be made by economic actors, anyway, sooner or later. The benefits deriving from an all-digital environment and the turn-off will be achieved sooner or later, too, but in that case each additional year of transmission savings or frequency release is a *net* gain, economically.

In this conceptual framework, public intervention only changes the **timing** and scheduling of the flows of investments and benefits. Nobody denies that in the long term television will be delivered in an all-digital form; but everybody admits that a process relying on market forces only might take a long or very long time, in the current market situation, because of the obstacles and market failures identified in this report. Therefore the problem is not the existence of the switchover but its pace and completeness. The faster reception switchover will be, the sooner analogue turn-offs (on all platforms) will take place, and the sooner the benefits of it will impact the economy and the society. The level of preference for the present, which is more or less summarised by the interest rate, will thus be a key variable in the assessment of a public policy aiming at regulating the pace of the migration.

We have to compare a « natural » scenario in which regulatory intervention is kept to a minimum policy-driven scenario in which market players have incentives to migrate earlier. We do not need to assume a particular intervention tool to reach the objective of accelerating the process (though the potentially detrimental side effects of the tool is taken into account qualitatively) ; in fact we only assess the **rationale of the objective** as such.

In the « natural » scenario, all economic actors invest, year after year, in acquiring digital converters for all receivers in the home. Consumers directly buy some of them ; some others are bought by pay TV operators and given away or lent or rented to subscribers. The analogue turn-off can't occur as long as nearly all receivers have been equipped so as to receive digital signals by one of the delivery mechanisms. According to historical precedents, we assume that when digital penetration will be nearly universal (close to 100%), market players and/or public authorities will finance the very last converters[102]. According to Governments official expectations, we could assume that this near universal penetration would occur after 10 years of digital broadcasting on the three platforms.

In the "policy-driven" scenario, economic actors are encouraged in order to make the same material investment faster, so that they can achieve the near universal switchover earlier, e.g. in 4 years instead of 10.

[102] A forced and subsidised migration of the very last % at the end of a technological migration has been observed in some historical precedents, like the conversion from 110V to 220V.

We therefore have to compare :

- **The additional macro-economic cost**, for the country, of making the necessary investment earlier than what would have been the case in a "natural" scenario (i.e. without special incentives), *plus* the risks that are attached to policy intervention on markets (costs C6 and C7 in the table at the beginning of the section). This additional cost is the difference between (i) the cost of the "natural" switchover (9 years of market-driven, then analogue closure in year 10) and (ii) the cost of the "policy-driven" switchover (e.g. 3 years of spontaneous switchover, then encouraged analogue closure in year 4)
- **The global macro-economic benefit** of achieving *earlier* the final benefits that are expected

Details on costs and benefits at stake

The main **cost** is the additional macro-economic cost of an anticipated migration. It is a second degree expression of the investment in digital converters (C2). The material investment will be the same in any scenario, but there is a monetary differential that comes from two factors :

- The **immaturity cost** : in policy driven/incentive-driven migration, economic actors will invest in a less mature technology, at a moment costs and prices have not fully gone down the technological maturity curve, and therefore at a higher cost[103].
- The **financial cost** : the macro-economic investment is made earlier than it would have been made otherwise. This timing difference creates a financial cost which is the opportunity cost of the interest that could have resulted from this money if it had been invested, e.g. in financial markets, in the meantime.

The other element of « cost » lies in the risks involved by policy intervention on markets, which is more or less important depending on the incentive tools employed (C6 and C7 : risks of competition distortion, business inhibition and moral hazard).

In terms of benefits we consider the following ones.

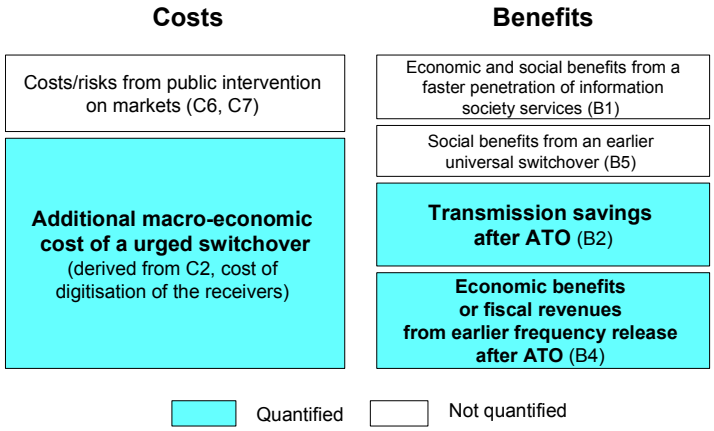
- **Economic and social benefit** deriving from an earlier penetration of information society services (earlier B1)
- **Flow of transmission savings** after analogue turn-offs (B2). If analogue broadcasting is stopped after 4 years instead of 10, broadcasters would save the cost of 6 full years of nationwide analogue broadcasting (which can amount to up to €2,500m).

[103] The conversion could be made through equipment with IDTVs. To simplify, we only talk about "converters", but the additional cost of an IDTV compared with an equivalent analogue set will be about the same magnitude as that of an external converter.

- **Flow of economic benefits resulting from earlier release/refarming of broadcast frequencies (B4)** [104]. We assume that released frequencies could be refarmed rapidly after turn-off and replanning, and that the reallocation/refarming give way to a better spectrum efficiency that we value in euros per year per inhabitant (several valuations are tested). This benefit would correspond to the increase of economic growth generated by new, wider uses of the public resource and/or the payments made by service operators to access these frequencies.
- **Social benefits resulting from early and universal switchover (earlier B5).** An earlier completion of the switchover would allow low-income households to access digital services much earlier than what would have occurred otherwise. It would therefore contribute to prevent and avoid the "digital divide".

The following figure summarises these costs and benefits

Figure 51 : Costs and benefits of the "urged switchover" option



The quantitative model

In order to proceed to various simulations, to test the influence of assumptions and national contexts on the cost-benefit assessment, we have taken into account the following variables.

[104] This benefit was not considered in test 2a because it is relevant to the economy as a whole and not to any economic actor in particular.

Figure 52 : Variables used in the quantitative model for test 2b

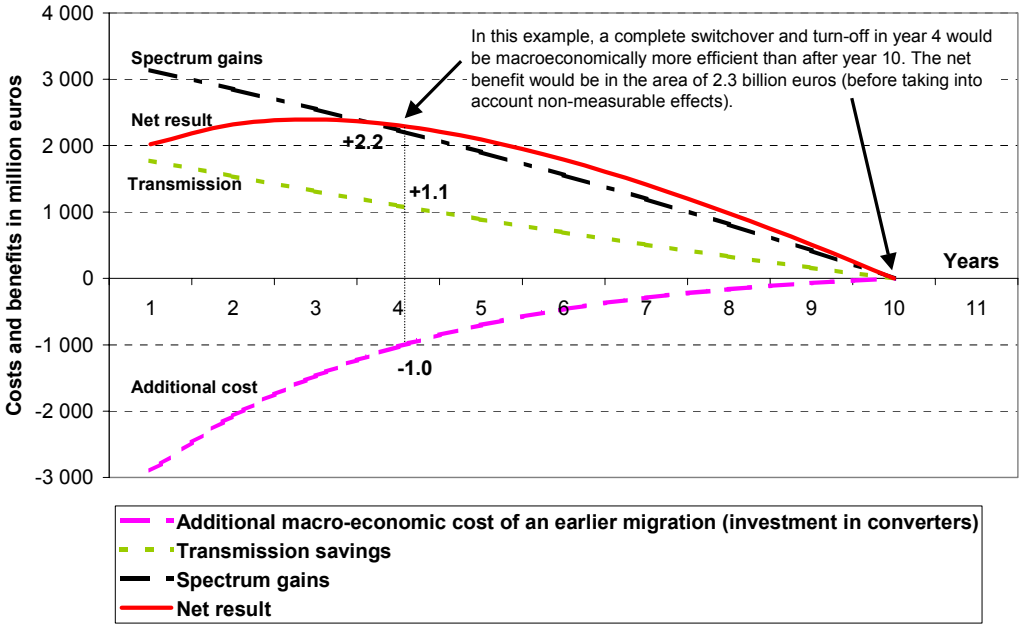
	Variable	Comment	Example (simulation 1)
A	Percentage of purely analogue households in initial situation	Used to calculate the global cost of digital converters needed (C2)	70%
B	Total number of households		23 millions
C	Total population	Used to calculate the global economic value of a Mhz in the country.	57 millions
D	Interest rate	Determines the financial cost of the urged switchover and the current value of future benefits.	5%
E	Spontaneous switch rate to DTV	Switchover of reception to DTV, under market forces action alone, without specific policy incentives.	15% of all remaining analogue households each year
F	Initial converter price		150 euros
G	STB converters decrease in price each year		10%
H	Number of receivers to convert, per home.	Determine the total number of receivers to be converted, incl. secondary sets and VCRs.	2,7
I	Fixed cost of adaptation of reception	Upgrade of reception devices (sat dish or aerial).	€50 per household
J	Yearly cost of analogue terrestrial broadcasting	Depend on size, topography and coverage of a country. Analogue satellite broadcasting cost – 5 to 10 times lower – is neglected.	€250m per year
K	Quantity of frequencies released after ATO	Depend on infrastructure and planning choices (MFN vs.SFN, indoor reception or not) and on reallocation/refarming choices.	100 Mhz
L	Economic value of released frequencies.	Expressed in euros per Mhz, par year per inhabitant.	0.05
M	Annual growth of this value	The new services created thanks to the released spectrum capacity will be increasingly valuable as service availability is completed and the markets are growing.	10%

Quantitative results

To illustrate the model, we take, for example, the assumptions of simulation one (above table). The result indicates that **the number of benefits coming from an urged switchover and turn-off are more grater than the investments required to trigger this acceleration**. It would be incorrect to think that "the sooner we turn-off, the better", because in the first years analogue households will be numerous and converters are still expensive. In fact the optimal timing seems to occur after 3 to 4 years (see following figure) : 2 or 3 years of spontaneous migration, then digital switchover completion and analogue turn-off.

If we look at the outcome of a migration in four years, for example, the additional macro-economic cost is about – 1 billion euros, while the current values of spectrum gains and the transmission savings cumulated in 6 years (years 5 to 10) reach +2.2 and +1.1 billion euros respectively. The net result is therefore 2.2+1.1-1.0=2.3 billion euros. This is the differential macro-economic benefit of achieving a completion/turn-off in year 4 *rather than* in year 10. This differential progressively decreases as we get closer to year 10 in which it is - by definition - zero.

Figure 53 : Result of simulation 1



This result comes from the three factors we are able to quantify. To make a complete cost-benefit policy assessment we need to estimate whether non measured costs (C5 and C6, systemic risks of public intervention on markets) and non measured benefits (B1 and B5) could significantly modify the quantitative result in one direction or another.

Of course it is for each national policymaker to make this qualitative, political assessment. We, nonetheless, can recall that risks of distortion in markets are acceptable only if (i) they are *proportionate* to the general interest benefits expected (ii) it is proven that they are *necessary* to achieve the general interest (i.e. market forces alone can't lead to a similar result).

In the present case, risks of competition distortion can be kept relatively low if the incentive measures are kept platform-neutral and technology-neutral, i.e. they apply in the same way *no matter what* the initial analogue and the final digital delivery mechanisms are, and no matter what is the business model for the conversion (external converter, IDTV, subscription to digital pay TV with STB rental). But even if the measure is platform neutral, risks of moral hazard remain (players anticipating future incentive measures and thus being discouraged from making the strategic moves and investments they would have made otherwise).

Sensitivity of assumptions

The simulations that we have performed show that the most sensitive variables/assumptions are : (i) the initial number of analogue households to convert, (ii) the valuation of the "releasable" Mhz, and (iii) the interest/discount rate.

For example, if we stick to the assumptions of simulation one and if we assume a Mhz valuation of 0 instead of 0.05, we end up with a result which is negative for the first years and then slightly, but no significantly positive. As the maximum surplus is below €250m (see following figure), it becomes much more difficult to assume that the assessment might remain positive after the non-measured costs, risks and benefits will have been considered.

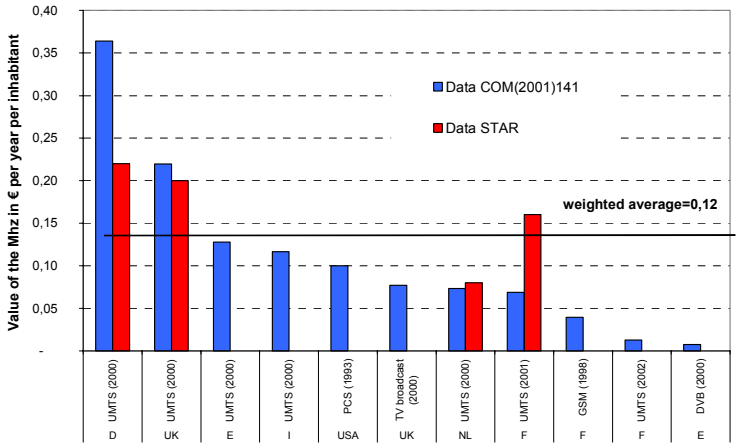
Figure 54: Result of simulations depending on Mhz value assumption

Valuation of « releasable » frequencies (in € per Mhz per inhabitant)	**Maximum result at optimal ATO timing (**in million €)
0	+231
0,01	+570
0,02	+951
0,05	+2396
0,10	+5170

Source : BIPE

A sample of recent historical examples of spectrum valuation displays a great diversity : from 0.01 to 0.35, with a weighted average at 0.12. But considering the very peculiar context in which these valuations were reached (UMTS auctions, during the stock market's speculative bubble), the nature of the "broadcast" frequencies and the fact that telecom operators have *already* secured access to the bandwidth they are likely to need in mid-term, we think it is necessary to remain cautious and not to envisaged values beyond 0.05.

Figure 55 : Valuation of frequencies – Some historical examples



Interpretation of the model : digital switchover or terrestrial turn-off ?

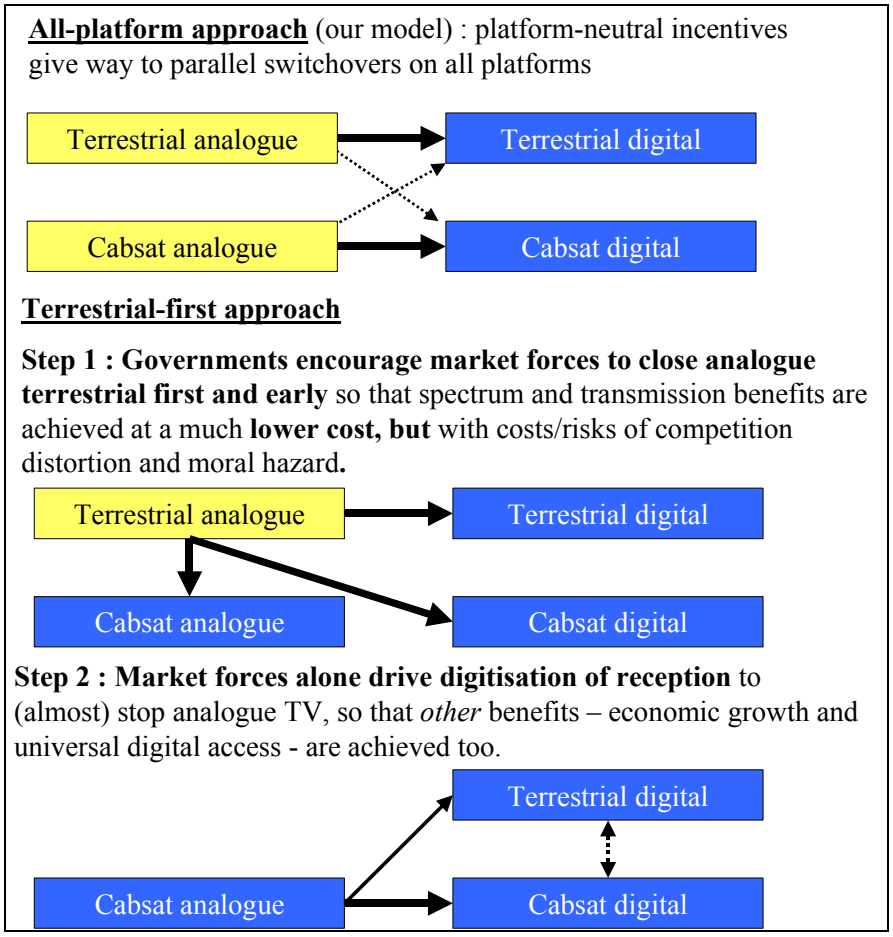
It may appear somehow theoretical, in our « platform neutral » model, to assume that *all* households need to migrate or be migrated, no matter what their original reception mode was. Indeed, to meet the *measurable* objectives of the model (transmission savings and spectrum gains), it is not necessary to migrate *all* analogue households immediately but *only* analogue *terrestrial* households.

This is why a similar model could be used to assess the relevance of a policy focusing on analogue terrestrial homes first, instead of all analogue households. In this case, the policy objective in the short-mid term would be to reach turn-off by migrating analogue terrestrial households towards cable or satellite (digital or analogue), or DTT.

For example in the case of Germany, we would no longer consider the cost of converting 95% of analogue households, but only about 10% of analogue terrestrial homes (maybe more if we consider terrestrial reception in secondary sets in cable homes). For similar measured benefits, the cost would be much lower ; therefore the net result would be much more positive.

But in that case we would be assessing something profoundly different. The non-measurable benefits, which derive from the digital completion (economic growth and social inclusion) would not be fully achieved, whereas the non-measured costs would be significantly increased. Indeed, if *terrestrial* turn-off was promoted, even if it was in a neutral way as regards the *destination* platform, it could result in competition distortion and moral hazard effects.

Figure 56 : Achieving measurable benefits first



Source : BIPE

4.6.5 The issue of the « mandatory digital tuner »

We have focused on one particular incentive measure aiming at accelerating the migration : the “mandatory digital tuner” (prohibition of putting analogue-only TV sets on the market). The pros and cons of such a measure are analysed in detail in the annexes ; we only describe the main conclusions here.

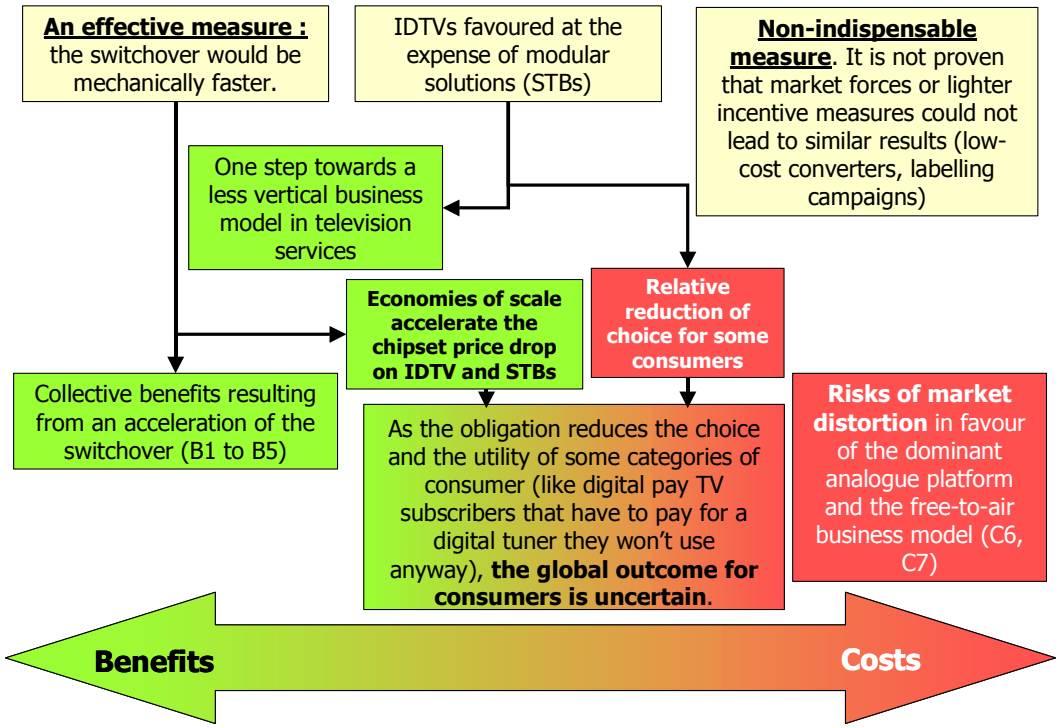
Firstly, this measure would obviously be effective in accelerating the reception switchover, by mechanically converting all receivers at the time of renewal.

Secondly we do not think, however, that such a measure is indispensable, considering that (i) conformity labelling and information campaigns could lead to a near similar impact on retailers and consumers behaviour, (ii) low-cost sell-through converters are arriving on European markets in 2002, and could lead to a dramatic acceleration of digitisation, if attractive free-to-air digital services are available and well-promoted in parallel.

Thirdly, we estimate that the net cost-benefit result is uncertain. It depends on (i) the national context (the initial reception mix and the penetration potential of digital pay TV), (ii) the assessment of non-measurable risks of distortion. Again, even if platform-neutral in its drafting, this measure would favour the dominant platform in the existing national analogue environment, and would benefit to free-to-air television at the expense of pay television.

Lastly, while a strict mandatory digital tuner could be recommended in some cases, because of its effectiveness and the scale effect it would trigger on chipsets costs, the analysis might be extended to full-service IDTVs, which would integrate several *other* features (API, EPGs, CAS) with a much heavier cost increase, and increased risks of market distortions.

Figure 57 : Summary of pros and cons of a « mandatory digital tuner" measure



Benefits	Inconveniences
Urging the migration and the analogue turn-off.	Risk of favouring the current dominant platform and FTA TV vs. Pay TV
Larger scale effects a decrease .and components costs	
In the long term, encourage new, lighter, non-subscription pay TV schemes.	In the long term, risk of discouraging digital convergence through modular digital television
Migration less expensive for some consumers.	Migration more expensive for some consumers.

5. Digital Radio

5.1 Synthesis

- Digital radio technology (DAB[105] essentially) is operational ; regulation is in place ; licences have been granted and some networks are being rolled out in major European countries. Major public broadcasters and some private ones also deliver some digital audio content. **The major problem is now on the reception side**: receivers are expensive, and consumers do not perceive a sufficient added value (compared with FM/RDS features and price) to be ready to buy them. This more generally raises the question of the business model of digital radio, and the involvement of radio players.
- Digital migration of radio is less advanced than the TV one. This can be explained by **specific obstacles that radio has to cope with**: new frequencies have to be found to simulcast analogue programmes and new expected ones (which is not the case with digital TV that can be simulcast in the *same* bands) ; very high digital receivers prices create a chicken-and-egg situation ; while payTV is a strong driver of TV digital migration a pay-radio business model seems not to be sustainable so far ; RDS, data services and free-to-air multichannel FM reduce the attractiveness of digital radio.
- Public-service broadcasters and satellite operators are the main supporters of digital radio. Among commercial broadcasters, new entrants support DAB, but some generalist radio broadcasters are more reluctant to accept DAB, while some are interested in DRM. Car manufacturers and consumer electronics manufacturers are not ready to invest in DAB radio and are waiting for third party involvement.
- Digital radio is not only terrestrial DAB broadcasting. It is also possible to use its satellite version (S-DAB). Other technologies are also developing such as DRM and other networks can transmit audio content : web-radios and mobile networks. This raises the question of the traditional business model of radio, but it may also be considered as an opportunity to develop radio audience and introduce new models and new revenues.
- These different ways are complementary and will be used to manage spectrum scarcity for FM. The major uncertainty lies in the long-term persistence of dedicated broadcast networks as dominant platforms or their relative marginalisation to the advantage of new networks and players.
- Facing these difficulties, digital radio backers are demanding the support of public authorities with the creation of a specific stable regulation and sufficient frequency allocation to create added value compared with FM radio. A policy signal is expected to ensure confidence of all other players (equipment suppliers, consumers, etc.)
- Lastly, digital radio success requires a spectrum compromise between terrestrial and satellite digital broadcasting, both having advantages for consumers.

5.2 Objectives of this section

In the context of a survey addressing essentially the digital TV migration issues, a focus on digital radio presents several interests:

- To compare the two situations, drivers and obstacles, highlight lessons from both migrations. Digital radio, less advanced than digital TV migration, could derive benefits from drawing on the DTV experience. And reciprocally, radio as a multi-channel FTA model, demonstrates some general features that can be extracted for some TV models.
- Digital radio and digital TV are two examples of the general digital convergence. Some technologies can cover both media for instance: DAB can be used to transmit mobile television, and DVB can also transmit radio programmes.
- Spectrum sharing between TV and radio is also a link between the two. Spectrum efficiency concerns both media assuming general efficiency for radio spectrum usage across the board is a major policy objective.
- The digitisation of radio, as the digitisation of TV, challenges traditional access (delivery mechanisms) : terrestrial vs. satellite reception, broadcast vs. on-line.

5.3 Players involved in digital radio

- **Radio broadcasters**. One should distinguish between public broadcasters with public service missions, and private broadcasters who try to increase their number of listeners and advertising revenues. Public players are supporting digital radio migration as a whole, whereas private broadcasters are looking for the best economic model in terms of revenues and benefits. The latter approach does not depend on the use of digital technologies.
- **Consumer electronics manufacturers**. Radio is only one dimension of global digital convergence. When arbitrating between product investment, manufacturers will first of all focus on high revenue, high margin products, which is not the case of radio receivers compared to other audiovisual equipment (TV, DVD).
- **Governments and regulators**. As a whole, Governments are favourable to digital radio as proven by plans adopted (legislation, licensing regimes, subsidies…) to promote it. In practice, DAB spectrum constraints make such deployment difficult. Extra bands are needed and licences, when delivered, are theoretical or still at a pilot stage in terms of operational broadcasting.
- **Consumers.** Analogue radio receivers are low cost devices offering numerous, free-to-air channels and with FM audio quality. In this context, the benefits of digital radio as presented by the DAB model so far are insufficient compared to its cost per user.

---

[105] Commercial name of the digital radio standard developed under the Eureka 147 project.

- **Car manufacturers**. Car manufacturers could be very influential in supporting the take-up of digital radio if they decided to equip their new cars with digital receivers. This would advertise digital radio to the public and decrease the cost of components thanks to economies of scale. **Transmission operators**. Radio is today broadcast over the air thanks to terrestrial transmitters. Nevertheless, it is possible to receive it through satellite or via the Internet. Radio broadcasting represents only a small part of the revenues of transmission service providers but the costs of broadcasting, even in digital, are not negligible for radio broadcasters.

5.4 State of development of digital terrestrial radio

DAB has been commercially available for 7 years (1995). Commercial licences have been granted in major European countries (Spain, the UK, Germany…). DAB technical coverage is quite heterogeneous : from 20% (Austria, France) to 80% (UK) or 95% (Belgium). But licences and coverage do not imply that digital broadcasts have begun (e.g. Spain), and when digital broadcasting is effective (e.g. UK), the audience is negligible.

According to interviews, some private generalist broadcasters have limited ambitions for DAB today and some public ones are questioning the cost of such services. The UK is one exception to this situation, where private digital broadcasters such as *Digital One*[106] *have* started up and where more than 178 digital programmes are available. But even in this best case, only 0.1% of the population owns a digital radio receiver.

Figure 1 : DAB standard story and frequencies allocation

	DAB Milestones		Frequency Allocation
1986	DAB R and D project start (Eureka 147)	**1992**	L band is allocated to DAB at the WRC Torremolinos conference
1995	BBC's first DAB programmes in Band III	**1995**	CEPT Wiesbaden Conference low band L is allotted to T-DAB
1997	DAB is acknowledged as a standard by ETSI	**2002**	Project to enlarge bandwidth (CEPT)

Source : BIPE, Coutard report

[106] See http://www.ukdigitalradio.com.

5.5 Main issues

5.5.1 Technologies for reception

The DAB standard

The DAB technology was developed within the Eureka 147 project and was recognised as a standard by ETSI[107]. This standard is a reference for digital terrestrial radio in Europe, Canada and some countries in Asia. In fact there are 2 sub-standards: T-DAB for terrestrial and S-DAB for satellite broadcasting.

DAB technology supporters, gathered within the *WorldDAB Forum,* estimate the technology is now mature enough to enable a large-scale commercial launch. *AER*[108]*,* essentially gathering together private broadcasters, officially supports DAB as the successor of FM radio but in practice, some major radio broadcasters estimate that the DAB does not adequately support associated radio services (datacasting), which decreases its overall attractiveness in terms of forward-looking business models. Some broadcasters also believe that the standardisation process is not flexible and rapid enough to update the standard. In the meantime recent and alternative standards are developing.

Digitisation of AM radio (DRM[109])

Large commercial radio broadcasters (talk stations) think that the high quality of DAB sound does not offer significant benefits. They prefer to focus on ensuring large coverage (cities and main roads) with only one frequency at the scale of a country or even a continent). This is the proposal of the DRM consortium that aims at the digitisation of medium wave in AM (amplitude modulation).

This technology enables the analogue / digital simulcast, which does not require finding new frequency slots.

Satellite radio

Continental coverage can also be ensured thanks to satellite broadcasting. This is possible in the DAB framework thanks to S-DAB or other standards.
Several satellite radio projects have been commercially launched:

- *World Space*[110] operates 3 geo-stationary satellites covering Africa, Latin America, and Asia. Price of receivers is around € 50, initial pricing (between € 150-450) was too high compared with the purchasing power of potential listeners ;

[107] Digital Audio Broadcasting - European Telecommunications Standard (ETS) 300 401 V1.3.3 (2001-05). http://www.etsi.org.
[108] The Association of European Radios (AER) is a European association that represents approximately 4,500 private radios stations in nine EU Member States and Switzerland. http://www.aereurope.org.
[109] See http://www.drm.org.
[110] http://www.worldspace.com.

- *Alcatel* is also supporting satellite digital radio service for users such as trucks in Europe ;
- *Global Radio*[111] is offering radio sat services in the US ;
- *XM Radio*[112] and *Sirius*[113] address coast to coast listening for US trans-continental cars and trucks. XM Radio, launched in 2001, is supported by General Motors and others car makers. Consumers can buy the receiver (about €300) or pay a monthly subscription (≈ € 10) for hearing free to air radio.

Figure 2: S-DAB advantages and drawbacks compared to T-DAB

S-DAB advantages	S-DAB drawbacks
Lower cost terminals (€50).	Uncertainty of reception in urban zones (discontinuity). Terrestrial repeaters necessary.
Larger choices of stations.	Limited satellite exploitation life-cycle and malfunction risk/redundancy overhead.
Single continent frequency.	

Advantages of S-DAB and T-DAB can make them complementary (as in general satellite and terrestrial broadcasting): S-DAB is well suited to road reception, to national or international programming; whereas T-DAB is well suited for urban broadcasting (fixed or mobile), and local content broadcasting.

Digital radio through digital TV packages

Audio services are available through cable and satellite, via digital pay-TV packages (existing terrestrial radio stations + special music services[114]) or even analogue cable. As an example, in France, more than 2 million people listen regularly to the radio via their pay TV bouquet (cable or sat), and 1 million *every* day[115].

Radio over the Internet and mobile

Today the web gives access to numerous terrestrial radios from all over the world in addition to specific Web-Radio stations and on-demand radio services[116]. But this assumes ownership of a PC connected to the net (20 to 40% households in Europe). It is also possible to listen to FM radio on GSM terminals (not over the GSM interface, but separately) because the cost of FM is small compared with the cost of the mobile terminal.

[111] http://www.globalradio.lu.
[112] http://www.xmradio.com.
[113] http://www.siriusradio.com.
[114] Example : Music Choice (www.musicchoice.com).
[115] Source : Médiamétrie
[116] Exemple : http://www.dioranews.com.

This should also be possible on UMTS terminals, but in digital form, via transmission of files with formats such as MP3. This possible enlargement of terminals and access will put into play the issue of territorial rights, especially music rights which are managed separately in the case of dedicated radio terminals today. Multicast limitations imposed by the Web will also be a limitation to a general deployment (quality of service and size of audience versus capacity).

If generalist talk radio remains popular in the future - a reasonable assumption - terrestrial broadcasting will remain economically justified compared with point-to-point models (narrowcast or multicast).

5.5.2 Why radio should go digital

Some radio broadcasters consider digital radio as a question of survival in the long term. Audio services will always exist, but as seen above, digitisation of content, transmission and multipurpose receivers could squeeze out the possibility of having a dedicated radio platform with its own players, services and listeners. The fact of having a dedicated platform could maintain the existing value chain. If not, alternative, third-party digital platform operators will enter the game, and this could reduce radio specificity as it is understood today or even break the radio business model.

Some radio stations are also concerned by FM band saturation, which prevents the launch of new services or coverage extensions in order to roll-out nation-wide networks and branding (which is appreciated by advertisers).

Other radio players highlight the fact that FM radio is still progressing in terms of listeners and advertising revenues whereas FM technology is mature and the number of stations is stable. They don’t see the opportunity for developing more radio channels or improving sound quality much.

5.5.3 Earlier radio migrations - precedents

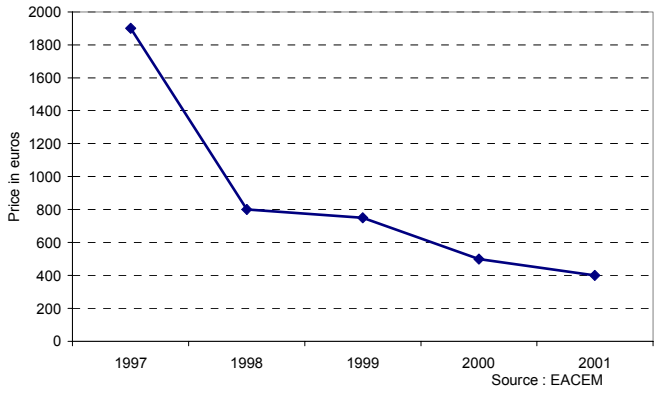
The most obvious precedent is FM/AM simulcast. Created in 1933 in the USA, FM was introduced in Europe in the 50’s (1955 in the UK, 1961 in France) to overcome the saturation of the low and medium wave bands and to bring a better sound quality. More than 30 years of simulcast AM/FM were necessary to substitute nearly completely AM by FM listening. This lengthy duration covered network deployment, frequency release, launch of music channels (the killer application), and diffusion of FM functionality through the installed base of all the receivers.

5.5.4 Major obstacles to digital radio migration

Obstacles to digital radio are numerous and more difficult to overcome than those ones of digital TV migration.

- **Receiver cost**. A survey mandated by the *WorldDAB*[117] indicated that consumers are ready to pay an extra 50% compared with an equivalent analogue receiver[118]. However, prices of receivers today are far above this psychological ceiling. As shown in the next figure, DAB receivers were priced between €400 and €500 at end 2001. Recent initiatives of chip manufacturers should further reduce prices thanks to an OEM strategy[119].

Figure 58 : DAB car-radio prices evolution



- **Low consumer awareness** (and information).
- **No pressure to release the FM band**. DAB is costly in terms of bandwidth used and difficult to insert in existing radio bands. As a consequence, it requires allocating new bands or the release of existing radio bands (and termination of some analogue radio services).

  But the quantity of spectrum released by terminating analogue radio services is much less significant than the potential release of spectrum following the turn-off of analogue terrestrial television broadcasting.

---

[117] World Forum for Digital Audio Broadcasting. This association gathers broadcasters, equipment manufacturers (professional and consumer equipment), administrations and experts. (http://www.worlddab.org).

[118] WorldDAB : « The Market potential for DAB » (1997).

[119] British firm Radioscape and Texas Instruments recently announced that they have managed to fit all the basic components for a digital radio into a software and hardware package smaller, cheaper and less power hungry than before. As a result, manufacturers could be able to bundle in a digital radio with a variety of other devices, such as mobile phones and portable digital music players. Using the chip, they could be able to produce portable radio sets costing less than £100, which is considered to be the minimum psychological threshold for acceptance. Digital One, partly controlled by NTL, entered a £3m joint venture with Imagination Technologies to produce a cheaper generation chip which is also intended to put the cost of receiver below £100 for Christmas 2001.

- **No pay model driver**. TV has a strong digital driver thanks to the PayTV model. Radio has been almost exclusively a FTA model until now.
- **No clear killer application** : Together, FM and RDS already combine a certain degree of quality with important data services (TPS – traffic information).
- **Lack of interest for higher quality sound**. Commercial broadcasters are targeting best audience time. Primetime for radio is in the morning and during car "rush hour" travel periods. The in-car listening situation is not the most sensitive to hi-fi sound. Quality certainly is a benefit but can not be considered as a killer application in such contexts. Nevertheless, past experiences showed that packaged media educate consumers to demand better quality, and that real-time media adapted their quality to this new demand. Phonograph stereo pushed market players to adopt FM; CD/DVD sound (and image) will also push quality of sound for radio (and for TV).
- **Lack of interest from carmakers**. Support from car manufacturers could be significant for overcoming the chicken-and-egg situation by triggering the consumer interest and mass-market uptake. For instance, the RDS roll-out was supported strongly by carmakers because they specified the feature in their own factory-fitted car radios. According to *WorldDAB*, *Ford* has planned DAB integration into some of its cars by 2003. However, many car manufacturers don't see the interest in equipping their vehicles as long as there are few attractive digital services and no European services. Manufacturers seem to be more interested in the supply of pay services associated with the car use (such as e-commerce, traffic information, location…) rather than with free-to-air listening. As a consequence, they don't invest in promoting others' technologies that will not generate revenues.
- **Necessity of a European market**. Low cost receivers requires addressing mass markets. Different national timing in the digitisation of radio does not create the conditions or incentives for achieving critical mass.
- **The installed base of receivers**. There are between 3 to 5 radio receivers per household, many of them being lower cost receivers. To replace such an installed base means achieving low costs and/or to supply attractive, new services.
- Other standards apart from T-DAB are possible, FM digital[120] in the US for instance. This competition may reduce the mass-market achievement in Europe.

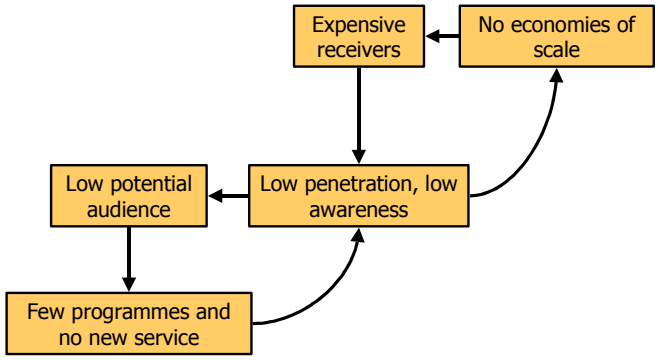
[120] IBOC system – digital service is transmitted "in band" with the analogue service so no additional frequency is required.

- **Lack of radio spectrum capacity** (spectrum uncertainty) for T-DAB. The DAB multiplex is much larger than one FM channel: insertion in the FM band is not possible, spectrum efficiency is poor. As a consequence, it is not possible to broadcast many new stations without other bands being allocated in addition.
- **Multi-channel is already a feature of analogue (FM) radio**: additional services will have a marginal effect.
- DAB **license** has been sometimes delayed, restricted to pilot projects with no legal certainty, or restricted to public broadcasters.

All these barriers are creating a chronic chicken-and-egg situation:

- Receivers remain expensive because there are no scale effects. This reduces audience and revenues of radio broadcasters who demand that manufacturers decrease receiver prices in order to provoke a mass-market and to trigger mass audiences ;
- There is no specific advantages in digital radio, no killer application, nobody buys digital receivers, the audience remains negligible, and prices stay high.

Figure 59 : A double chicken-and-egg situation



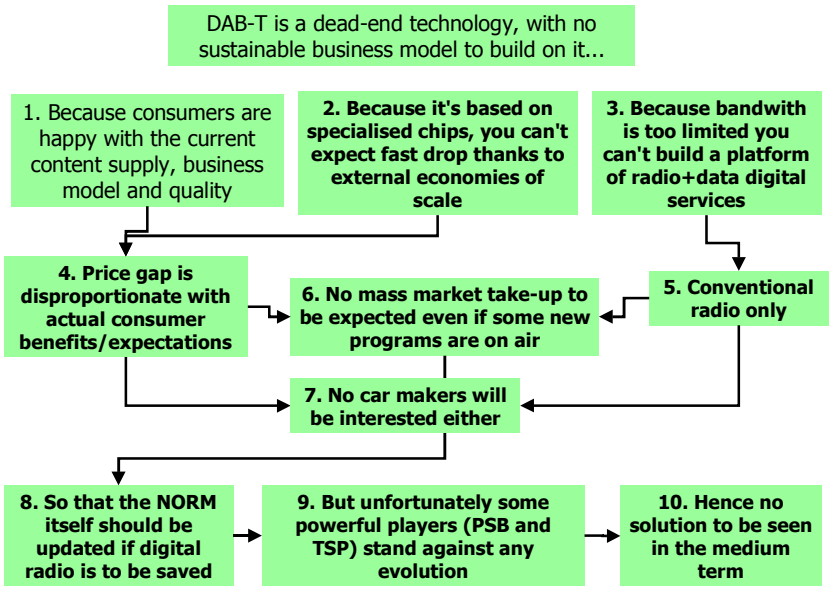
Source: BIPE

With the same technology, this dead-end can be overcome if:

(i) radio broadcasters subsidise digital services to initiate an audience (this is the case today)

(ii) equipment suppliers (car and radio manufacturers), or even broadcasters, accept to subsidise the receivers to reduce then public cost (this is not the case today)

Figure 60: Is DAB-T a deadlock : the view of commercial radio broadcasters



Source: BIPE

Figure 61: Digital TV and digital radio drivers

Digital TV	Digital Radio
High potential of frequencies to be released at the ATO	Low frequencies not potentially interesting for telecom operators. No simulcast in the same band and uncertainty of analogue frequency release.
Low cost digital-analogue converters (€ 150) to watch FTA channels on existing receivers	No DAB/FM converters
Integrated receivers can support marginal cost increase due to digital/analogue function (€50 extra cost for an average price of € 500, i.e. +10%)	Digital radio receivers are much more expensive than analogue FM receivers.
Pay-TV audience initialisation and public general awareness of digital technologies. Economies of scale of Pay-TV technologies also reduced the cost of FTA equipment.	No Pay Radio business implemented or planned.

Source: BIPE

5.6 Solutions

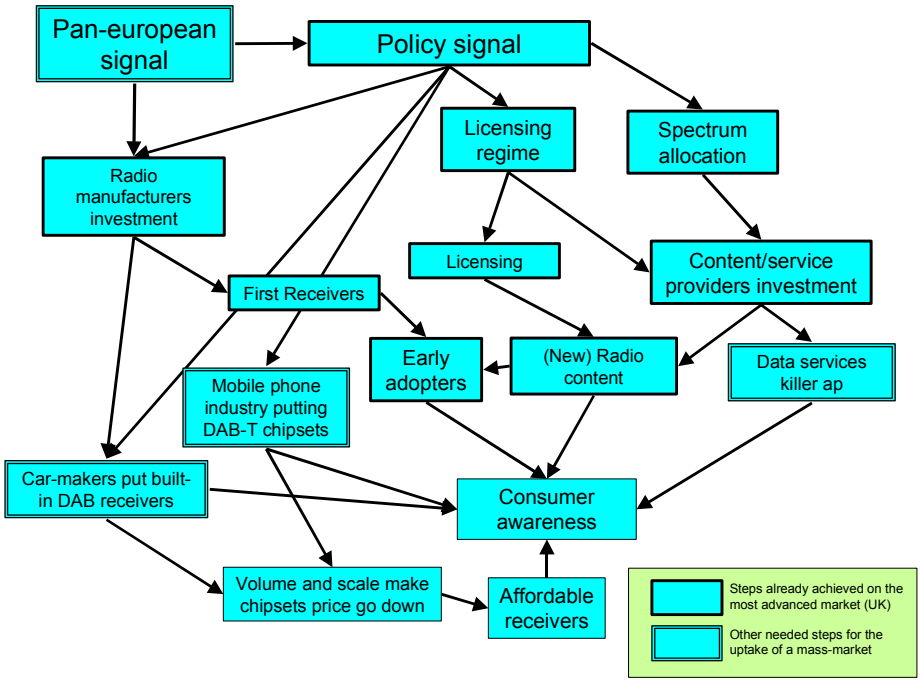
DAB supporters now estimate that this standard is largely accepted by the industry. The second step would be to have a stable regulatory framework to install confidence of all players of the economic chain.

This also fits the conclusions of the Coutard[121] report which aim to:

- Give a definitive legal status to digital radio, and to decide finally on a unique, definitive frequency band in Europe
- Send a positive public signal at European level, to reduce uncertainty to manufacturers and dealers
- Improve the DAB standard
- Open bands to both terrestrial and satellite radio

However, it should be noted that there is a risk of requesting regulators and the States to take the risks that public and private players are not ready to take, and to support a non-sustainable model (business inhibition effect).

Figure 62 : The virtuous circle expected by DAB supporters



Source: BIPE

[121] L'avenir de la radio à l'ère du numérique (Rapport de Mme Anne Coutard au Ministre de la Culture, Septembre 2001) (http://www.culture.gouv.fr/culture/actualites/rapports/coutard/coutard.pdf).

6. Conclusions and recommendations

6.1 Main findings

6.1.1 Market mechanisms and the migration

Thanks to a better understanding of classic mechanisms at work in migrations, a comprehensive approach of market players strategies and consumer behaviour, we are now able to identify the main drivers and obstacles to the digital migration. In particular we have insights on how far market forces can drive the migration and what kind of inefficiencies in markets (or market failures) prevent market players from moving further or faster.

General market drivers and migration phases

1. A distinction must be made between **two categories of technological migrations**: **adoption migrations** (technological innovation leads to a "killer application" which is adopted *en masse* by consumers) and **purely technological migrations** which modify production modes without having a major impact on the final value perceived by the final user.
2. **The transition to an all-digital television is based on these two historical frameworks**. After digitisation of pay digital television subscribers (phase 1), the two frameworks can be envisaged for terminating the digital migration, in parallel or successively: (2) adoption-migration by consumers spontaneously equipping themselves with digital terminals ; (3) technical-migration within the framework of industrial actions or public policy, to convert the last reluctant consumers and thus achieve the expected benefits of analogue turn-off.

DTV migration drivers and phases

3. **This study introduces specific terms** in order to differentiate between different notions and phases within the digital migration from an all-analogue television towards an all-digital television in the future. **"Turn-on"** refers to the introduction of digital broadcasting. The **"switchover"** refers to the switch for analogue to digital reception. Analogue **"turn-off"** (ATO) refers to the close-down of analogue broadcasting, which can implicitly occur only when the reception switchover has been (almost) fully completed. We, last, refer to **"post-ATO"** phases, where replanning and refarming of "releasable" terrestrial frequencies take place.

4. **Positive network effects** in a service are sometimes an obstacle to take-up but ensure strong acceleration after a certain threshold of penetration has been reached. Subscriber pay TV, like television in general, only displays *indirect* network effects, which is linked to the fact that it is a uni-directional means of communication (from the operator to the user). Therefore the growth rate is bound to diminish rather than to increase, and could saturate at a certain level.

5. In contrast, the functionalities offered by **"interactive television" could someday bring a *direct* network externality dimension to digital television**, as it offers the possibility of communication (including the user to the operator and even between users). This may lead to an acceleration of penetration for (interactive) digital television from the critical threshold of equipment provided by digital pay-TV.

6. Although the demand for technical quality is growing unceasingly because of the development of digital packaged media such as DVD (people become used to a crystal-clear picture), the **choice and** number **of channels remains the main incentive for consumers**.

7. The **willingness to pay demonstrated by European consumers**, when they perceive a clear added value in a new technology, goes well beyond the €100 to €150 additional cost they may have to pay in a near future to access digital television (through an external converter or an integrated TV set). As a result the problem is to find this or these "killer application(s)", in each national context, for each consumer segment.

Historic national TV landscape

8. The action of market forces and the process of migration will be **highly variable depending on pre-existing national television landscape**. The main distinction is between "terrestrial" countries where multichannel television is only available as a pay-TV offering and thus limited in penetration ; and "cable-satellite" countries where these platforms have been delivering basic or free-to-air multichannel television for a long time, which automatically reduces the attractiveness of pay-TV. This multichannel driver, either through pay-TV or free-to-air TV, will therefore facilitate the migration in the terrestrial countries, while "cabsat" countries will have to find *other* drivers/killer applications.

Limits to market-driven DTV migration

9. While the digitisation of pay-TV services has been fast, since driven by a clear business model, the digital migration in free-to-air or basic cable television face strong economic obstacles, which do no lie so much in the digitisation of broadcasting, but more in the digitisation of reception (the consumer switchover).

10. The pay-TV market is beginning to approach saturation in certain countries (decreasing growth rate). **The continuation of digital migration should therefore occur via free-to-air (i.e. non-pay) digital services, and by households equipping themselves for digital reception** on a spontaneous basis, i.e. without the operator subsidising the equipment, as has been the case with pay-TV.

11. The problem is that entire segments of consumers might be very reluctant and slow to migrate spontaneously. We identify the digital-reluctant (who are reluctant to accept either spontaneous equipment or digital pay-TV subscription, which include “Aunts Emily”) ; the opportunists (waiting for new subsidies) ; and next-generation viewers (who go directly to new mediaand have a with low interest in l “enhanced” digitaTV).

12. While the **benefits** of transition to an all-digital television are obvious in the long term (better quality, wider choice of contents and platforms, more competition…), the short-term benefits are not always clearly *perceived* by consumers. And they worry about the short to mid-term **costs** they may have to bear when swtching switch (conversion of receivers in the house). Besides, the announcement of terrestrial analogue turn-off, even with safeguards, can upset consumers and their representatives.

Market inefficiencies

13. **A large variety of players** are involved in the migration towards digital TV : regulators, television players, transmission service providers, electronics manufacturers and technology providers, other spectrum users. Therefore the objectives and strategies in question are multiple and multi-dimensional.

14. Within these categories, incumbents or first-movers do not necessarily share the same objectives as challengers/newcomers. The latter (in free-to-air broadcasting, pay-TV or consumerselections) would welcome a very fast migration and advocate policy intervention to accelerate the process ; the former, while taking advantage of DTV in the long term, would see an urged migration as distorting the markets and challenging their competition positions. Incumbents prefer to recoup the earlier investments in services and products, and exploit their oligopoly rent, before investing in new developments. All this makes the **strategic situation** a **highly unstable and uncertain one**.

15. An analysis of the players’ behaviour and strategy shows that, from the point view of classical economic theory, **imperfections in market operation exist**: rents linked to free licences in terrestrial and satellite broadcasting, co-ordination and moral hazard problems, etc. These structural factors prevent the market players from acting in accordance with the general interest and even with their own long-term interest in some cases.

16. In particular, **market forces alone are not likely to pave the way for a rapid and *total* digitisation** of households’ main sets in the medium term, let alone of *all* receivers, which would however be an unavoidable political prerequisite for any analogue turn-off.

17. The general interest benefits that could be expected from a rapid global digitisation and the ensuing analogue extinction are ***external* to market players**. They therefore do not have an incentive to take account of these in their behaviour. This is why, to a certain extent, we can speak of a “market failure” situation.

18. In this type of situation, economic theory suggests that it is **justified for public authorities to intervene** and modify the markets’ operating mode by introducing corrective mechanisms or incentives.

19. Conversely, certain imperfections in market operation can derive *precisely* from the fact that **some players anticipate intervention by public authorities** in their own strategy, which can lead to moral hazard effects or other market distortions, and can make them try to influence public authorities in the direction they anticipate, in a ways that suit their strategies.

DTT case

20. **The most controversial objectives as regards digital television** relate to the introduction of digital terrestrial television, its modalities, and the planning of analogue turn-off. It supporters typically include: Governments, consumer electronics manufacturers, advertisers, independent channel publishers, newcomers in DTV technology, free-to-air broadcasting, pay-TV, i-TV. Its opponents include existing pay-TV players (operating via satellite and/or cable), satellite operators, cable operators and dominant free-to-air broadcasters.

21. We must **distinguish the concepts** of the "sustainability" of the pay-TV players using DTT and the long-term sustainability of (digital) terrestrial broadcasting as a delivery mechanism.

22. The difficulties and risks of failure of DTT-based pay-TV players is above all the **failure of vertical, "me-too" business models on maturing markets**. Satellite-based second-movers experience similar difficulties.

23. The **cost-competitiveness** of the delivery mechanism for commercial players has yet to be proven. Only major free-to-air broadcasters clearly have a reason to pay for a near-nationwide digital terrestrial broadcasting. For all other players, it will depend on national/local conditions and business models.

Cable

Contrary to DTH-based pay-TV operators, broadband cable operators seem to prefer to **maintain analogue simulcast** on their networks to address low-ARPU, pay-TV-reluctant subscribers, rather than losing them by turn-off or having to rent them a subsidised STB. In the long term, low-cost and sell-through digital converters could change things. Thus market forces can drive the switchover of cable households to a large extent. We believe, however, that the **switchover completion won't be universal under the action of market forces** alone.

24. A non-universal digital penetration in cable may appear less detrimental than in terrestrial, considering that analogue cable subscribers can often access basic multichannel. But if policymakers want digital reception to be really universal **some policy options can be envisaged** to complete the digitisation of cabled homes.

25. Among these measures, the incentives for consumers to buy STBs should be extended to horizontal cable STB. Encouraging indoor DTT reception and more actively fighting undue restrictions on terrestrial and satellite reception would help basic analogue cable subscribers to access free-to-air digital delivery mechanisms if they want to. Besides it would **put competition pressure on cable operators**, so that they might be more likely to make "digital propositions" to even low-ARPU households.

26. **The modalities of the roll-out of DTT could harm the cable economy** in two ways that could require public authorities intervention : the risks of interferences on existing cable systems ; the risk that new free-to-air channels on DTT might increase the must-carry obligations put on cable operators.

27. There is a **dilemma between broadband and DTV policies**. Pushing “digital” TV including on cable, in the short term, if prematurely and with too heavy regulation, might discourage investors from rolling-out broadband networks and services, and finally jeopardise the long term development of the information society.

6.1.2 Spectrum management and television

A thorough understanding of the potential consequences and opportunities resulting from the digital TV migration in spectrum management allows to foresee why and how spectrum efficiency objectives should be taken into account in planning digital switchover and analogue turn-off and post-ATO policy.

28. One of the benefits over time of the digitisation of broadcasting and reception of terrestrial television is a **potentially major release of spectrum** (several hundreds of MHz) once analogue broadcasting is definitively turned-off. This is made possible by the improved spectral efficiency of digital compared with analogue, notably thanks to possibilities for compressing and multiplexing digital information.

29. However, it also appears that this situation of abundance will be **preceded by a situation of relative scarcity during the ‘simulcast’** (period of simultaneous digital and analogue broadcasting), which is particularly difficult to manage in border areas.

30. This raises the question of **optimising spectrum management at European level** as uncorrelated management by countries could reduce this global efficiency in terms of time frame, coverage, quantity of spectrum available. **Co-ordination requirements** derive from two necessities : (i) avoiding interferences at international borders, and (ii) allocate the same band(s) to a given service throughout Europe (and beyond) in order to promote an open, dynamic internal market for consumer electronics and digital services.

31. The **access mode to the spectral resource is becoming a determining factor in efficiency**. In particular, the traditional technical-administrative approaches, which might be endorsed by international spectrum authorities, do not correspond to an **economic optimisation** of the spectrum and economic efficiency if the operators’ oligopoly rent is not recovered.

32. It can be observed from historical and current examples that such a mode of allocating the spectrum presents a **risk of competitive distortion.** In particular, the incumbents use technical planning rules or demand substantial bandwidths to reduce the quantities of spectrum made available to other operators or services, thus reducing the level of potential competition.

33. Furthermore, there is a second inertia and possible inefficiency factor in spectrum management due to the **installed base of receivers**. As such, the operators with an installed base using a certain frequency are not favourable to a modification of this band which would generate substantial costs, unless they can anticipate new revenues which would absorb this cost.

34. **Mobile telecom operators could become new users of the "broadcast" frequencies in the UHF band, that could be released after ATO**. These low frequencies could make perfect technical and economic sense for them in low-density areas. **However they do not express a clear demand for these frequencies**. This is because they have already secured and paid for the bandwidth they are going to need for UMTS in mid-term, and they also have already taken official positions in order to access additional frequencies, in higher bands, for longer term needs.

35. As far as television is concerned, there are five ways for improving the economic efficiency of spectrum management : (i) encourage analogue terrestrial turn-off, (ii) switch to a SFN instead of a MFN planning, (iii) encourage broadcasters and transmission service providers to use statistical multiplexing and new compression techniques, (iv) encourage more competition in the transmission services market (by enforcing third-party access to the essential infrastructures), (v) monetise the use of spectrum according to the quantity of Mhz used.

6.1.3 Public policy

With a view to address the market failures affecting television and DTV migration, and the stakes of spectrum management, we are now able to analyse, discuss and assess the public policies followed in these domains. While market failures in television and the objective of spectrum efficiency justify public intervention, some incentive measures and tools could create new inefficiencies on markets.

Scope for public intervention because of market failures.

36. **Five categories of general interest objectives motivate public intervention during the migration** : cultural objectives, social inclusion, competition, innovation and industrial competitiveness, efficient spectrum management. Public intervention should be aimed at correcting existing market failures so that market forces action can fulfil general interest objectives.

37. Focusing on DTT, we observe that among the four technical benefits that can be brought by this technology (more TV channels transmitted in the same bandwidth, less spectrum used, improved picture and sound quality, indoor reception), **most Governments have designed their licensing schemes so as to encourage multichannel**. However, other structures are and will be possible for DTT, especially after analogue turn-off when new decisions will need to be taken. In the long term, depending on policy choices on TV and spectrum, terrestrial broadcasting could deliver highly multichannel TV (like satellite and digital cable), or low multichannel TV (like today's DTT), or even focus on niche markets/uses.

Reasons for public intervention.

38. We think the **specificities in national policies come from three main factors** : (i) national trade-offs between the different above-mentioned categories of general interest objectives (which sometimes cannot all be achieved simultaneously), (ii) the national TV context (notably the reception mix and the situation of competition), and (iii) the influence of the different national players.

39. In some countries public authorities have a **special agenda for digital terrestrial television**. This particular focus is first justified by their responsibility in spectrum management, which is a scarce, public resource. It also derives from the still dominant position of terrestrial reception in a number of member states. Besides, even in other countries, where main sets are mostly connected to satellite or cable, terrestrial reception is often used for secondary and tertiary sets in the home.

40. In some cases, though, there might be **other motivations** for public intervention. For instance in terrestrial countries, policymakers might be tempted to regulate market forces' action so as to maintain the current analogue « reception mix » in the future. The reason is that national control on services or contents appears to be easier to implement in the context of terrestrial TV, which is a national, territorial infrastructure. Such a "teleological" approach of regulation could be also considered a "bureaucratic failure".

Aspects of and criteria for public intervention decisions.

41. In the framework of the migration towards an all-digital television, two important choices must be made by national policymakers : a **choice of infrastructure and a choice of timing.**

42. Firstly a choice of infrastructure. The digitisation of all delivery mechanisms and convergence reduces the scarcity of transmission capacity. This raises the question of the role of each delivery mechanisms in the future. Given their responsibilities for spectrum management, governments will have to decide to what extent the frequency bands currently used for terrestrial broadcasting should continue to be used, exclusively, for television. Hence the **alternative between a "triple way" and a "cabsat way"**.

43. Then Governments have to make some decisions over the regulation of the process and the timing of the migration. Should policymakers regulate markets with a view to **accelerating the migration process** (and if yes to what extent and how?), or should they let market forces act under existing regulation ? An acceleration of the process would of course **allow the country to obtain the benefits expected from the digital migration earlier.**

Impact and effectiveness of public intervention.

44. We have conducted quantitative simulations. The results show that the best **infrastructure choice depends on the initial reception mix in a given country and the spectral opportunity cost**, which derives from the assumptions about the economic value of the "releasable" frequencies. Unsurprisingly the "triple way" appears more relevant in terrestrial countries, and the "cabsat" way in already cabsat countries. But the opportunity cost in terms of competition (2 delivery mechanisms instead of 3) could affect the latter assessment.

45. **The acceleration of the migration through incentive policies can also be relevant**, macro-economically speaking, in certain national contexts (residual number of analogue households/receivers to be migrated) and under some assumptions on interest rates, Mhz value and evolution of the cost of digital converters.

46. **The net result** of the macro-economic cost (earlier investment in converters) and the macro-economic benefits (years of transmission savings and spectrum gains) can determine, under the assumptions of the model, the convenience of public intervention to accelerate the turn-off. But then some non-measurable benefits (faster and more universal access to information society) and costs (risks of competition distortion, business inhibition and moral hazard) must be taken into account to make a complete policy assessment.

The range of tools for public intervention.

47. Of **all the possible tools** that can be envisaged to overcome market failures and achieve general interest objectives, only some of them have been implemented so far by European Governments.

48. Nearly all Governments have designed **licensing schemes** for DTT. Several Governments have issued **migration roadmaps** and timeframes, thus sending signals enabling all involved market players to co-ordinate their expectations and investment cycles (therefore accelerating the migration in a self-fulfilling way). Some are encouraging **explicit labelling** of TV receivers in order to increase consumer awareness and push consumers, retailers and manufacturers towards digital-compliant receivers. Some Governments envisage **subsidising the investments** of broadcasters and consumers. Some policy makers envisage **prohibiting purely analogue receivers** so as to prevent the expansion of the installed analogue base.

49. All these measures can be effective to some extent but they all create **risks of perverse effects** if they don't follow some regulatory principles such as platform-neutrality (see horizontal recommendations).

50. We have discussed the modalities, pros and cons of such policies. We also suggest **incentive measures on current and future potential users of the "broadcast" spectrum** (see recommendations).

6.1.4 Digital radio

51. Though technologically ready, with licences being granted and already on air in some countries, digital radio is **nowhere in terms of actual reception**.

52. This is because digital radio faces **a number of specific obstacles** that are worse than those affecting digital television : need to find additional frequency bands, strong chicken-and-egg problem due to still very expensive receivers ; absence of pay business model because FM is free-to-air and multichannel ; digital sound quality not necessarily a powerful driver given listening patterns ; and the fact that some automobile manufacturers are not ready to invest in factory-installed digital radios.

53. Digital radio will probably be delivered through a **much larger variety of technologies** and platforms than analogue radio, which is essentially terrestrial. These will involve broadcasting or point-to-point, online or on-air, satellite, terrestrial or cable delivery, DAB, DVB or DRM technologies. These techniques will be competitors but very complementary for consumers and broadcasters.

54. **Digital terrestrial radio (DAB and DRM) will probably be the successors of FM and AM** in the long term. This is the first choice of traditional radio broadcasters who want to keep a dedicated distribution platform, rather than becoming dependent on platform operators or access providers. The DAB norm is widely accepted by broadcasters, even if some consider it too sophisticated for mainstream radio.

55. Of course audio broadcasting will always exist, no matter which delivery mechanism becomes dominant ; therefore the question of **the future role of a horizontal, broadcast terrestrial delivery platform is more a political issue**: radio broadcasters seem to consider that it is a condition for maintaining their editorial independence.

56. To help **break the current chicken-and-egg** situation and give a chance for digital radio to take off, its supporters (mainly broadcasters) need more licensing certainty (not only pilot experiments) and policy signals to help them trigger the confidence and co-operation of key players (automotive manufacturers, consumer electronics manufacturers).

6.2 Recommendations

6.2.1 Purpose of this part and general considerations

The purpose of this final part of the study is to provide general and, when appropriate, **operational recommendations for national and European authorities,** in order to encourage the extent and speed of migration to digital broadcasting (radio and television).

However, the **primary responsibility in the switchover process lies with market players**, as it is normally the case with the introduction and promotion of any new technology on the market. The present study provides enough indications for the **success factors** market players should work on, in order to accelerate and extend digital broadcasting uptake. Most of these are summarised in the previous "Findings" sub-section, such as : develop DTV "killer applications" in particular (contents and services) to attract consumers who are of course not interested in the technology itself but on the added-value from it ; develop "killer applications" for *non-subscription*-based DTV, as digital pay TV is now starting to mature and the classic multi-channel driver is not so attractive in "cabsat" countries where analogue multi-channel television is already accessible free-to-air on satellite or basic on cable ; provide a large variety of affordable equipment to receive FTA DTV ; improve consumer information and promotion regarding DTV benefits and possibilities of access (many consumers are unaware or confused about DTV and often don't distinguish it from pay TV), etc.

The above are big challenges, requiring major concerted efforts and investments to attract consumers to DTV. However, the study shows that the current DTV market is relatively fragmented and unstable, with many players, not all commercially viable in the medium term, who sometimes send contradictory messages to consumers. In this context, there is **scope for co-operation between market players at different levels of the broadcasting value-chain** (R&D, contents and services, transmission, customer service, reception, marketing, etc) insofar as the switchover is a shared goal. Public support should encourage these efforts and only intervene more directly if justified under general interest grounds.

Under certain circumstances, **efforts from public players and market players should be pursued in parallel and be complementary**. Moreover, the large number of parties involved in the switchover process recommends some global co-ordination which is best provided by public authorities. Finally, public authorities have exclusive competence for certain aspects relevant to the switchover (e.g. spectrum management and licensing, broadcasting and communications market regulation, tax policy, etc). All of these reasons justify the present recommendations for public authorities, with the mentioned provision that the switchover process should essentially be a market-driven one.

Finally, in these recommendations, as in the rest of the study, there is a **special focus on terrestrial broadcasting** because (i) this delivery mechanism is at the centre of the switchover/spectrum debates, (ii) benefits from analogue turn-off are more obvious for terrestrial (spectrum efficiency gains, decreased transmission costs, released frequencies), and (iii) terrestrial SWO and ATO present specific obstacles, which explain a greater tendency to public involvement.

6.2.2 General principles for policy intervention (horizontal recommendations)

Any public intervention regarding the SWO, at national, sub-national or international level should require a previous analysis of the **necessity** for such intervention. This could be in particular justified by the existence of **structural market failures**, which jeopardise the achievement of certain general interest objectives by market forces alone.

Then policymakers should define the areas targeted, the measures to adopt, and their parameters in terms of nature, intensity and timing.

- Nature: measures should be kept **technology and platform-neutral**, not to unduly favour certain market choices.
- Intensity: measures should be **proportionate** to clearly identified objectives.
- Timing: measures should not be too premature or late, but well-adapted to market developments[122].

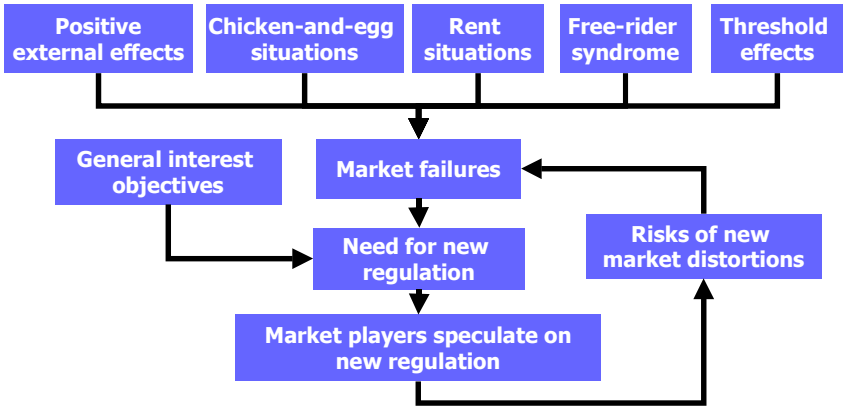
These three safeguards should minimise the risk of public intervention creating more market problems than it resolves, and notably avoid:

- Competitive distortion: public intervention could favour certain commercial/technical solutions over others.
- Inhibit or over-stimulate action by market forces leading to outcomes that are unsustainable in the longer term: decreased investments, reckless risk-taking (moral hazard), etc.

All these general principles for policy intervention, if applied to the digital migration may help to find the best compromise between correcting existing structural market failures, and not creating *new* market failures deriving from public intervention or the *anticipation* of public intervention by market players. These ideas are summarized in the figure below.

[122] Attention is drawn to the argument in the technological migrations' section of the market chapter concerning the three phases of the SWO, and the general recommendation to reserve public intervention essentially for the last stage of the process.

Figure 63 : Reasons to regulate and reasons to regulate carefully



6.2.3 Recommendations to national authorities (14)

6.2.3.1 Overall switchover strategy

1. National switchover roadmap and action plan

Description. Draw up a national SWO roadmap with objectives and target dates. To achieve them, establish a national SWO action plan defining criteria, actions and responsibilities, indicators of achievement, etc.

Justification. Under certain circumstances, we saw that it could be in the national interest, macro-economically, to accelerate SWO through public intervention, so that it moves faster than under market forces alone (see cost/benefit section in the Public policy chapter).

But the SWO process is long and complex one. We saw that strong cross dependencies exist in the section on players' strategies in the Market chapter. Therefore a smooth switchover requires co-ordination between many actors and interests. Short term individual players' interests don't necessarily coincide with long term national interests (external benefits). The same may apply even between short and long term interests for the same category of players, so that those players don't want to internalise the costs from actively pursuing SWO and are tempted to wait for SWO/ATO benefits without contributing to the necessary efforts (free rider syndrome effect).

In this context, a roadmap and time-frame could provide some degree of certainty on market evolution, and create common knowledge and expectations amongst the players involved. This would then facilitate players' decisions and investments, encourage co-ordination around common objectives in response to known future scenarios, so as to ensure a faster and more efficient process, for players themselves as well as for Society.

Implementation/tools. Broad consultation involving all parties (authorities, consumers, operators, manufacturers, etc) long-term plan global covering all main aspects of the SWO complex process, i.e. multi-platform (cable, satellite and terrestrial including spectrum aspects), infrastructure and reception, contents and services, consumers, etc ; regular progress evaluation and review by co-ordination groups where main parties are represented.

Many public policy tools in support of the plan can be envisaged, e.g. regulation (setting obligations or incentives), licensing conditions and obligations, tax measures, subsidies, etc (see range of measures under cost/benefit section in Public policy chapter). Some suggestions are given in other recommendations below.

Implications/feasibility. As indicated in the public policy chapter SWO/ATO objectives/targets should be sufficiently rigid to be useful but flexible enough to be credible (e.g. indicative ATO date associated to SWO progress criteria) and to avoid excessive risks of market distortion.

Then setting SWO/ATO objectives/target dates is in itself an easy task, but not so much to define appropriate ways and measures to achieve them.

Politically, resistance could arise from various parties: e.g. incumbent operators (who tend to favour the status quo), consumer associations (afraid of financial burden), leading pay operators (afraid of advantages given to other operators who made less investments in DTV), etc. There is a need to get them on board and achieve broad consensus. The process should define realistic objectives and secure the involvement of the main players to maximise chances of success.

Secondly, some players, especially those with less favourable market prospects, are likely to try and push for policy intervention and influence public policy in their interest, notably by using general interest arguments (e.g. consumer protection, media plurality, digital divide, etc).

Economically, if issues are not approached in a global way that caters for the complexity of the SWO process within national circumstances, the market place could be distorted and certain SWO options favoured in a detrimental way for the achievement of overall public policy objectives, e.g. too exclusive focus on digitising certain TV delivery mechanisms. It is necessary to look for synergies and complementarity between different elements rather than focusing on exclusive solutions.

Secondly, there is a risk of discouraging market efforts if public authorities assume most of the responsibility for SWO (see above comment, under general principles for policy intervention, about inhibiting market forces). So before making official announcements it is necessary to identify responsibilities and obtain commitments from main market players. Moreover, objectives under the SWO action plan should not constitute an "obligation of result" for public authorities, which might then feel obliged to take disproportionate measures to ensure its realisation, but rather *indications* given to market players in order to build common knowledge and help co-ordination of expectations.

Legally, any SWO financial incentives (subsidies, tax deductions, etc) may require clearance under EU State aid provisions.

Avoid announcements of early/rigid ATO dates; these are counter-productive in terms of the credibility of the SWO process. Avoid too exclusive focus on certain DTV options, e.g. public broadcasting only via DTT, if difficulties and costs involved are excessive in the national context considered. That could delay the overall SWO process.

Examples, best practices. National SWO action plans and target ATO dates in some MS. Consider multi-platform DTV penetration criteria e.g. UK penetration tests : coverage, penetration, affordability).

2. Financial instruments in support of the switchover action plan

Description. Financial support to SWO policy (expenses or tax reductions) could come either from the national budget or from a special fund fed with contributions from those parties most interested in accelerating the SWO/ATO process (including or not public authorities). This mechanism would be a complement to individual private investments.

Justification. Compared with, or in addition to, purely public funding or purely private financing, a dedicated fund would present several advantages. It would: (i) provide more transparency, (ii) require central co-ordination of effort by all interested parties and oblige them to decide in a consensual way the best use of the fund (iii) ensure that all incentive measures are kept platform-neutral.

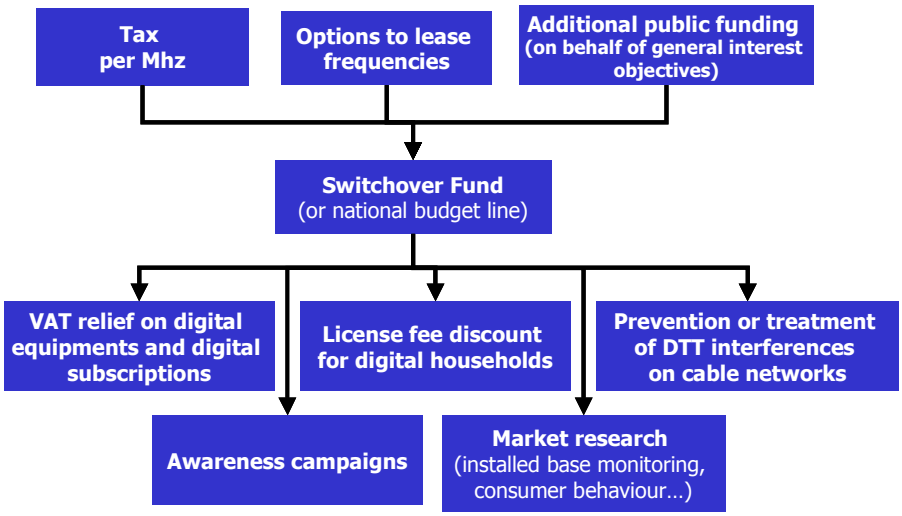
Implications/feasibility. Setting a SWO fund would require defining contributions from different players involved according to their position and interests in the broadcasting landscape and the SWO process. In political and practical terms, this wouldn't be an easy exercise. Market players could be reluctant to invest alone in accelerating the switchover if there was no mechanism to ensure all other interested parties also contribute (avoid the free-rider effect). Even if they agree to pay, parties concerned would obviously try to reduce their contribution, but this would depend on how explicitly market benefits would accumulate for them. For instance, some operators could accept financing the SWO (e.g. receiver subsidies) if the government committed to turn-off the analogue signal at a certain date, resulting in important transmission savings for those operators. Or some operators may accept to make financial contributions in exchange for promises to receive spectrum in future, at the time of ATO.

Managing such a fund could also be complex, in particular agreeing on the specific expenses to be made.

With regard to tax reliefs, public authorities and licence-fee-funded public broadcasters are always reluctant to lose money from taxes. They would normally compensate by raising other taxes.

Besides, such initiatives could raise concerns under EU State aid provisions regarding their detailed implementation.

Figure 64 : Possible resources and expenses of a "Switchover Fund"



The above figure summarises some of the financial flows related to the switchover.

In addition to private investments from market players, a policy intervention could generate money that could then be assigned to and invested in general interest measures aimed at accelerating the global process (mainly consumer incentives) through general State budget or a dedicated fund. The figure represents an extensive version of this idea ; it might also be implemented in more modest ways, with only some of the revenues or some of the expenses/actions mentioned here.

3. Monitor digital broadcasting market status and development

Justification. Availability of accurate and updated information on the situation of the national broadcasting market (infrastructures, reception, services, etc…) is essential to establish SWO targets and measures. This concerns in particular the installed base of TV sets. Indeed, the Cost-benefit section of the Policy chapter has emphasised that optimal SWO policy decisions are highly dependent on existing national reception "mixes" (cable, satellite, terrestrial, etc) However today, there is no clear vision of this mix, because of multi-set homes. Therefore policymakers, at national, and if possible EU level, should commission surveys on all the active receivers in households (secondary and tertiary sets, VCRs), in order to be able to consider *all* house terminals in the switchover and not only the main set (on which all existing surveys are based). This would be useful to design switchover targets and turn-off criteria based on all receivers, and not only main TV sets.

Implications/feasibility: Very feasible. Would be more useful if led Europe-wide with a common methodology to allow comparisons ; therefore EU action or co-ordination is recommended.

4. Define post-ATO policies and scenarios

Description. As part of the recommended DTV SWO plan above, or separately, the alternatives for post-ATO scenarios should be discussed and made explicit, notably regarding spectrum management: ways to optimise spectrum use; potential uses for released frequencies after ATO, etc. The Policy chapter and Spectrum chapter emphasised that while switchover policy is often detailed, very little thinking has been devoted so far to post ATO policy.

Justification. SWO measures are conditioned to a certain extent by post-ATO choices, e.g. implications for terrestrial transmission network upgrade if priority given to portability rather than number of channels.

To commit to and assume responsibilities in the SWO process, market players require some certainty concerning its final stage, so that benefits to actively co-operate can be identified, interests from relevant players made explicit and commitments obtained. Some of these players may be now watching the process from "the sides", waiting for developments and not wishing to be involved.

To a certain extent, decisions related to DTV migration are purely commercial. However, public authorities play and important role, e.g. in spectrum management, obligations imposed on cable networks, etc. It is important for market players to know public authorities' intentions and plans regarding these aspects.

There is scope for significantly improving spectrum management after post-ATO, e.g. through SFN networks and economic rather than purely administrative spectrum management, etc. Discussions on these issues should start sooner rather than later.

Implementation/tools. As for the DTV action plan, broad consultation involving all main players; creation of policy/technical experts groups to discuss spectrum matters; national governments/ regulators to make public their preferred scenarios in terms of technical coverage through each delivery mechanism, terrestrial network architecture (MFN, SFN), etc.

Government could publish White Papers on post-ATO policy to enable market players to react to their scenarios. The next step would be European co-ordination and country-per-country cost-benefit analyses to define the most efficient policy.

Implications/feasibility. Authorities might want to leave options open. Openly discussing post-ATO scenarios and arbitrages between conflicting interests may open the "Pandora's box" and complicate the SWO process rather than the opposite.

Incumbent players, public or private, may be reluctant to accept alternatives that challenge the analogue status quo, and they have enough power to influence public policy so as to block or change the orientation of the debate.

Examples, best practices. The British "Independent review of spectrum management" and public consultation on "DTV: the principles for spectrum planning".

5. Link broadband policy and digital television policy under information society objectives

Justification. Policy makers often justify DTV measures using information society considerations, e.g. to increase internet access, overcome the "digital divide", etc. For instance the British DTV action plan is explicitly related to a global policy objective of universal internet access by year 2005.

The Policy chapter has shown that there are economic and social benefits in encouraging a more rapid introduction of information society services: impacts on European growth and employment, international competitiveness of European companies in technology, services and content. Broadband networks can deliver state-of-the-art information society services.

Trying too hard to make digital television universally available could in some cases lead policymakers to encourage lower capacity ”narrowband” DTV solutions exclusively in the short-term, thus jeopardising the development of broadband platforms (and subsequently broadband services) in the long term[123].

Sufficient freedom should be given to market forces to develop high-end services, which are generally pay ones and therefore not universally available. A balance must be found between minimum DTV services widely accessible and added value services initially introduced at relatively expensive prices and afterwards, hopefully, becoming more affordable and widespread.

It is necessary to avoid premature and disproportionate universal access obligations on DTV services, which could create an excessive burden on certain market players, thus discouraging private initiative for more advanced solutions.

Implications/feasibility. Requires co-ordination of digital TV and information society development policies. Requires monitoring convergence development and take it into account into DTV policy in order to identify role of DTV in convergence. Monitor developments of “interactive” television services and target sustainable market progress. Know what “interactive television” services can and cannot viably do from a technology and commercial viewpoint at any given moment, and adapt policy and regulatory requirements accordingly.

6.2.3.2 Actions regarding industry

6. Ensure greater commercial freedom for digital TV and broadband services

Justification. As a general rule, preference should be given to digitisation of TV under the initiative of market forces. Barriers that hinder this process, i.e. certain licensing obligations or legal restrictions imposed on operators, should be identified and alleviated or removed if not justified.

Such barriers may affect cable operators in particular, which is relevant considering the role of cable in the introduction of broadband communications[124]: spectrum interference caused by DTT roll-out; excessive must-carry obligations (e.g. potential extension to new FTA DTT channels) without compensation ; restrictions/obligations imposed by local authorities regarding commercial offerings, access to cable networks, etc.

[123] However the opposite effect could also occur (DTV jeopardised by incentives on broadband development).

[124] See recommendation on DTV and broadband policies.

Cable operators need to have sufficient commercial freedom (in tiering the offer and pricing) and legal certainty to be able to design the long term business plans that they need to finance particularly heavy investments. This needs careful handling by cable operators and public authorities. In certain member States, a sudden transition from civic utility to a totally commercial posture could lead to a public backlash over affordability in certain countries, as in the United States.

Barriers can also affect satellite network operators : e.g. restrictions on satellite dishes imposed by landlords or local authorities on environmental or other grounds.

Also terrestrial operators may in some cases be constrained by service obligations that limit their capacity to find viable business models that would ensure DTT commercial sustainability in the long term. Moreover, in some cases, licensing and ownership restrictions, aimed at reserving DTT to new entrants and increasing the number of TV platforms on the national market, may excessively fragment the TV landscape, compromise the viability of certain TV players, and ultimately the viability of the network operator. There is a policy trade-off between ex-ante competition regulation and sustainability.

Implications/feasibility. Governments and regulators should arbitrate solutions (e.g. between DTT and cable to solve interference problems) and ensure appropriate legal frameworks which limit obligations on operators to what is necessary under clearly defined general interest objectives (e.g. reasonable and compensated must-carry obligations). This is something only public authorities can do.

It may be necessary to take a flexible licensing and competition law approach, where a trade-off between market concentration and commercial viability is found. DTT licensing schemes should perhaps not be a tool to achieve pro-competitive objectives. One major risk derives from allocating DTT licences to operators already present in other TV delivery mechanisms who, in fact, want to enter DTT to block its development (“Trojan Horse” strategy). Monetising the use of licences and/or Mhz could partly deter such defensive strategies but would raise financial barriers for newcomers at the same time.

7. Tax spectrum to encourage efficient use

Justification. As shown in the Spectrum chapter, analogue transmission is wasting a scarce public resource. For instance, analogue terrestrial broadcasters would use about six times less Mhz, if they transmitted their signal in digital form. Therefore spectrum users must have an incentive to optimise the use of spectrum, e.g. switch to digital and turn-off their analogue broadcast, or even spontaneously switch to *other* delivery mechanisms. Economic theory (Coase, etc.) suggests that taxation can be a scaleable and efficient incentive to achieve this. This is also a way of recovering incumbents’ oligopoly rents.

Governments should create a tax based on the use of the terrestrial radioelectric spectrum (on the quantity of Mhz used). This will create an incentive on commercial and public users of spectrum to internalise its cost and thus optimise its use on the different communication networks by accelerating digitisation.

Implications/feasibility. To avoid any competition distortion, the tax should apply to every commercial spectrum user. Public service users might or not be submitted to the tax : it would be neutral for global budget, but would create an incentive for them to optimise their expenses.

Political feasibility is the main problem, as many private and public players would oppose such a measure. Cultural authorities fear it could interfere with traditional cultural objectives, but it should be possible to maintain cultural obligations on broadcasters, while making them pay for the volume of spectrum they use through terrestrial broadcasting. Tax exemptions in exchange of fulfilling general interest obligations could be also envisaged.

Examples, best practices. The ITV licence scheme in the UK[125] and the spectrum tax in Spain are indirect, embryonic taxes on the Mhz.

8. Make spectrum users reveal their economic utility, to optimise long-term spectrum management

Description. Governments should create mechanisms aiming at making spectrum users reveal their utility/willingness to pay for frequencies. While the focus of the previous recommendation was on management of *current* spectrum, the current recommendation focuses on dynamic management of *future* spectrum capacities.

Justification. As shown in the Spectrum chapter, it should be made clear whether the apparent lack of interest of telecom operators for UHF-broadcast frequencies comes from technical/economic reasons, or from a strategic/regulatory analysis as a result of which they renounced to claim for these bands *because* they are pessimistic over their *political* chances to get them anyway, any time soon.

Economic theory suggests that monetisation of resources is often a good way to reveal true economic utility. A reservation mechanism, i.e. option to buy or lease future “releasable” frequencies, could provide such information, and help policymakers appreciate the proportionality of their SWO measures with reference to the potential market value for releasable frequencies.

[125] ITV franchise holders make an annual payment to the Treasury for the frequencies they use. This payment is now calculated by the ITC (UK audio-visual regulator) taking into account analogue/digital households in the franchise area in such a way that ITV licensees have an incentive to encourage digital switchover among their viewers.

An option mechanism, in which the option holder can exert the option or not, or even sell it to other interested parties (i.e. a secondary trading of spectrum capacities), introduces market flexibility[126]. Raising money should not be the main purpose, and the focus should not be put on the amount of money raised. But the cashflow generated by the mechanism could be used to feed an independent fund that would in turn finance actions aiming at accelerating the release of frequencies (see our recommendation on such a fund).

Implications/feasibility. Very difficult in terms of feasibility, as the most likely alternative users of the broadcast frequencies are mobile telecom operators, players who have already paid significant amounts of money to acquire the frequencies they are going to need over the next 5-10 years. And beyond that limit, for long-term needs, the UMTS forum is already targeting frequencies in higher bands. Besides, national policymakers might be afraid that opening "broadcast" frequencies to mobile telecommunications, and thus increasing the spectrum supply, could reduce the virtual "market price" per Mhz, and lead operators to try to renegotiate the price they have already paid for other spectrum.

The precedent of UMTS auctions would probably ensure this time more EU co-ordination, and more carefully designed mechanisms, since policymakers are aware that a one-shot "bargain" for public budgets can result in industrial crises.

Cultural authorities and broadcasters will oppose such a potential de-specialisation of the broadcast UHF-band. They might fear that commercial or public service broadcasters would be unable to financially compete with telecommunications operators. The technological possibility of DTV/mobile platform convergence means that the issue will be debated anyway.

Examples, best practices. Recent episodes of monetised frequency assignment schemes are not to be considered as best practices. Many observers considered that the mechanism used (often auctions), in the financial context of the time, led to valuations far beyond economic utility, which can result in counter-productive effects on markets and suppliers. This must not, however, question the general economic rule that monetisation can lead to efficient market valuation.

9. Proportionate regulation on standards for receiving equipments and facilities

Description. Avoid premature and/or excessive regulatory obligations on broadcasting equipment, as these could be counter-productive for business development.

[126] Contrary to recent UMTS auctions in which the right to use future capacities was bought for very high upfront payments, and is not transferable.

Justification. As seen in the Policy chapter and in annex, having **digital tuners** incorporated in television sets would be an effective way of encouraging a rapid and universal migration of all house receivers, with the natural renewal of equipment. This would allow termination of analogue broadcasting on all platforms, and especially on free-to-air or basic cable platform much earlier. This would trigger a rapid drop in the cost of chips, thus bringing down the price of external converters too, which will be needed anyway to digitise pre-existing, recent sets.

Regarding **interactive TV standards**, while many European industry players seem now to agree on converging towards MHP in the long term, it is not necessary nor useful to force the process. Even if a standard is needed to help take-up of a horizontal market for DTV receivers and interoperable iTV services/contents in Europe, this should remain a mid-term prospect, as both consumers' and industry players' priorities lie elsewhere in the meantime[127].

Implications/feasibility. Regulatory measures on technical characteristics of equipment are feasible, as shown by historic precedents[128]. But, as detailed in the cost/benefit annexe, imposing a digital tuner on all new TV sets sold would entail potentially harmful implications on the single European market if taken in a member State (or a few) alone[129].

It would increase the cost of receivers, notably in the low-end market, in the short term, though reducing the cost of digital chips in the *long* term.

In any case, we recommend that such a measure should not be taken too early, as market forces alone can convert receivers to a large extent (low-cost external converters are now arriving on the market). Converters can also extend DTV penetration and benefit from economies of scale. IDTVs and converters both have respective advantages and disadvantages. Moreover, extensive information on compatibility/obsolescence of equipment can make retailers and consumers spontaneously switch to digital-compliant receivers anyway. Besides, in order to avoid competition distortion, any measure should be kept technology-neutral[130], and should not lead to an inflation in mandatory features required (conditional access modules, APIs, etc.)

---

[127] See Market chapter about the limits of the appeal of interactivity over TV sets.

[128] SCART interface, mandatory 220V-compatibility on electric appliances as analysed in the Market chapter, Migrations section.

[129] A potential distortion of the internal market (obstacle to the free movement of goods) could take place if a mandatory digital tuner is imposed by some MS in isolation for the rest, for at least 2 reasons: technical rules imposed in one MS but not others; receivers need to be adapted to the same frequency all over EU (as mentioned in spectrum chapter). Therefore there is a need to co-ordinate any such action at EU level.

[130] E.g. don't impose integrated digital tuners for *terrestrial* reception only.

There needs to be a balance between market freedom (innovation and achieving profitability) and certain harmonisation/enforced interoperability (to develop horizontal markets for equipment, horizontal platform for content/service providers, interoperable equipment for consumers to have access to several providers…).

Example, best practices. Historic precedents. Spontaneous industry agreements on standards in Nordic countries and Germany (e.g. on the MHP).

6.2.3.3 Actions regarding consumers

The main message from this section is the need to improve consumer information about digital broadcasting so as to encourage its spontaneous adoption.

10. Undertake common consumer research

Description. Study consumers' behaviour and expectations towards DTV through various access platforms and the prospect of ATO.

This can be done through joint initiatives from market players regarding consumers ; an monitoring digital broadcasting market (to provide input to inform measures destined to consumer under the SWO action plan).

Justification. In the consumer section of the Market chapter we analysed the diversity of consumer positions facing the digital switchover and the confusion about what digital is about. However, it is necessary to build common knowledge amongst all market players on consumers' attitudes and behaviour (while today most surveys are led by private players with non-public results), in order to help them co-ordinate their strategies. Policy must address the needs of *all* groups of citizens, even those that are less profitable under market mechanisms, and especially those that are less likely to switchover spontaneously.

Implications/feasibility. Requires active co-operation of public authorities and all stakeholders. Difficult but feasible.

Example, best practices. The Market Preparation Group created in the framework of the British Digital TV Action Plan, and the UK Go Digital Pilot Project.

11. Improve consumer information about DTV

Justification. As seen in the Market chapter, surveys show that consumers are confused over what is digital, digital television, and digital switchover. In particular consumers tend to think that DTV is equal to pay TV and be unaware that digital TV can be free-to-air too. As the incumbent in many Member States, terrestrial free-to-air television has never had to promote itself. It must learn how to do that in order to survive in competitive infrastructure markets. Protection of consumers justifies labelling or information obligations on consumer electronics manufacturers and retailers regarding compatibility and obsolescence. Advertising campaigns should also be conducted.

Implications/feasibility. Very feasible, all the more so when - like in the UK - industry players support the process.

Example, best practices. The DVB-logo campaign in the UK help retailers and consumers to identify IDTVs (able to receive digital signals) from other TVs with "digital" features (digital sound…).[131]

12. Encourage consumer switchover by reducing the switchover cost

Justification. Once it is established that accelerating the SWO generates positive externalities (see cost-benefit section in the Policy chapter), incentives can be envisaged to encourage consumers to spontaneously drive the process, i.e. to make it a "pull" rather than a "push" process.

The Policy chapter has examined the range of possible incentives on consumers and other market players. Incentives on early adopters would prevent the "sit and wait" and free-rider effects: every one is tempted to wait for *others* to switch-off first and thus benefit from the maturity of equipment and lower prices due to the economies of scale.

Direct subsidies to equipment renewal like the ones that were implemented by some Member States in the car market, are not to be recommended, at least on a global scale[132]. Other tools, like **licence fee discounts** or **VAT discounts** on products/services enabling digital reception, could be examined.

In particular, one could imagine a **discount on the licence fee for digital households** that would decrease with time, so that it would be all the more attractive for a household to switch-off earlier than the general turn-off deadline, and it would compensate for the fact that a conversion based on purchasing a converter or IDTV will be more costly if it is done early (because of technical immaturity and higher prices). This particular tool could be justified by the fact that public broadcasters that are funded through the licence fee will definitively save the cost of analogue terrestrial broadcasting *after* ATO is reached.

Implications/feasibility. From a market competition viewpoint, to keep such a measure platform and business model neutral, it should apply to every digitisation way (through digital pay TV, through converters, through IDTVs, on any delivery mechanism). The problem is that even if the measure is theoretically neutral it may favour a digital switchover based on the platform which is currently dominant in the existing analogue environment.

---

[131] This is an accepted industry scheme. *Mandatory* labelling schemes would require notification under the EU Transparency Directives affecting national technical rules (Directives 98/38 and 98/48). These contain a Transparency Mechanism requiring notification of national technical rules, in order to protect the Single Market.

[132] Because of market distortions: demand peak then recession, less incentive on market players, like manufacturers, to innovate and reduce prices.

Feasibility. A licence fee discount might be difficult to monitor. Besides, in some countries low-income households are already exonerated from the licence fee, and in some others there is no such tax.

13. Prefer ex-post, targeted measures to deal with the "digital divide" risk

Justification. Some Governments might consider as a general interest objective that all citizens have access to television in digital mode, on the grounds that (i) it would create a social problem ("digital divide") if some households were deprived of access to "information services" and (ii) digital television is a way for them to access these services (Internet, interactive television, etc)[133].

Implications/feasibility. When a majority of citizens have access to "information services", and a minority are deprived because of structural reasons (low-income, low-education social, remote geographic locations, etc), the policy response should be proportionate i.e. targeted on *these* segments, rather than consisting in general, *ex ante* subsidies or obligations across the whole market.

14. Ensure consumers' multiplatform access to broaden competition

Justification. As mentioned in the Policy and Market chapters, many European consumers don't have an actual choice in the delivery mechanism to access television, because of restrictions imposed on service providers[134], but also restrictions on reception facilities e.g. restrictions on satellite dishes imposed by landlords in apartment buildings, or imposed by local city authorities responsible for urban planning for an aesthetic or environment grounds.

In order to enable market forces to play their full role in the digital migration, all obstacles to actual competition between delivery mechanisms should be kept as low as possible. In particular in highly cabled countries, any potential competing transmission infrastructure would certainly make cable operators improve their service more rapidly (but then, as already said, they might need to have greater commercial freedom and more limited obligations to do it).

This applies to restrictions imposed on terrestrial aerials and satellite dishes (individual or collective). In the case of terrestrial access, indoor reception through small set-top aerials can be a remedy to restrictions on roof-top aerials. That is why, and also in order to encourage complementarity between delivery mechanisms, spectrum planning and regulation should encourage a high level of indoor reception whenever possible (NB problem with cable interference).

---

[133] It can be considered that there are 2 factors of "digital divide » associated to the introduction of new communications technologies (see the migrations section on the Market chapter). In a first phase technological immaturity creates a temporary divide, but market forces deal with that to achieve « conversion » of most of the population (say 95%). In a second phase there is structural divide, after the technology is consolidated on the market some segments of the population have still no access to it for different reasons (low-income households, remote areas, etc), market forces *cannot* deliver because it would be un-economic for them to address these segments.

[134] Such as those mentioned under the above recommendation on "Ensure greater commercial freedom for digital TV and broadband players".

Implications/feasibility. The EU has recently issued a communication that details the limits in which the use of satellite dishes can be restricted. Though it is politically complex, national Governments should initiate a dialogue with local authorities and landlords about that, and in some cases change multi-dwelling management regulation to ease collective decisions (qualified majority often required for any decision…).

Figure 65 : Summary of the 14 recommendations to national authorities

Overall switchover strategy	
1	National switchover roadmap and action plan
2	Financial instruments in support of the switchover action plan
3	Monitor digital broadcasting market status and development
4	Define post-ATO policies and scenarios
5	Link broadband policy and digital television policy under information society objectives
Actions regarding industry players	
6	Ensure greater commercial freedom for digital TV and broadband services
7	Tax spectrum to encourage efficient use
8	Make spectrum users reveal their economic utility, to optimise long-term spectrum management
9	Promote proportionate regulation on standards for receiving equipment and facilities
Actions regarding consumers	
10	Undertake common consumer research
11	Improve consumer information about DTV
12	Encourage consumer switchover by reducing the switchover cost
13	Prefer ex-post, targeted measures to deal with the “digital divide” risk
14	Ensure consumers’ multi-platform access to broaden competition

6.2.4 Recommendations to European authorities[135]

6.2.4.1 Justification for, and limits to policy intervention at European level

In general, the necessity of intervention at international level must be **justified under subsidiarity grounds**, i.e. supra/trans-national implications such as: (i) for EU action: internal market implications, (ii) for CEPT: co-ordination of spectrum management to minimise trans-national interference

Once the necessity for international action is established, the **above general principles for policy intervention** should apply and appropriate co-ordination/ consultation mechanisms followed.

We think the EU should continue to actively monitor the development of digital television and information society services, within the boundaries of the subsidiarity principle, and as far as a number of European stakes are involved. The need for European action in this area derives in particular from :

(i) the **transnational nature of spectrum management**,

(ii) the free circulation of goods and services in the **single European market**,

(iii) the promotion of **global European competitiveness** in all the industries involved (television services, consumer electronics, advanced television technologies, etc.), which requires co-ordination and synchronisation of developments.

However, there are also **limits to EU intervention** in the broadcasting area:

(i) the broadcasting landscape and traditions vary widely from one Member State to another, which in practice implies limitations to the European single market for broadcasting (subsidiarity),

(ii) television is politically very sensitive, as it is closely related to national identity and culture, and it has great political and social impact.

For the reasons above, “extreme” solutions such as imposing a common date for turning-off analogue broadcasts across the EU would be politically and practically very difficult to implement. Instead, European contributions to the digital migration and switchover process seem justified under two main grounds:

[135] By « European authorities » we refer to the European Union and specialised technical entities like the CEPT.

(i) where, in line with the principle of subsidiarity, there is an added value from intervening (also) at European level, rather than at national level only,

(ii) where European co-ordination and harmonisation is required by law, notably due to internal market or other transnational implications.

6.2.4.2 European action justified by efficiency considerations (subsidiarity)

Some of the above recommendations to national public authorities, if adapted to cater for the heterogeneity of television landscapes in the EU Member States, could be pursued at European level, for instance:

(i) European switchover roadmap and action plan,

(ii) assignment of European funds to support switchover measures,

(iii) monitor digital television market status and development,

(iv) identify obstacles to switchover (licensing obligations, access restrictions, etc.),

(v) discuss alternatives to management of spectrum used for broadcasting, etc.

In fact, certain activities in the areas mentioned above are already undertaken, though independently of switchover considerations, and will contribute to this objective.

Existing European actions and new ones could be structured in a **global European initiative aiming at encouraging the switchover**, as one contribution to the Information Society in Europe. This would help co-ordinate, and would be a catalyst for, national activities, thus providing a **strong political signal** to consumers and market operators. Just as much as in national contexts, a political signal at European level would help all national and pan-European industry players to co-ordinate their expectations and synchronise their investments.

Moreover, while some countries devote private and public resources to achieving an early switchover and analogue turn-off, they might be unable to reallocate and refarm the released frequencies, because *other* countries would be delayed on the switchover path. A certain degree of EU synchronisation, or at least some political signals, would be therefore useful.

In practice, EU action could be implemented through a **White book** or a **Communication** making policy recommendations to Member States, possibly encompassing some of the recommendations made here to national regulators. In particular it could be useful to:

- issue **guidelines** on best/bad practices to follow/avoid in national SWO initiatives,
- consolidate national roadmaps in a descriptive **Pan-European roadmap**, which would help to plan the timing and preparation of co-ordinated post-ATO policies and harmonised measures.
- encourage **evolution in the approaches to spectrum management** at national and European level. As seen in the Spectrum Chapter, spectrum management should indeed evolve from the current administrative approach to an approach based on the economic optimisation of spectrum use that better reflects its economic and social value, through the use of more sophisticated tools (spectrum tax, reservation or option mechanisms, etc.). The radio spectrum policy group proposed by the European commission will be entitled to discuss these issues : better spectrum management, more efficient spectrum planning, alternatives for pre and post-ATO scenarios, etc. Moreover, the UMTS auctions have showed the need for more preparation and greater co-ordination at EU level on these matters.

6.2.4.3 European action required by Law

EU Treaties and international agreements identify several areas relevant to the SWO, in particular:

Compatibility of national measures with fair competition on the European single market

The EU must prevent competition distortions and fragmentation of markets at European level. For this, the EU should monitor in particular that the measures taken at national level in the framework of the digital migration are in line with the principles for policy intervention that we recommend above : platform and technological neutrality of intervention ; proportionate intervention, limiting *ex ante* market regulation to cases where proven necessary by market failure considerations ; transparency of objectives and measures, etc.

The EU also has to control the compliance of national State aids with the provisions of the Treaty.

Moreover, two areas require technical co-ordination at EU level: standards/technical specifications for terminals, and spectrum planning.

Standards/technical specifications for terminals (hardware and middleware)

The free movement of goods within the European single market requires some technical harmonisation of communications terminals and services for at least two reasons:

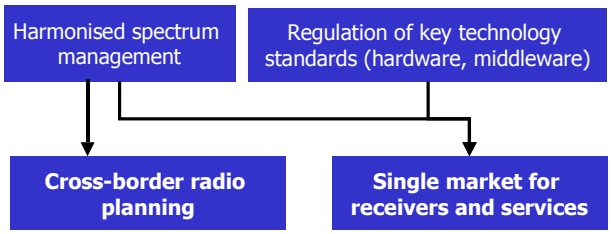
- The mutual recognition principle implies that any product legally sold in any EU Member State, and therefore complying with the obligations imposed by the relevant national legislation, should normally be traded across the whole of the EU. For this reason, technical specifications for hardware (e.g. mandatory digital tuner on all new TV receivers sold) or middleware (e.g. support the MHP standard) must be agreed at EU level.
- Spectrum planning must remain harmonised at European level and in ITU zone 1, so that a given wireless communication service (e.g. mobile telephony) is delivered in roughly the same bands everywhere in Europe, and thus can be received by terminals supporting that service sold anywhere in the EU. That is why if licences for non-broadcast services are to be granted in the top of the broadcast UHF-band (800 Mhz), this must be harmonised at European level, within CEPT and in co-ordination with EU services. In the perspective of the revision in CEPT of the *Stockholm 61* plan for terrestrial broadcasting (see the Spectrum chapter), EU position should be prepared in advance, notably through the procedures foreseen under the EU *Spectrum Decision*. It will provide an occasion to discuss the new digital broadcasting world, its impact on spectrum management during the switchover and after the ATO.

Regarding the measure on a “mandatory digital tuner”, the cost-benefit analysis highlighted the European dimension of the issue[136]. Although interesting for several reasons (its effectiveness, the impact it would have on chipset prices, etc.), the measure includes risks in terms of consumer perceptions and market distortion. If attempted on a national basis (while consumer electronics markets and manufacturers are pan-European), such measures could be inefficient or even counter-productive. There would be a risk that such national measures be incompatible with the Single Market. That is why the EU should lead a in-depth study on this specific issue, with a large consultation of all stakeholders (consumer electronics manufacturers and chipset manufacturers in particular), which would identify all the operational issues and aim also to develop an industry consensus about the switchover from analogue to digital equipment.

[136] See it in the policy chapter, cost-benefit subsection, and in Cost –Benefit annex.

In the meantime, a short term proxy alternative is to concentrate on labelling and information of analogue and digital receivers, the public information route, in order to empower consumers to make more informed purchase decisions on the basis of obsolescence timetables and product information. If such measures were to be mandatory (instead of voluntary, industry schemes on the UK model), then an EU level initiative would be necessary in order to secure the Single Market dimension. This option has attractions during the market-led phase of switchover policy. A mandatory scheme would require close consultation with the consumer electronics industry and consumer involvement. The public information option does not rule out the possibility of mandatory tuners at a later stage.

Figure 66 : Why the needs for technical co-ordination at EU level



Encourage more effective cross-border radio planning

The other reason why refarming/reallocation process must be harmonised at European level is of course the management of cross-border spectrum planning, in order to prevent interference. In particular, effective, operational implementation of digital terrestrial television needs to be improved in border areas. Some terrestrial market players consider that the main CEPT planning agreements place very conservative limitations on transmission range and power. These affect DTT competitiveness in border areas. Under the impulse of terrestrial broadcasters, Member States negotiate bi-lateral agreements to improve on official planning, but this is time consuming and not very transparent. The EU should find ways to speed up this process and improve transparency.

Beyond this, lies the task of defining the EU role in CEPT's Stockholm 61 replanning process. This lies outside the scope of this study, but it nonetheless merits reflection, given its importance for making DTT and DAB both sustainable *and* competitive in infrastructure terms, able to take up the many technical innovations that are in the pipeline, including converged/hybrid networks that combine broadcasting and mobile communications into single platforms.

7. Annexes

1. **Bibliography**
2. **Glossary**
3. **Contributions**
4. **Websites**

7.1 Bibliography

7.1.1 Reports from public authorities

- **ANFR (FR) : Rapport de l'Agence Nationale des Fréquences** : "Etude sur la planification des fréquences en vue de l'introduction en France de la télévision numérique de terre - DVB-T" (March 1998) (http://www.anfr.fr/fr/textedoc/television.html).
- **Ministry of culture (FR) : Report on DTT (COTTET– EYMERY) (1999)** (http://www.culture.gouv.fr/culture/actualites/rapports/cottet-eymery/intro-cottet.htm).
- **Ministry of culture (FR) :** « **Propositions pour une stratégie de développement » (**Rapport HADAS – LEBEL à la ministre de la Culture, 2000) (http://www.culture.fr/culture/actualites/rapports/hadas-lebel/intro.htm).
- **Ministère de la Culture (FR)** : « L'avenir de la radio à l'ère numérique » (Rapport de Mme Anne Coutard à la ministre de la Culture, Septembre 2001) (http://www.culture.gouv.fr/culture/actualites/rapports/coutard/coutard.pdf).
- **AGCOM** (IT) : Il libro bianco sulla televisione digitale terrestre (White book on DTT) (2000) : http://www.agcom.it/provv/libro_b_00/librobianco00.htm.
- **CEPT** : Detailed Spectrum Investigation Phase II (29 Mhz-960Mhz) (1995)
- **CSA** (FR): Consultation relative à l'aménagement du spectre hertzien (2000)
- **Department for Culture Media & Sports (DCMS) / Department of Trade and Industry (DTI)** (UK) : White book on Communications (http://www.communicationswhitepaper.gov.uk).
- **Department for Culture Media & Sports (DCMS) :** Digital Decisions : Viewer Choice and Digital Television (A Report by the Viewers' Panel to the Secretary of State for Culture Media & Sports, December 2001). (http://www.digitaltelevision.gov.uk/pdfs/DCMS_digital_tv_e.pdf).
- **Ministère de l'Economie, Direction Générale de la Concurrence et de la Consommation (DGCCRF) (F)**: « La télévision numérique de terre : enjeux et modalités de mise en œuvre au regard des règles de concurrence et de la distribution » (http://www.minefi.gouv.fr/DGCCRF/consommation/telecom/tnt0202.pdf).
- **Department for Culture Media & Sports (DCMS) / DTI (UK) :** Digital TV Action Plan (2001) **(**http://www.digitaltelevision.gov.uk/pdfs/draft_digital_TV_action_plan.pdf**)**
- **Department for Culture Media & Sports (DCMS) (UK)** : The Future Funding of the BBC (Davies Report) (July 1999) (http://news.bbc.co.uk/hi/english/static/bbc_funding_review/reviewco.pdf)

- **EBU/DigiTAG** : Report on API migration (May 2001)
- **EBU/DigiTAG** : The positionning of Digital Terrestrial Television in selected European Markets (Spain, Italy, France, Finland, Ireland, Germany) (May 2000).
- **European Commission (DG INFSO)** : A common regulatory framework for electronic communication and services (Working document).

  (http://europa.eu.int/ISPO/infosoc/telecompolicy/review99/wdregfwk.pdf).
- **European Commission (DG INFSO) :** Final Evaluation of the 16:9 Action Plan (prepared by IDATE, November 2000).

  (http://europa.eu.int/comm/information_society/evaluation/pdf/report1691_en.pdf
- **Federal Ministry of Economics and Technology (BMWI) (DE)** : Digital Broadcasting in Germany : Launch Scenario 2000 (2000).
- **French Parliament (FR)** : Rapport d'information de M. Jean-Marie LE GUEN, au nom de la commission des finances, de l'économie générale et du plan sur la télévision numérique terrestre (Parliamentary Report on DTT implementation, French only).
- **Independent Television Commission (UK)** : Annual Report 2000 (www.itc.org.uk).
- **ITC/OFTEL/OFT (UK)**: Joint ITC, Oftel and OFT advice to Government on digital television (May 2000) (http://www.oftel.gov.uk/publications/broadcasting/digi0500.htm).
- **ITU-R** : Economic Aspects of Spectrum Management (Report SM.2012-1) (http://www7.itu.int/publibase/cat_pub/itupub.asp?Part=3.4).
- **National Broadcasting Council of Poland** : Strategy of terrestrial digital radio and television development in Poland (support material for parliamentary debate) (Periodical Bulletin of the NBCP, No 9/01).
- **OECD** : Communications Outlook 2001 (http://www1.oecd.org/dsti/sti/it/index.htm).
- **OFTEL (UK) :** OFTEL's response to the Independent Spectrum Review **(**http://www.oftel.gov.uk/publications/oftel_response/2001/spec0901.pdf**).**
- **Radio and Television Authority (RTVV) (SE)** : Developments in the media field 2000 (2000 annual report).
- **Radio Communication Agency (UK)** : Radio Spectrum Management Review Consultation Paper, a independent review led for DTI and HM Treasury (Martin Cave, June 2001) (http://www.spectrumreview.radio.gov.uk)
- **Radio Communications Agency (UK)** : Mapping the Future of Convergence and Spectrum Management (2000)

7.1.2 Papers

- BLACKMAN, Colin : « Convergence between telecommunications and other media – How should regulation adapt ? » (Telecommunications Policy, Vol 22, No3, pp163-170, 1998)
- BURGER James, GRAY Todd : « The Gore Commission Report on Public Interest Obligations of Digital Broadcasters - Self-Regulation and Increased Flexibility » (Digital Television and the Law, January 1999, http://www.digitaltelevision.com/law/index.shtml)
- CAVE Martin : Regulating digital television in a convergent world, in telecommunication policy, vol. 21, n°7 pp 575-596
- COASE Ronald : « Frequencies to sale – The Federal Communities Commission » (Journal of Law and Economics, October 1959 ; Réseaux, 64, Mars-Avril 1994).
- CRAMPTON P., KWEREL E., WILLIAM J. (1998) : Efficient re-allocation of spectrum incumbents in Journal of Law and Economics, vol XLI, october 1998, pp. 647-675.
- DAVIES, Gavyn : Market failure in the Broadcasting Industry (annex n°8 to the Review of the Future Funding of the BBC, pp 202-208) (http://news.bbc.co.uk/hi/english/static/bbc_funding_review/annex8.pdf)
- DE COCKBORNE Jean, CLEMENTS, WATSON-BROWN Adam : "EU Policy on Multimedia Regulation" presented at the Montreux Symposium '99 http://europa.eu.int/ISPO/infosoc/telecompolicy/en/montreux.html.
- DOEVEN (Nozema) : « The Spectrum, use it or loose it » (for Digitag , December 2000)
- FONTAINE, Gilles (IDATE) : Analyse des facteurs économiques de succès de la TVNT (for Digitip, Jan 2000)
- FRANCESCHINI Laurence : Les enjeux juridiques de la télévision hertzienne numérique (The regulatory stakes with DTT) (Légipresse, Octobre 1999, French only)
- GRUNWALD Andreas, HOLZNAGEL Bernd : « Introduction to digital television in Germany – Regulatory Issues, a comparative analysis » (International Journal of Communications Law and Policy, issue 4, Winter 1999-2000) (http://www.ijclp.org/4_2000/pdf/ijclp_webdoc_10_4_2000.pdf)
- GRUNWALD, Andreas : « Analogue Switch-off (Spectrum Auctions in the age of digital television) » (http://www.digital-law.net).
- GUPTA, JAIN, SAWHNEY : « Modeling the evolution of Markets with Indirect Network Externalities : an Application to Digital Television » (Marketing Science, 1999)
- HALLIKAINEN Harold : « Spectrum for sale or rent – Comments on US Spectrum Auctions » (International Journal of Communications Laws and Policy (Issue 5, summer 2000) (http://www.ijclp.org/5_2000/pdf/ijclp_webdoc_6_5_2000.pdf).

- HUBERT Jean-Michel : « Vers une nouvelle gestion du spectre en Europe ? » (17 december 2001) (http://www.art-telecom.fr/communiques/discours/index-sophia.htm).
- MCQUAIDE : « What is the role of the umpire in the digital "playground of the giant" » (Intermedia)
- MC CALLUM Linsey : « EC competition law and digital pay television » (Competition policy newsletter - 1999 number 1) (http://europa.eu.int/comm/competition/publications/cpn/cpn19991.pdf)
- NOLAN Bowie, Hugh Carter Donahue : « Doing well by doing good : the Gore commission's hope for digital broadcasting in the public interest » (Journal of Policy, regulation and strategy for Telecommunication and Media)
- NOLAN, Dermot (1997) : Bottlenecks in pay television. Impact on market developments in Europe, in Telecommunications Policy, Vol. 21, N°7, pp. 597-610.
- NOLAN, Dermot (2000): « Can spectrum auctions solve the 'Aunt Emily' problem ? », in TBS, May 2000
- PLUMB, Graham (BBC) : « Digital Migration and Future Uses for Broadcast TV spectrum Following Switchover » (DigiTAG Mini Conference, IBC 2001)
- PONS Jean François : « The application of competition and anti-trust policy in media and telecommunications in the European Union » (Speech at the International Bar Association, 1998) (http://europa.eu.int/comm/competition/speeches/text/sp1998_041_en.html)
- PONS Jean François : « The future of broadcasting » (Speech at the Institute of Economic Affairs, 1998) (http://europa.eu.int/comm/competition/speeches/text/sp1998_034_en.html)
- UNGERER Herbert: « Competition in the Information Society – Multimedia » (Annual General Meeting European MultiMedia Forum, 1996) (http://europa.eu.int/comm/competition/speeches/text/sp1996_056_en.html)
- WATSON-BROWN, Adam (DG INFSO) : The European vision of DTT role in the Information Society (for Digitip, Jan 2000)

7.1.3 Other reports and documents

- Aegis Systems Ltd : « Implications of international regulation and technical considerations on market mechanisms in spectrum management » (A report to the Independent Radio Spectrum Management Review, November 2001) (http://www.spectrumreview.radio.gov.uk).
- BIPE : Survey on consumer communication services (penetration and expense) (1999)
- BIPE : Communication services and generation effects (2000)
- Consumer Association : « Turn on, tune in, switched off. Consumer attitudes to digital television » (March 2001)

- Continental Research : « Promotion of free-to-air digital channels could boost subscriptions to multi channel TV » (Presswire, 01/11/2001) (http://www.continentalresearch.com).
- Counterpoint Research : « Digital TV : consumers' uses and perceptions » (prepared for OFTEL, August 2001) (http://www.oftel.gov.uk/publications/research/2001/digtv0901.pdf)
- Digicast BV : « Forcing migration while saving costs ! » (Discussion paper on DVB-T, April 2001).
- DVB/UMTS ad hoc group : « The convergence of Broadcast and Telecommunications Platforms » (March 2001)
- ECCA : Report on the interference problem on cable communication networks in Europe with special consideration to digital terrestrial services (Dirk Jaeger, ECCA, 2001)
- European Audiovisual Observatory : Statistical Yearbook 2001 (August 2001) (http://www.obs.coe.int/oea_publ/yb)
- FT MEDIA : The TV viewer of the future (1998)
- ICP : Lisbon Conference on DTT - Working Document (February 2000) (http://www.icp.pt/info/noticia.asp?id=1164&ida=183).
- IDATE : Digital TV receivers and video terminals in 2005 (November 2000) (http://www.idate.fr).
- IDATE : Development of Digital Television in the European Union (IDATE report to the European Commission, DG INFSO, June 2001) (http://europa.eu.int/ISPO/infosoc/telecompolicy/en/Study-en.htm).
- InformaMedia : Global Digital Television 2000
- Institute for Prospective Technological Studies (IPTS) : Future Bottlenecks in the Information Society. Report to the European Parliament, Committee on Industry, External Trade, Research and Energy (ITRE) (http://www.jrc.es/FutureBottlenecksStudy.pdf)
- IP *: European Key Facts – Television 2000* (September 2000) (http://www.ip-deutschland.de/pages/64.html .
- Ipsos Media : « Un français sur deux séduit par la télévision numérique terrestre » (Baromètre Ipsos/Stratégies sur la TNT) (Décembre 2001) (http://www.ipsos.fr/CanalIpsos/articles/801.asp?rubId=23, http://www.ipsos.fr/CanalIpsos/articles/798.asp).
- NERA : The Impact of a Digital License Fee on the Take-Up of Digital Television (1999)
- Novamedia : Sommet de la TVNT (2000)
- OVUM : Study on the Development of Competition for Electronic Communication Access Networks and Services (OVUM report to the European Commission, DG INFSO, February 2001).

- Pace Microelectronics : The Pace report 2001 : consumer attitudes towards digital television. (www.pace.co.uk)
- PriceWaterhouseCoopers : Consumers or content ? The digital dilemma (The European Digital Television Report 2000)
- Reed Electronics Research : 2001 Yearbook of world Electronics Data
- Statistical Research : How People Use™ Interactive Television (http://www.statisticalresearch.com)

7.1.4 Position papers (besides answers to BIPE/INFOSOC questionnaire listed)

- AER : AER position on digital switchover (May 2001)
- WorldDAB : Dossier on digital radio (May 2001)
- RTE : Digital TV policy document (http://www.rte.ie/about/organisation/policydigital.html).
- Sky : Why IDTVs are bad for consumers (15 October 2001)
- AFORM : Les opérateurs du câble réagissent à la parution du décret « must carry » (press release, February 2002) (http://www.aform.org/actualite/index.html).

7.1.5 Regulation and policy – European Union

7.1.5.1 Spectrum

- Green Paper on radio spectrum Policy - COM(1998)596 (http://europa.eu.int/ISPO/spectrumgp/sgptxt/sgp.pdf)
- Communication on next steps in radio spectrum policy, results of the Public Consultation on the Green Paper – COM(1999)538 (http://europa.eu.int/ISPO/spectrumgp/sgptxt/sgpcomen.pdf)
- Communication on the Results of the World Radiocommunications Conference 2000 (WRC-2000) in the context of Radio Spectrum Policy in the European Community - COM (2000)811 (6 December 2000) » (http://europa.eu.int/ISPO/spectrumgp/sgptxt/wrc2000finalEN.pdf)
- Proposal for a Decision of the European Parliament and the Council on a Regulatory Framework for Radio Spectrum Policy in the European Community - COM(2000)407 (http://europa.eu.int/ISPO/spectrumgp/sgptxt/specdece.pdf)
- Communication : Introduction of Third Generation Mobile Communications in the European Union, State of Play and the Way Forward – COM(2001)141 (http://europa.eu.int/information_society/topics/telecoms/radiospec/mobile/docs/pdf/3gcomen.pdf).

7.1.5.2 Telecom review – New regulatory framework

- Green Paper [COM(1997)623] on the Convergence of the Telecommunications, Media and Information Technology Sectors, and the Implications for Regulation. Towards an Information Society Approach - December 1997 http://europa.eu.int/ISPO/convergencegp/greenp.html.
- Commission Communication on the convergence of the Telecommunications, Media and Information Technology Sectors, and the Implications for Regulation - Results of the Public Consultation on the Green Paper (http://europa.eu.int/ISPO/convergencegp/com(99)108/com(99)108enfinal.html)
- Proposal for a Directive of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services - COM(2000)393

  (http://europa.eu.int/ISPO/infosoc/telecompolicy/review99/com2000-393en.pdf).
- Proposal for a Directive of the European Parliament and of the Council on access to, and interconnection of, electronic communications networks and associated facilities - Com(2000)384
- Proposal for a Directive of the European Parliament and of the Council concerning the processing of personal data and the protection of privacy in the electronic communications sector - Com(2000)385
- Proposal for a Directive of the European Parliament and of the Council on the authorisation of electronic communications networks and services - Com(2000)386
- Proposal for a Directive of the European Parliament and of the Council on universal service and users' rights relating to electronic communications networks and services - Com(2000)392
- Proposal for a Regulation of the European Parliament and of the Council on unbundled access to the local loop, adopted 12 July 2000 - Com(2000)394

7.1.5.3 Competition and internal market

- Articles 81 to 85 of the EC Treaty concerning competition (http://europa.eu.int/comm/competition/legislation/treaties/ec/new_numbering.html)
- Commission Communication on the application of the general principles of free movement of goods and services (articles 28 and 49 EC) concerning the use of satellite dishes. (http://europa.eu.int/comm/internal_market/en/services/services/antenna.htm).
- Communication from the Commission - Services of general interest in Europe (2001/C 17/04) (http://europa.eu.int/comm/competition/oj_extracts/2001_c_017_01_19_0004_0023_en.pdf)
- Commission Communication on application of State aid rules to Public Service Broadcasting (17/10/2001).

7.1.5.4 Audiovisual

- Resolution of the Council and of the Representatives of the Governments of the Member States, meeting within the Council of 25 January 1999 concerning public service broadcasting
- Protocol on the system of public broadcasting in the Member States, annexed to the Treaty establishing the European Community
- TV standards Directive : Directive 95/47/EC of the European parliament and of the Council of 24 October 1995 on the use of standards for the transmission of television signals (http://europa.eu.int/eur-lex/en/lif/dat/1995/en_395L0047.html)
- « Television without frontier » Directive : Council Directive 89/552/EEC of 3 October 1989 on the coordination of certain provisions laid down by Law, Regulation or Administrative Action in Member States concerning the pursuit of television broadcasting activities. http://europa.eu.int/eur-lex/en/lif/dat/1989/en_389L0552.html.

7.1.6 National Regulation

7.1.6.1 Austria

- Austrian Broadcasting regulation page (http://www.bka.gv.at/bka/medien/medienrecht.htm#aktu, German).
- KommAustria-Gesetz (KOG), BGBl. I Nr. 32/2001 (http://www.bka.gv.at/bka/medien/kog.pdf, German Only).
- Privatfernsehgesetz (PrTV-G) BGBl. I Nr. 84/2001 (Private Television Act 31/08/2001) (http://www.bka.gv.at/bka/medien/privatfernsehgesetz.pdf, German Only).

7.1.6.2 Belgium

- Décret du 14 juillet 1997 portant statut de la Radio-Télévision belge de la Communauté française (RTBF) (http://www.csa.cfwb.be/documentation/decretaux/decret_02.htm)
- Décret du 17 juillet 1987 sur l'audiovisuel – Decree of 17/07/87 (http://www.csa.cfwb.be/documentation/decretaux/decret_01.htm).
- Décret du 24 juillet 1997 relatif au Conseil supérieur de l'audiovisuel et aux services privés de radiodiffusion sonore de la Communauté français (Decree on Commercial Broadcasting) (http://www.csa.cfwb.be/decret/decret.htm, French only).

7.1.6.3 Denmark

- The Danish Radio and Television Broadcasting (Consolidation) Act , Consolidation Act No. 701 of July 15, 2001 (http://www.dr.dk/omdr/english/Facts%20on%20DR/act_broadcasting.htm).
- March 2001-2004, Media Agreement (signed between the Government and the political parties).
- The Danish Broadcasting Act - Promulgation of the Radio and Television Broadcasting Act, cf. Consolidation Act No. 75 of January 29, 1997 with the amendments pursuant to Act No. 399 of June 10, 1997 and Act No. 1095 of December 29, 1997.
- All Danish TV regulation (in Danish) : http://www.nmn.org/Lover/lover.htm.

7.1.6.4 Finland/Suomi

- Act 744/1998 on Television and Radio Operations (October 1998) (http://www.mintc.fi/www/sivut/english/tele/massmedia/index.html).
- Act 745/1998 on the State Television and Radio Fund (October 1998) (http://www.mintc.fi/www/sivut/english/tele/massmedia/index.html)

7.1.6.5 France

- Loi du 30 septembre 1986 modifiée – Broadcasting Law (http://www.csa.fr/pdf/loi86201.pdf, in French)
- Appel aux candidatures pour des services nationaux de télévision numérique diffusés par voie terrestre - Call for proposal for digital terrestrial services (24/07/2001) (http://www.csa.fr/pdf/texteoff.pdf)
- Cadre juridique de la TNT – Legal framework for DTT, abstract of the broadcasting law (http://www.csa.fr/pdf/doc32TNTloi1986.pdf)

7.1.6.6 Germany

- Rundfunkstaatsvertrag (Interstate Broadcasting Treaty 1996) (http://www.alm.de/rfstvert.htm).
- 5th Agreement amending the Interstate Agreement on Broadcasting (http://www.artikel5.de/gesetze/rstv.html)
- Television signal Transmission Act (1997) (http://www.artikel5.de/gesetze/fueg.html)
- Cabinet Resolution of 24 August 1998 (http://www.bmwi.de/Homepage/English%20pages/Publications/resolution980824.jsp)

7.1.6.7 Greece

- Law 2644/1998 of 13 October 1998 on the provision of subscription radio and television and related regulations.

7.1.6.8 Ireland

- ODTR : Programme Services Distribution Licence (1999 cable licence)

  http://www.odtr.ie/docs/cable.doc.
- 1988 Independent Radio and Television Act : http://www.irtc.ie/88Act.htm.
- Broadcasting Act 2001 (March 2001) : http://www.gov.ie/oireachtas/frame.htm.

7.1.6.9 Italy

- Summary of the regulation of the Media in Italy : http://www.agcom.it/eng/resp_reg.htm.
- Law texts : http://www.comunicazioni.it/english/normativa_e/index.htm.
- AGCOM : White book on DTT (2000) :

  http://www.agcom.it/provv/libro_b_00/librobianco00.htm.
- Law n° 249 of July 31, 1997 for the institution of the Autorità per le Garanzie nelle Comunicazioni and the regulations for telecommunications and radio and television broadcasting systems (http://www.agcom.it/eng/l_249_97.htm).
- Law n°66 of March 20, 2001 concerning TV broadcasting (analogue and digital) as well as improvement of radio and TV broadcasting plants :

  http://www.comunicazioni.it/normativa/radiotv/rtv_66-01.htm.

7.1.6.10 Luxembourg

- Law of 1991 regulating electronic media and liberalising radio.

7.1.6.11 Netherlands

- Media Act : http://www.cvdm.nl/index.html?article=185

7.1.6.12 Portugal

- Telecommunications Law n°91/97, of 1st August 1997 :

  http://www.icp.pt/legisuk/lei.asp?item=7
- Television Act : Law n°31-A/98 of 14th July : http://www.icp.pt/legisuk/lei.asp?item=59.
- Regulations of the public tender for the grant of a license for the establishment and operation of a Digital Terrestrial Television Platform, approved by the Admnistrative Rule nr. 346-A/2001, of 6 April : http://www.icp.pt/tdtuk/tdtlegis02uk.html.
- ICP pages on DTT : http://www.icp.pt/tdtuk/indexuk.html.

7.1.6.13 Spain

- Real Decreto 2169/1998, de 9 de octubre, por el que se aprueba el Plan Técnico Nacional de la Televisión Digital Terrenal - Decree on the National technical plan on DTT (1998) (http://www.setsi.mcyt.es/legisla/radio_tv/rd216998.htm)
- Cable Telecommunication Act - Ley 42/1995 de 22 de diciembre de 1995
- Ley 17/1997 de 3 de mayo de 1997 (which incorporates the 1995 TV standards European Directive)
- Ley 66/1997 de TV digital - Régimen jurídico de la radiodifusión sonora digital terrenal y de la televisión digital terrenal

7.1.6.14 Sweden

- The Radio and Television Act (SFS 1996 :844) (http://kultur.regeringen.se/pressinfo/pdf/lageng.pdf).

7.1.6.15 United Kingdom

- Broadcasting Act 1990 (defining ITC regulatory role, and the licensing conditions) (http://www.hmso.gov.uk/acts/acts1990/Ukpga_19900042_en_1.htm)
- Broadcasting Act 1996 (http://www.hmso.gov.uk/acts/acts1996/1996055.htm) (introducing DTT and DAB licensing and amending the Broadcasting Act 1990)

7.1.6.16 Hungary

- Act No. 1 of 1996 on radio and television services (http://www.ortt.hu).

7.1.6.17 Poland

- Broadcasting Act adopted by the Polish Parliament on December 29, 1992 (consolidated text) (http://www.krrit.gov.pl/stronykrrit/english.htm).

7.1.6.18 Czech Republic

- Act No 231/2001 dated 17 May 2001 on radio and television broadcasting operation and on changes of other acts (http://www.rrtv.cz/zakony_en/broadcasting_act2001.html).

7.1.6.19 Romania

- Law no. 48 / May 21, 1992 - Law on Radio and Television Broadcasting : http://www.cna.ro/eng/legis.html.

7.1.6.20 Slovakia

- Act Nr. 308 of 14th September, 2000 on Broadcasting and Retransmission : http://www.rada-rtv.sk.

7.1.7 Books

- BALIO Tino : *Hollywood in the Age of Television* (see in particular « Red, Blue and Lots of Gree : the impact of Color Television on Feature Film Production » by Brad Chisolm).
- DANARD Benoit, LE CHAMPION Rémy : *Television de pénurie, télévision* d'abondance (La Documentation Française, 2000)
- EDEN C. and ACKERMAN F. : *Making Strategy* (London, Sage Publications, 1998)
- GODET Michel : *Manuel de prospective stratégique* (Dunod, 1997)
- GODET, Michel : *Creating Futures (Scenario Planning as a Management Tool)* (Economica, 2001).
- GREFFE Xavier : *Economie des politiques publiques* (Dalloz, 1994).
- KALMAN Eva : *L'analyse économique du spectre hertzien* – Thèse de doctorat en économie, soutenue le 8 juillet 1993.
- LANGE André : *Stratégies de la musique* (Pierre Mardaga, 1984).
- NEGROPONTE, Nicholas : *Being Digital* (Knopf, 1995)
- OECD : *Les aspects économiques de l'allocation des fréquences hertziennes* (OCDE, 1993)
- PREEL, Bernard : *Le choc des générations* (La Découverte, Paris, 2000)
- RIFKIN, Jeremy : *The Age of Access* (GP Putnam's Sons, New York, 2000)
- THOMAS, Robert : *New product success stories – Lessons from leading innovators* (John Wiley & Sons, 1995)
- TVEDE, PIRCHER, BODENKAMP : *Data broadcasting – Merging digital Broadcasting with the Internet* (John Wiley & Sons, 2001)
- VAN DER HEIJDEN : *Scenarios – The art of strategic conversation* (John Wiley & Sons, 1997)
- VARIAN, Hal, SHAPIRO Karl : *Information Rules, A Strategic Guide to the Network Economy* (1999)

7.2 Glossary

In the following table we listed the most used acronyms, players categories, technical terms and the main concepts used in the report. For technical terms, we favoured a lay-reader-friendly definition and illustration.

Figure 67 : Glossary

Term	Definition and comments
ACTE	**Association des Télévisions Commerciales Européennes.** Association of commercial European broadcasters.
ADSL	**Asynchronous Digital Subscriber Line**. Software technology allowing broadband communication (at least downstream if not bi-directional) on traditional telephone copper lines in the local loop. While ADSL already delivers mainly high-speed Internet, other xDSL technologies can compete with digital cable to deliver Video on Demand.
AER	**Association Européenne des Radios**. European association of commercial radio broadcasters.
AGCOM	**Autorità per le Garanzie nelle Comunicazioni**. Italian telecom regulator.
ANFR	**Agence Nationale des Fréquences**. French agency for spectrum management.
ATO	Under the term "**analogue turn-off**" we must distinguish the natural ending of analogue broadcasting (turn-off is made when there is no one left willing to receive analogue signals or equipped to), and a policy-driven programme intended to foster or "force" the turn-off (turn-off is announced in order to accelerate switchover, in a self-fulfilling process). In the latter case, we may also talk about "planned" turn-off. We suggest to distinguish ATO from the concept of digital switchover which is the *continuous* process of diffusion of digital broadcasting and digital *reception*. At one point digital reception could be near universally completed (99% of households receiving television in digital mode) without necessary an turn-off of analogue *broadcasting*.
API	**Application Programming Interface**. Operating system embedded in an STB. Allows navigation and allows to play the different other interactive services that can be used or downloaded. Examples: MediaHighway (developed by Canal+ Technology) or Open TV.
ARPU	**Average Revenue per User** (or subscribing home, when employed in pay television).
ASP	Application Service Provider.
ATSC	Advanced Television Systems Committee. US body responsible for overseeing the digital HDTV standards.
"Aunt Emily"	Epitome of the most conservative TV viewers, uninterested in premium content, unlikely to switch to pay TV solutions or to spontaneously upgrade their equipment to digital. The "Aunt Emily" issue can refer to universal access to public service channels, or to digital television.
BBC	**British Broadcasting Corporation**.

Beauty Contest	Other name for comparative hearings that are organised in order to license a franchise or frequency, when several bidders are applying. The “best” project wins. Opposed to auction schemes under which the *higher bid* wins.
Bluetooth	In-home radio system for communicating between devices in the same room. As always it will first appear on computers and peripherals but you will soon be using your mobile phone as a remote control for the TV. Today DTT is the only digital television delivery mechanism that allows portable reception (no cable) : wireless connectivity technologies like Bluetooth could make this feature common to *all* delivery mechanisms (cable and satellite reception).
BMWI	**German Ministry for Economy, Industry and Culture.**
BREMA	**British Radio & Electric Equipment Manufacturers Association.** Trade association of consumer electronics manufacturers. www.brema.org.
Broadband	A broadband technology empowers bi-directional telecommunication networks with the high bit rate (512 to 1024 kbits) which is necessary to deliver real time broadcast media. For instance, UMTS allows broadband mobile telecommunication, DSL allows fixed broadband uses (video, high-speed Internet) over traditional PSTN copper lines.
BTBS	**British Telecom Broadcast Services**.
CA	British Consumer Association.
“Cable” countries	Countries in which cable reception is today the predominant delivery mechanism to television. Germany, Belgium, Luxembourg and the Netherlands are in this category.
“Cabsat” channels	TV channels that are exclusively available through cable and satellite.
CAS	**Conditional Access Systems**. Software used by pay-TV operators to encrypt their programmes. Example: Mediaguard (designed by Canal+ Technology) and Viaccess (design, by Viaccess SA).
CATV	**Cable Television.**
CBR	**Constant Bit Rate.**
CDMA	**Coded Division Multiple Access.**
CE	**Consumer Electronics**.
CEA	**Consumer Electronics Association.** US equivalent to EACEM.
Channel	May in the text refer to *TV channels* (in French “chaînes”), or *frequency channels* (in French “canaux”) that are eg 6 Mhz-wide “slides” in the radio-electric spectrum.
CI	**Common Interface.**
CENELEC	**European Committee for Electrotechnical standardization.**
CEPT	**Conférence Européenne des Postes et Télécommunications.**
CMT	**Comisión del Mercado de las Telecomunicaciones.** Telecom regulator in Spain.
COFDM	**Coded Orthogonal Frequency Division Multiplex.** Modulated multi-carrier transmission technique. Used in the DVB-T norm.
Convergence	Digitised contents and services can be supported by any network and transmitted to any terminals with little adaptation. This fundamentally creates the technological and business convergence between all telecommunications activities (broadcast and

	point-to-point), publishing activities, software activities.
Converter	In this report, "converter" refers to mere analogue-digital adapters, i.e. the simplest and cheapest kind digital STB.
CPM	**Cost Per Thousand Impressions**
CRM	**Customer Relationship Management**. The arts and techniques to conquer customer and build loyalty. Includes technical skills like billing. All the more strategic when operating on subscription based industries.
CSA	**Conseil Supérieur de l'Audiovisual.** Name of the radio-television regulator in France and French-speaking Belgium.
DAB	**Digital Audio Broadcasting**. Norm for digital radio developed through Eureka 147. European Telecommunications Standard (ETS) 300 401 V1.3.3 (2001-05). Terrestrial and satellite-based versions. www.etsi.org. www.worlddab.
DCMS	**Department for Culture, Media and Sports (UK).**
DDM	**Direction du Développement des Médias.** Media division in French Premier's Cabinet.
DG INFSO	**European Commission's Directorate-General Information Society.** http://europa.eu.int/information_society/noflash/index_en.htm
DGPT	**Dutch Directorate General for Post and Telecommunications.**
Digital	Information that is encoded with 0s and 1s is said "digital". Then it can be compressed and transmitted more efficiently, on a variety of networks, to a variety of terminals. Telecommunication networks that have been upgraded to be able to transmit digital information, are also said to be "digital" (eg : digital television).
Digital divide	The fact that a minority of citizens may not able to access digital networks and then be set aside the "information society" is seen as a major risk because it could worsen their economic situation and impact the cohesion of the society. "*One of the most important political objectives is to fight the digital divide. The potential of new technologies, such as mobile communications and digital television should be exploited to address the digital divide. We believe that digital television can be an effective solution to connect a large share of the population to the Information Society."* (Commissioner Erkki Liikanen, Sarajevo, 16 July 2001).
DigiTAG	**Digital Terrestrial Action Group.** www.digitag.org.
Dominant position (abuse of)	Dominant position is defined as a situation of economic power held by a firm which allows it to hinder effective competition in the relevant market. There is abuse of a dominant position when the conduct of a firm influences the structure of the relevant market or its degree of competition, even if such conduct is favoured by a national law. Abuse of dominant position is prohibited by the Article 81 of the EC Treaty.
DRM	**Digital Radio Mondiale.** Technical norm for digital radio broadcasting in medium waves.
DTG	**Digital Television Group.** British association of digital television players (service operators, manufacturers, retailers, etc..). www.dtg.org.
DTI	**British Department for Trade and Industry.**
DTH	**Direct-to-home**. Direct satellite reception with individual dishes. As opposed to cable TV (in which head-ends are fed by satellite transmission), or SMATV (direct satellite reception, but with a collective dish).

DTT	**Digital Terrestrial Television.**
DTV	**Digital Television.**
Dual Funding	Combination of public funds and advertising revenues in public service broadcasters' resources. Strongly opposed by commercial broadcasters.
DVB	**Digital Video Broadcasting**. The DVB norm, including MPEG2 compression, has been developed by European players in electronics and content industries. There are DVB specifications for satellite (DVB-S), cable (DVB-C) and terrestrial broadcasting (DVB-T). The 1995 TV standards Directive provided the basis for widespread adoption of the DVB norm.
DVB-T	**Digital Video Broadcasting – Terrestrial.**
EACEM	**European Association of Consumer Electronics Manufacturers.**
EAO	**European Audiovisual Observatory.**
EBITDA	**Earnings Before Interest, Tax, Depreciation and Amortisation.** One of the main, most internationally harmonised, profitability indicator.
EBU-UER	**European Broadcasting Union.** European PSBs association. Union Européenne de Radiodiffusion.
ECCA	**European Cable Communications Association.**
ECPT	**European Conference of Post and Telecommunications administrations.**
EPG	**Electronic Programme Guide.**
ETSI	**European Telecommunications Standards Institute.**
EU	**European Union**.
Externality	There are positive or negative externalities of external effects when the acts of a player influence directly the choice possibilities or situation of another player. Externalities can lead to market failures.
FCC	**Federal Communications Commission.** US federal regulator for telecommunications, radio and television.
FIFO	**First In First Out.**
FM	**Frequency Modulation.**
FTA	**Free-to-air** (also FTV for Free-to-view). TV service whose access is not based on subscription. Does not necessarily mean free-of-charge: one can imagine interactive service with free access by pay-per-use. Does not necessarily mean on terrestrial air: free-to-air television channels are broadcast on cable systems (especially in Germany), and satellite systems. Does not necessarily mean unencrypted: some FTA services have to be encrypted for copyright reasons, even if the smartcard is free-of-charge.
GEO	**Geo-stationary**.
General interest (services of)	"This term covers market and non-market services which the public authorities class as being of general interest and subject to public service obligation" (Communication 2001/C17/04). The European Community leave the definition of these service to Member States. The above-mentioned Communication adds : "In certain circumstances, in particular where market forces alone do not result in a satisfactory provision of services ["market failures"], public authorities may entrust certain operators of services with obligations of general interest and where necessary grant

	them special or exclusive rights and/or devise a funding mechanism for their provision."
GHz	**GigaHertz.** 1 Ghz = 1000 Mhz.
GSM	**Global System for Mobile communications.**
HDTV	**High Definition Television.**
Head-end	Central distribution point for a cable network, where programmes are received from satellite and VOD films storage.
HF	**High Frequency.** 3 to 30 Mhz.
HFC	**Hybrid Fibre Coax.** A type of network that contains both fibre-optic cables and copper coaxial cables. The fibre-optic cables carry TV signals from the head-end office to the neighbourhood; the signals are then converted to electrical signals and then go to coaxial cables.
HTML	**Hypertext Mark-up Language.**
ICT	**Information and Telecommunications Technologies**.
Incumbent	The former State-owned operator in telecommunications, before deregulation and the introduction of competition (e.g. : Deutsche Telekom, British Telecom). By extension, can be said of any established player in oligopoly situation, as opposed to (potential) new entrants.
Information Society	Refers to a widespread citizen access to information technologies (Internet, mobile telecommunications, digital television, etc.), that would trigger dramatic changes in the Society (access to information and learning, electronic democracy…) and in the economy.
IRD	**Integrated Receiver Decoder.**
IP	**Internet Protocol.**
IS	**Information Society.**
ISM	**Industrial, Scientific and Medical Frequency Band.**
ISP/IAP	**Internet Service Provider, Internet Access Provider.**
ITC	**Independent Television Commission.** British regulator for commercial television.
ITU	**International Telecommunication Union.**
Java	A general purpose programming language developed by Sun Microsystems and best known for its widespread use on the World Wide Web. Unlike other software, programs written in Java can run on any platform type (including set-top boxes), as long as they contain a Java Virtual Machine.
LAN	**Local Area Network**.
LMDS	**Local to Multipoint Distribution System.**
LCD	**Liquid Crystal Display**. One of the technologies used for flat screens.
Market failure	Circumstance under which the market equilibrium cannot be optimal, mainly because the product production or consumption create impacts (either positive or negative) on other players than those acting on the markets. Market forces alone cannot lead to social optimum. Externalities can lead to market failures.
Media Player	Operator in the media/entertainment/content industry. Can be multi-medias or single media oriented. Media players not involved in TV (in the press, radio, videogame

	media oriented. Media players not involved in TV (in the press, radio, videogame, interactive services, etc.) are more and more likely (not to enter TV activities as technological, cost and regulatory barriers fall.
MFN	**Multiple Frequency Network.** Broadcast architecture under which when a frequency channel is used in one broadcasting area, it cannot be re-used in contiguous areas neither for same programme nor for any other one. Opposed to SFN.
MHP	**Multimedia Home Platform.** One of the DVB standards family, based on a Java virtual machine, MHP defines a generic interface between interactive digital applications and the terminals on which those applications execute. The goal of MHP is to provide a open middleware standard, including API functions, that supports a great range of applications and services, from linear service to interactive TV and web browsing. If universally implemented, the standard could create benefits for consumers (lower prices in STBs because of economies of scale, after an initially increase in the hardware cost because of higher memory requirements, richer interfaces to support the future home local network), for broadcasters and service publishers (lower re-authoring cost for the applications, reduced cost due to a larger, horizontal market, lower IPR payments), and for the consumer electronics industry (economies of scale).
MHz	**MegaHertz**. 1 Mhz = 1000 Mhz.
Middleware	Software layer between hardware (STBs) and applications. Interactive TV equivalent to the operating systems in the computer world.
MMDS	**Multipoint Microwave Distribution System.**
Modem	**Modulator/demodulator.** A device that transforms a typical two-level computer signal into a form suitable for transmission over a telephone line. Also does the reverse--transforms an encoded signal on a telephone line into a two-level computer signal.
MPEG	**Moving Picture Expert Group.** This group defines standards, like the MPEG2 standard that is used for compression in digital TV and incorporated in DVB.
Multicrypt	The DVB has given its backing to two approaches to CA, simulcrypt and multicrypt. Simulcrypt is intended to permit different CA operators in different geographic areas. The service carries entitlement messages for each CA provider within an agreed common framework, but the viewer does not have a choice of SMS. In technical simulcrypt, the system is designed to allow two competing CA systems within an agreed framework. Multicrypt is an open system which makes use of the common interface to allow competing CA systems, subject only that the service provider must transmit entitlement messages for each CA provider.
Multiplex	**Digital bitstream, carrying several digital programs or services** that are “multiplexed” together so that it can be transmitted efficiently within a suitable channel in the spectrum: they do not occupy each a specific “position” inside the multiplex. In a multiplex, bandwidth use can be optimised thanks to “statistical multiplexing”: each channel is allocated at any moment only the bandwidth or bit rate needed, considering the amount of data carried (fast-moving images like of sport at one end, still teletext at the other end).
MS	**Member State.**
MSO	**Multiple Systems Operator**. A cable operator running several local networks (as opposed to local operators of local networks). All major cable operators are MSOs.

Narrowband	Communication channel providing a low bandwidth (eg : 64 kbit/s)
NAB	**National Association of Broadcasters.**
NCTA	**National Cable Television Association** in the US**.**
Network Externalities	There are network externalities when the value of a service increases with the number of users. For instance a mobile telephony service have no interest at all, when there are few subscribers.
NMT	**Nordic Mobile Telephone.**
NRA	**National Regulation Authority**. Refer to the national bodies charged by a member state to with the regulatory tasks required under EU directives.
NTSC	**National television system committee**. US analogue TV standard or the organisation that developed this standard, currently in use in the US, Canada, and Japan.
NVOD	**Near Video on Demand.** Impulse PPV with higher flexibility (e.g. a new screening session starting every 20 minutes).
OFCOM	**Office of Communications.** This future British super regulator will replace the 5 following entities : ITC, OFTEL, Radio Authority, Radiocommunications Agency, Broadcasting Standards Commissions. Public Broadcaster BBC should stay outside OFCOM's remit, being regulated by the BBC Authority under the Royal Charter.
OFTEL	**Office of Telecommunications.** British regulator for telecoms.
ONP	**Open Network Provisions**. The ONP regulatory framework set European rules for open access to the networks of incumbents telecom operators, so that the new entrants can offer services in competition with the ex-monopolies.
Packet-switched transmission	When digitised, information can be broken in a series of smaller data packets. Each packet is routed and carried separately across the network, using whatever capacity is available at any time. Packets are re-assembled when they reach destination. This method allows a safer transmission and a much more efficient use of the network's bandwidth than the traditional way, especially for point-to-point communications. Opposed to circuit-switched transmission or networks.
PAL	**Phase Alternate Lines**. Dominant analogue TV standard in Europe (the other one being SECAM).
Pay TV Platform	Package of TV channels and other services. Pay TV platform operators perform the following functions : packaging of the offer, dealing with channels and other right-holders, marketing, billing, customer care, managing proprietary set top boxes…
PCS	**Personal Communication Service**. Current US second generation mobile telephony standard. Equivalent of European GSM.
Portable reception, portability	With DVB-T, and under certain technical conditions, indoor reception can be much better than in analogue. Then consumers do not need anymore an individual or collective aerial, and it enables then to change the place of the TV set more easily. Because it needs more power and uses more spectrum, this feature is more or less developed in the various DTT roll-outs. Only in the Netherlands it is supposed to be universal.
PMR	**Professional Mobile Radio system.** Eg : Tetra and Tetrapol in Europe.
PPV	**Pay Per View.**
PSB	**Public Service Broadcaster**. In this report we do not use the term in the original British sense (encompassing all FTA analogue terrestrial broadcasters because their

	British sense (encompassing *all* FTA analogue terrestrial broadcasters because their licenses go with public-service programming obligations) but in a more restrictive sense of "State-owned", non-profit, channel publisher. Also : "Pubcaster".
PSTN	**Public Switched Telephone Network.** Standard copper telephone lines. This narrowband network can be made broadband thanks to xDSL software technologies.
PVR	**Personal Video Recorder.** System with hard drive memory that makes it possible to digitally record program without an external material support. It also enables one to parameter automatic recording profiles and skip advertising while recording or watching live shows. *TiVo* systems was one of pioneers. Also referred to as "Personal TV".
QAM	**Quadrature Amplitude Modulation.**
QPSK	**Quadrature Phase Shift Keying.**
RAI	**Radio Televisioni Italiana.**
RDS	**Radio Data System.**
SDTV	**Standard Definition TV** (as opposed to High Definition TV).
SECAM	**Système Séquentiel Couleur A Mémoire.** The analogue television broadcast standard in France, the Middle East, and most of Eastern Europe.
SFN	**Single Frequency Network.** Broadcast architecture under which the same frequency channel can be used in two contiguous areas to transmit the same programme, without interference (opposed to MFN).
SMATV	**Satellite Master Antenna Television**. Collective satellite dish. Germany is the only European country where this reception system is widespread.
SME	**Small and Medium Entreprises.**
SMP	**Significant Market Power.** Refers to a test that is set out in various EU Directives and used to identify those operators that must receive additional obligations**.**
Spectrum Efficiency	Ratio of the rate of information transfer (I) (bitrate in digital transmission), and the amount of spectrum used (U). Its unit is Mbit/s / MHz / m².
STB	**Set-top-boxes**. Sometimes also referred to as "decoders". This is a generic name for boxes that can perform extra functions with conventional TV sets: decode encrypted signals (descrambling), demodulation, conversion from digital signals into analogue (so that signals can be "understood" by the analogue tuners of the TV sets), sometimes a return-path through a telephone modem or cable modem, interactive navigation, and even digital video recording with storage capacity (for G2 STBs). They usually are proprietary devices, owned by the payTV operator and rented or lent to pay TV subscribers, though some "free" STBs can be purchased in retail stores.
Simulcrypt	The DVB has given its backing to two approaches to CA, simulcrypt and multicrypt. Simulcrypt is intended to permit different CA operators in different geographic areas. The service carries entitlement messages for each CA provider within an agreed common framework, but the viewer does not have a choice of SMS. In technical simulcrypt, the system is designed to allow two competing CA systems within an agreed framework. Multicrypt is an open system which makes use of the common interface to allow competing CA systems, subject only that the service provider must transmit entitlement messages for each CA provider.
Streaming	Process of transmitting data across a network by packets (instead of an entire file). The data is re-structured by local player software to deliver a continuous flow. Used

	The data is re-structured by local player software to deliver a continuous flow. Used to deliver sound or moving image over IP networks like the Internet.
Switch-off	Termination (id turn-off).
TV Publisher	Media player which aggregates programs and contents to build one or several channels, thematic or generalist, pay or free-to-air, that he may distribute himself (then becoming a broadcaster) or through third-party pay-TV operators. There are independent TV publishers, but more TV publishers vertically integrated with pay-TV platforms operators (i.e. Canal+, Sky, etc.).
T-commerce	Electronic commerce through digital television.
"Terrestrial" countries	Countries in which terrestrial reception is today the predominant (or default) access to free-to-air television. Italy, Spain, France, Greece, Portugal and the UK belong to this group.
TDD	**Time Division Duplex.**
TDF	**Télévision de France.** TSP. Owner and operator of the main French terrestrial network. A 100% subsidiary of the incumbent telco France Telecom.
TDMA	**Time Division Multiplex.**
Telco	**Telecommunication Operator.**
TSP	**Transmission Service Providers**. This includes network operators which own and operate a given network: satellite systems operators like Astra or Eutelsat, and "tower companies" like Crown Castle or Retevision. It may also include telecommunication operators that do not own or control a physical network and do not intend to develop one, but aim at serving clients through technical use of existing infrastructure. Here arises the question of interconnection.
Turn-off	Or "switch-off" (used indifferently throughout the report): termination (see ATO).
TVHH	**TV Households.**
TWF	**Television Without Frontiers.** Refers to the Directive regulating TV and audiovisual content in the EU.
UEFA	**Union Européenne de Football Association.**
UMTS	**Universal Mobile Telecommunications System.** European mobile standard for third generation ("3G") mobile telecommunications (telephony + multimedia).
UHF	**Ultra High Frequency.** 300 to 3000 Mhz. The bottom of the UHF band (300-850) is mainly used for terrestrial television broadcasting.
URL	**Universal Resource Locator.**
UTRA	**Universal Terrestrial Radio Access.**
VBR	**Variable Bit Rate.**
VOD	**Video on Demand**. Instant availability of a large number of films or sport event for impulse purchasing. The service can be delivered with local servers and through cable or DSL lines, or even through high-capacity home servers with asynchronous feeding.
VCR	**Video Cassette Recorder**
VHF	**Very High Frequency**. 30 to 300 Mhz. Analogue radio services are usually broadcast in the VHF band. Some countries also use the top of it for television.

Walled Garden	Package of interactive web-like services in limited number and under proprietary environment, as opposed to the open world wide web environment.
WAN	**Wide Area Network.**
WLL	**Wireless Local Loop.** Use of radio communication (rather than copper wire or fibre) to connect homes to the local exchange. (French : BLR)
WRC	**World Radio Conference** (in the framework of ITU).
XDSL	Any technology in the DSL family (see ADSL).

7.3 Contributions

7.3.1 Responses to the questionnaire BIPE/DG INFOSOC

Regulators and Governments	Austrian Chancellery
	CSA Belgique
	Czech Television Council
	Danish Ministry of Culture
	Finnish Ministry of Transport and Communications
	Portuguese ICP
	Ministry of the Flemish community
	Norwegian Ministry of Culture
	Finnish Telecommunications Administration Centre (THK)
Equipment manufacturers	BREMA
	EACEM
	Sony Visual Entertainment (IDTV division)
Cable Operators	Noos
	ECCA
	UPC Europe
Radio Operators	AER
	BFR (Non-commercial German Radio Broadcasters)
	TDF on DAB
	WorldDAB
	VDL (DAB)
TV players	Sogecable
	Kirch Pay TV
	RTL Group
	OLON (association of local TV and radio stations)
	Mediaset
	ORF
	EBU
Other	DTG
	International Communications Round Table (ICRT)

7.3.2 Interviews

Company	MS	Category	Name	1st Name	URL
AB Group	F	TV player	SAMAK	Gregory	www.abgroupe.com
ACTE	Eu	TV player	BIGGAM	Ross	www.acte.be
Agence Nationale des Fréquences (ANFR)	F	Regulator	GUITOT	Jean-Jacques	www.anfr.fr
AOC	ES	TV player	RODRIGUEZ GONZALEZ	Daniel	
Asociacion Nacional de Industrias Electronicas y de Telecomunicaciones (ANIEL)	ES	Manufacturer	FERNANDEZ PUERTOLAS	Edmundo	www.aniel.es
Assemblée Nationale	F	Regulator/Gov	FEUILLADE	Alexandra	
Association Européenne des Radios (AER)	Eu	Radio Operator	NATUCCI	Sergio	www.aereurope.be
Association Française des Opérateurs de Réseaux Multiservice (AFORM, Cable Operators Trade Organisation)	F	Cable Operator	BLANGILLE	Daniele	www.aform.org
BBC	UK	TV player	McGOUGAN	Julian	www.bbc.co.uk
BBC	UK	TV player	LEVY	David	www.bbc.co.uk
Boxer TV Access	SV	Manufacturer	APPELQVIST	Anders	www.boxer.se
British Radio & Electric Equipment Manufacturers Association (BREMA)	UK	Manufacturer	PELTOR	Hugh	www.brema.org.uk
BskyB	UK	TV player	GALLAGHER	Ray	www.sky.com
BskyB	UK	TV player	CASSELLS	Sheila	www.sky.com
BskyB	UK	TV player	JENNER	Philip	www.sky.com
BT Broadcast Services (BTBS)	UK	TSP	CAMPBELL	Malcolm	Www.bt.com
Canal + SV	SV	TV player	BORNOT	Charles	Www.canalplus.se
Canal+ Group	F	TV player	FRANCE	Stéfane	Www.canal-plus.com
Canal+ Technology	Eu	Technology Provider	KIND	Christophe	Www.canal-plus.com
Carlton Communications PLC	UK	TV player	CALDECOTE	Piers	Www.carltonplc.co.uk
Carlton Communications PLC	UK	TV player	WHETSTONE	Rachel	Www.carltonplc.co
CASEMA	NL	TV player	DE GOEDE	Henk	Www.casema.nl
Channel 4	UK	TV player	THOMPSON	Jonathan	Www.channel4.co.uk
Commision del Mercado de las Telecomunicaciones (CMT)	ES	Regulator/Gov	PEREZ GOMEZ	Alberto	Www.cmt.es
Conseil Supérieur de l'Audiovisuel (CSA)	F	Regulator/Gov	GANASCIA	Gérald	Www.csa.fr
Crown Castle International (CCI)	UK	TSP	WARD	John	Www.crowncastle.com
Dept of Culture Media and Sport (DCMS)	UK	Regulator/Gov	SMADJA	Catherine	Www.culture.gov.uk
Dept of Trade and Industry (DTI)	UK	Regulator/Gov	HUMPHREYS	Jane	Www.dti.gov.uk
Dept of Trade and Industry (DTI)	UK	Regulator/Gov	DIXON	Ian	Www.dti.gov.uk
Deutsche Telekom AG	DE	Telecom operator	STEINER	Volker	Www.telekom.de

Digital 3&4	UK	TV player - DTT Mux	HUGHES	Mike	
Digital TV Group	UK	TV player	CHURCHILL	Danny	Www.dtg.org.uk
DIGITENNE	NL	DVBT Consortium	GEERSING	Bauke	www.digitenne.nl
Directorate-General for Post and Telecommunications	NL	Regulator/Gov	Van HELSDINGEN	Roderick	
Directorate-General for Post and Telecommunications	NL	Regulator/Gov	VISSER	Tom	
Dixons	UK	Retailer	CHURCHILL	Danny	www.dixons.co.uk
Emettel	F	TSP	LAHONDE	Marin	
European Cable Communication Association (ECCA)	Eu	TV player	KOKKEN	Peter	www.ecca.be
European Cable Communication Association (ECCA)	Eu	TV player	ROUKENS	Thomas	www.ecca.be
Eutelsat	F	TSP	BARBERIS	Giuseppe	www.eutelsat.fr
Eutelsat	F	TSP	KERN	Christof	www.eutelsat.fr
Eutelsat	F	TSP	JOUSSET	Stéphanie	www.eutelsat.fr
France Television	F	TV player – PSB	GOUZ	Sylvain	Www.francetv.fr
Independent Television Commission (ITC)	UK	Regulator/Gov	BENSBERG	Greg	www.itc.org.uk
Institut belge des Postes et des Télécommunications (IBPT)	BE	Regulator/Gov	VANDROOGENBROEK	Michael	www.ibpt.be
ITV	UK	TV player - FTA Broadcaster	PITTS	Simon	www.itv.co.uk
ITVdigital	UK	TV player	ZERAFA	John	www.itv-digital.co.uk
ITVdigital	UK	TV player	MARRE	Andrew	Www.itv-digital.co.uk
JVC France / SECIMAVI	F	Manufacturer	BOSSE	Luc	Www.jvc.fr
KirchGruppe	DE	TV player	BUNDSCHUH	Anja	Www.kirchgruppe.de
Lagardère Images	F	TV player	OZANAT	Jean-Pierre	Www.lagardere.fr
M6	F	TV player	REY	Michel	www.m6.fr
M6	F	TV player	ROUSSEL	Marc	www.m6.fr
Ministère d'Etat, Service des Médias	LU	Regulator/Gov	GOERENS	Pierre	
Ministry of Cultural Affairs (Department of Mass media and Copyright)	NO	Regulator/Gov	KLUNDERUND	Kjetil	Http://odin.dep.no/kd/engelsk
Ministry of Culture	IT	Regulator/Gov	ARIA		Www.onda6.com
Ministry of Culture – Sweden	SV	Regulator/Gov	MAREN	Lars	www.kultur.regeringen.se
Ministry of Economy and Technology	DE	Regulator/Gov	GUNDLACH	Albrecht	http://www.bmwi.de/Homepage/English%20pages/index.jsp
Ministry of Economy and Technology	DE	Regulator/Gov	BECKER	Wolfgang	http://www.bmwi.de/Homepage/English%20pages/index.jsp
Ministry of Industry - IT Unit	F	Regulator/Gov	DONZ	Jean-Louis	www.telecom.gouv.fr
Ministry of Industry - IT Unit	F	Regulator/Gov	DIGNE	Christophe	www.telecom.gouv.fr
Mission Gouvernementale Haut Débit	F	Regulator/Gov	BOURDIER	Jean-Charles	
Noos	F	Cable Operator	MEUNIER	Dominique	www.noos.com
NRJ Group	F	Radio player	PALLAIN	Marc	www.nrj.fr
NTL	UK	TSP, cable operator	KIRBY	Phil	www.ntl.com

Office of Telecommunications	UK	Regulator/Gov	NIBLETT	Jim	www.oftel.gov.uk
Open TV Europe	Eu	Technology Provider	SAINT GIRONS	Regis	www.opentv.com
Open TV Europe	Eu	Technology Provider	MICHELET	Alain	www.opentv.com
Orange (France Télécom Mobile)	F	Telecom operator	REBECCHI	Véronique	www.orange.com
Pace Micro Technology	UK	Manufacturer	TROTT	Andy	www.pace.co.uk
Pathé	F	TV player - TV Channel Publisher	LUSSATO	Frédéric	www.pathe.com
Pathé	F	TV player - TV Channel Publisher	LACAN	Marc	www.pathe.com
Philips Consumer Electronics	UK	Manufacturer	JOHNSTON	David	www.philips.com
Post & Telecommunications Authority	NO	Regulator/Gov	SINKERUD	Knut	http://www.npt.no/norsk
Prensa Espanola - E-media	ES	TV player	CAPELL	Claudia	
Quiero TV	ES	TV player	MARTIN VIZCAINO	Angel	www.quierotv.com
Radio Authority	UK	Regulator/Gov	THOMAS	Mark	www.radioauthority.org.uk
Radio communications Agency	UK	Regulator/Gov	TOMAN	Dave	www.radio.gov.uk
Radio France	F	Radio Player	ANICHINI	Sylvain	www.radio-france.fr
RAI	IT	TV player	SOMALVICO	Bruno	www.rai.it
Retevision	ES	Transmission Service Provider	VENTOSA FREIXEDES	Josep	www.retevision.es
RTL Group	DE	TV player	HOFFMAN	Andreas	www.rtl.de
RTL Group	DE	TV player	PRAHL	André	www.rtl.de
Radio Televisión Española (RTVE)	ES	TV player	RODRIGUEZ	Luz	www.rtve.es
SAGEM	F	Manufacturer	SITTERLIN	Michel	www.sagem.com
SAGI	F	Other - Collective Housing	CALLOT		
SENDA	SV	TV player	IVARSSON	Lennart	www.senda.se
SNIDA (Aerial Installers association)	F	Other - Reception Services	PILLATRE	Jean-Pierre	
Sogecable	ES	TV player	ALVAREZ SANTOS	Gustavo	www.sogecable.com
Sony Electronics	F	Manufacturer	DESTRUELS	Arnaud	www.sony.com
Stream	IT	TV player - Digital Package	MORSELLI	Lucia	www.stream.it
Swedish Radio and TV authority (Radio och TV verket)	SV	Regulator/Gov	SCHIERBECK	Peter	www.rtvv.se
Syndicat de la Presse Quotidienne Régionale (SPQR)	F	TV player	DELIVET	Jean-Pierre	www.spqr.fr
TDF-Espace Numérique	F	Other - Reception Services	POISSON	Jean	www.espace-numerique.com
Tele Cinco	ES	TV player	OREJA ARBURUA	Manuel	www.telecinco.es
Telepiu	IT	TV player - Digital Package	GOUT	Emmanuel	www.telepiu.it
Télévision de France (TDF)	F	Transmission Service Provider	KOMLY	Alain	www.tdf.fr
TPS – Télévision Par Satellite	F	TV player - Digital Satellite Platform	MAUGARS	Gilles	www.tps.fr
Teracom AB	SV	TSP	VAN DER SPANK	Anders	www.teracom.se
TF1	F	TV player	AUDIGIER	Sylvain	www.tf1.fr
TF1	F	TV player	LOMBARDINI	Maxime	www.tf1.fr

Thomson TAK	F	Manufacturer	MOZELLE	Gerard	www.tak.fr
Towercast	F	Transmission Service Provider	BELLIN	Patrick	www.towercast.fr
Viaccess Sa	F	Technology Provider	GRAS	Yves	www.viaccess.fr
WDR (ARD-Koln)	DE	TV player	WERNER	Oliver	www.wdr.de
WorldDAB	Eu	Radio Operator	GREEN	Michael	www.worlddab.org
ZDF	DE	TV player – PSB	MATZEL	Eckardt	www.zdf.de

7.4 Websites

Players

Broadcasters, publishers

AB Groupe (www.abgroupe.com)
ACTE (www.acte.be)
Antena3 (www.antenna3tv.com)
BBC (www.bbc.co.uk)
Carlton Communications (www.carltonplc.co.uk)
Danish Broadcast Corporation (www.dr.dk)
DR (www.dr.dk)
EBU (www.ebu.ch)
ERT (www.ert.gr)
ITV (www.itv.co.uk)
KirchPayTV (www.kirpaytv.de)
MEDIASET (www.corporate.mediaset.it)
NRJ (www.nrj.com)
Onda 6 (www.onda6.es)
ORF (www.orf.at)
Recoletos (www.recoletos.es)
RTP (www.rtp.es)
RTVE (www.rtve.es)
RTÉ (www.rte.ie)
TF1 (www.tf1.fr)
YLE (www.yle.fi)

Cable

Aform (www.aform.org)
Casema (www.casema.nl)
Chorus (www.chorus.ie)
ECCA (www.ecca.be)
Noos (www.noos.com)
NTL (www.ntl.com)

Electronics & technology

ANIEL (www.aniel.es
Brema (www.brema.org.uk)
Convergence (www.convergence.de)
Dixons (www.dixons.co.uk)
EACEM (www.eacem.be)
FIEEC (www.fieec.fr)
NDS (www.nds.com)
Netgem (www.netgem.com)
Open TV (www.opentv.com)
Pace (www.pace.co.uk)
SAGEM (www.sagem.com)
TAK (www.tak.fr)
TiVo (www.tivo.com)
Viaccess (www.viaccess.fr)
Video Networks (www.videonetworks.co.uk)

Platforms

Boxer TV-Access (www.boxer.se)
CANAL+ (www.canalplus.fr)
ITV Digital (www.itv-digital.co.uk)
MTG (www.mtg.se)
Sky (www.sky.com)
SOGECABLE (www.sogecable.com)
Stream (www.stream.it)
Telepiu (www.telepiu.it)
TPS (www.tps.fr)
TV CABO (www.tvcabo.pt)
Via Digital (www.viadigital.es)
Viasat (www.viasat.se)

Digital radio

AER (www.aereurope.org)
Digital One (www.ukdigitalradio.com)
VDL (www.vdldiffusion.com)
World DAB Forum (www.worlddab.org)

TSP

CCI (www.crowncastle.com)
Deutsche Telekom (www.telekom.de)
Digita (www.digita.fi)
Espace Numérique (www.espace-numerique.com)
Eutelsat (www.eutelsat.fr)
Nozema (www.nozema.nl)
Rai Way (www.raiway.it)
Retevisión (www.retevision.es)
SES-ASTRA (www.astra.lu)
TDF (www.tdf.fr)
Teracom (www.teracom.se)
TowerCast (www.towercast.fr)

Regulators

AACS (www.aacs.pt)
AGCOM (www.agcom.it)
ALM (www.alm.de)

BMWi (www.bmwi.de)
CMT (www.cmt.es)
Commissariaat voor de media (www.CVDM.nl)
CSA (www.csa.fr)
CSA Belgique (www.csa.cfwb.be)
DCMS (www.culture.gov.uk)
Department of Public Enterprise (www.dpe.ie)
Digitip (www.telecom.gouv.fr)
DTI (www.dti.gov.uk)
FCC (www.fcc.org)
IBPT (www.ibpt.be)
ICP (www.icp.pt)
ICS (ww.ics.pt)
IRTC (www.irtc.ie)
ITC (www.it.org.uk)
MINTC (www.mintc.fi)
NPT (www.npt.no)
ODTR (www.odtr.ie)
Oftel (www.oftel.gov.uk)
OPTA (www.opta.nl)
Reg TP (www.regtp.de)
RTVV (www.rtvv.se)
Swedish Ministry of culture (www.kultur.regeringen.se)

Sources

Advanced Television (www.advanced-television.com)
BEUC (www.beuc.org)
Cable&Satellite (www.cable-satellite.com)
Digitag (www.digitag.org)
Digital Law (www.digital-law.net)
Digital TV in Finland (www.digitv.fi)
DTG (www.dtg.org.uk)
DTG Glossary (www.dtg.org.uk)
DTI - DCMS Communications White Paper (www.communicationswhitepaper.gov.uk)
DVB (www.dvb.org)
ETSI (www.etsi.org)
European Audiovisual Observatory (www.obs.eu.int)
IDATE (www.idate.fr)
IJCLP (www.ijclp.org)
IPTS (www.jrc.es)
ISPO (www.ispo.cec.be)
LyngSat (www.lyngsat.com)
NTIA (USA) (www.ntia.doc.gov)
Reed Electronics Research (www.rer.co.uk)
Screendigest (www.screendigest.com)
Simavelec White Book on DTT (www.simavelec.fr)

Spectrum

ANFR (www.anfr.fr)
CEPT (www.cept.org)
ITU (www.itu.int)
Orange (www.orange.com)
Radiocommunications Agency (www.radio.gov.uk)
Radio Spectrum Management Review (www.spectrumreview.radio.gov.uk)

7.5 List of other deliverables

- Volume one : Country Profiles.
- Volume two : cost-benefit analysis, spectrum management, case studies of technological migrations, secondary sets issue.