Strategic Outlooks for European High Definition and IP TV

LUDOVIC COPÉRÉ

KTH Information and
Communication Technology

Master of Science Thesis
Stockholm, Sweden 2005

IMIT/TS-LAB-2005-09

Strategic Outlooks for European High Definition and IP TV

Master's Thesis
May 2005

Ludovic Copéré
ludovic@kth.se
http://www.copere.net/

Industrial Supervisor: François Agueci
General Manager, Business Development, Sony Europe

Academic Supervisor and Examiner: Dr. Lena Ramfelt
School of Information and Communication Technology, KTH
Department of Management Science and Engineering, Stanford University

Thesis presented as a partial fulfillment
to the Master of Science in Engineering
Degree Program in Information and Communication Technology

Abstract

Since its commercial inception in the 50s, the television industry in Europe has experienced some drastic changes and evolutions. It first felt an increased complexity of its value chain and offer to the mass market when analog cable and satellite Pay TV packages first appeared in the 80s. Today, the generalized move to digital technology, from the production and edition level down to the consumer electronics installed base, has increased the pace of change and has set the foundation for a vastly more diversified offering.

This Master's thesis takes a forward-looking view at the major parameters driving the European television ecosystem to its new identity. Using the theoretical frameworks of high-tech strategic marketing, it analyses the impact of the four digital platforms – Satellite, Cable, Digital Terrestrial Television (DTT) and the emerging IP TV in the *accessibility* to digital television. In addition to the delivery platform, the transversal parameter of *quality* has recently got an increased attention with High Definition drawing close to a commercial reality.

This dual approach then enables to paint a strategic picture of the European digital television ecosystem in the five to ten years to come and show the key evolution trends and scenarios for the different economic players involved.

Keywords: Digital TV, High Definition, IP TV, Europe, strategy, business models

Sammanfattning

Sedan dess första kommersiella utveckling på 50-talet har television industrin i Europa undergått drastika ändrigar och evolutioner. Det började med en ökning av komplexitetet av värdekedjan och erbjudandet till massmarknaden, när analoga kabel och satellit betalTV kom ut på 80-talet. I dag har den generaliserade övergången till digital teknologi, från produktionen och uplagan till den installerade basen av elektronika apparater, ökat ombyteshastighetet och etablerat grunden till ett mycket mer skiftande erbjudande.

Detta exjobb tar ett framåt utsikt till de stora parametrarna som driver det europeiska television ecosystemet till dess nya identitet. Genom att använda den teoretiska inramningen av high-tech marknadsföring, analyserar effekten av de fyra olika digitala platformen – Satellit, Kabel, Digital Terrestrial Television (DTT), och den framkommande IP TV, som spelar en roll till *tillgänglighetet* av digital television. Därutöver de olika leverans platformen, den transverala parametren av *kvaliteten* har på senaste tiden fått ett ökat avseende, tack vare Hög Upplösning (“High Definition”) som närmar sig till en kommersiell verklighet.

Därför möjliggör detta duala synsätt att skapa en strategisk bild av det europeiska digital television systemet på de fem till tio kommande åren, och visa nyckeltrenderna och scenarion för de olika ekonomiska aktorerna.

Nyckelord: digital TV, Hög Upplösning, IP TV, Europa, strategi, affärsmodeller

Acknowledgements

As the concluding work of my double-degree studies in Sweden (Royal Institute of Technology) and in France (Ecole Centrale de Lille), this Master of Science Thesis was performed between December 2004 and June 2005 at Sony Europe in Paris, within the Business Development division. Words alone cannot express how much I thank François Agueci, General Manager of the Business Development at Sony Europe, for those six months of working together, and how his drive and commitment in challenging the processes has made each day a rewarding and exciting moment.

In addition, I very much wish to thank all my colleagues at Sony, in France, Europe and Japan, who have, in one way or another, helped me in my work and in the completion of this project: Denis Bajas, Samuel Boublil, Françoise Burgarella, Pascal Clisson, Stéphane Curtelin, François Daurès, Falk Dietrich, Arnaud Destruels, Thierry Emilien, Renato Fascina, Sébastien Fernet, Yuhsuke Iwahashi, Roberto Kauffmann, Charles Lelong, Mark Londero, Sabine Montaron, Tim Narramore, Paul Szucs, and Hiroshi Yamazaki.

Likewise, I would like to thank all the people from the European broadcasters and telecommunication operators I have been in contact with for their valuable time and exchange of information.

Last but not least, I want to express my deepest gratitude to Dr. Lena Ramfelt, my academic Supervisor and Examiner, for having shared my passion for this project as well as for her support and feedback.

Paris,

May 22th 2005

Table of Contents

List of Figures

List of Tables

1 Introduction

Television: a medium – so called because
it is neither rare nor well done.

Ernie Kovacs

For the past sixty years, television has been an extremely pervasive and commercially successful media platform, spawning in its trail the creation and support of a whole new industrial sector, from broadcast networks and production services down to consumer electronics manufacturers. The now iconic TV set has become a strong symbol of the adoption of audiovisual information and entertainment in households in the western world, while in parallel being a powerful incentive for the economic players in the TV value chain to explore new ways of making the TV experience and consumption more attractive, more widespread and more profitable.

Starting in the 90s, the introduction of digital technology into the TV production, transmission and reception environments has been a key parameter to hasten and amplify this process. More than just an incremental step in the natural improvement cycles, this innovation has had a profound role in allowing a more flexible framework for TV, thereby making the industry more complex, but in parallel more open to new opportunities.

Today, in 2005, we can look back at this past decade that saw the burgeoning of new access networks, such as digital satellite and cable, and alternative business models, such as digital channel bouquets and feasible pay-per-view. It is however far more exciting to look ahead and analyze how those palpable results of digitization are hooking up with the new disruptive innovations that are getting in a commercial stage. This new structure that is currently being experimented and launched represents the seed for the new TV ecosystem for the five to ten years to come: not only digital technology *per se*, but a redefined value proposition to consumers in terms of access, quality and content offering.

1.1 Goals and study environment

This Master's thesis takes a forward-looking perspective at the opportunities and challenges for TV. By focusing on Europe and its specific context in terms of technology readiness, market situation and key players' strategies, the goal of this report is dual:

- Give a faithful portrait of the current major trends in TV development that are reshaping the market and shifting the paradigm from the *digitized TV viewing* of the 90s to the *digital TV experience* of the 00s. As the title of the thesis suggests, High Definition TV (HD TV[1]) and Internet TV (IP TV) are the two major disruptions that are appearing on

[1] All acronyms and abbreviations are compiled in the Glossary section, Appendix 0.

the market. The report puts them back into their European context and shows the inter-relations and impact they have on the structure of the TV market.

- Project into the future to look at the opportunities and threats for the sector in regards to the forecasted consequences such innovations will have on the TV industry. Specifically studied are the projected characteristics for this new "mix" of technology, value chain and business model that is likely to emerge by the horizon of 2015 as a result of a shift of strategy from the key industrial and service players.

In short, the objective is to give a clearer picture of the digital crossroads the TV industry is currently positioned. By both acknowledging today's complexity and uncertainty and streamlining the future outlooks, this report aims at increasing the awareness on the current market situation, while opening the way for recommendations and creative thinking for the digital TV of tomorrow.

1.2 Why Europe?

This report focuses exclusively on Europe as the geographical region for the thesis work and analysis. Furthermore, the bulk of the studying has been done around the top five European markets:

- France,
- Germany,
- Italy,
- Spain,
- and the United Kingdom.

Beyond the fact of having undergone the thesis project at Sony Europe in Paris, a key argument for choosing Europe as the framework for the report is the interestingly complex and multi-faceted situation the region is experimenting in regards to digital TV:

- As we will see in the next chapters, the commercial deployment of disruptive innovations in Europe has occurred at a different pace and order as compared to the United States, Japan or Australia for instance. While it can be considered as a later adopter of HD TV, Europe is on the other hand spearheading IP TV commercialization. As a whole, the continent is therefore concurrently experiencing several waves of change: new access networks for TV, higher quality with HD TV and the redefinition of the content offering.

- On an internal level, major differences are noticed between the European countries. The specific situations and sizes of the national markets, the actual adoption of new

technology, the characteristics of the key broadcasters as well as alternative regulatory choices make each country a distinct environment. In looking at the forthcoming trends strategies for digital TV, country case studies consequently make a valuable complement to the European-level analysis.

As a result, the report integrates the European perspective both on a *global* scale – by explicating the critical differences and synergies of the region with the rest of the world, and on a *local* scale – by taking into account the specific particularities of the national implementations of those digital TV innovations.

1.3 Methodology

Working as a Marketing Assistant at the Business Development division of Sony Europe for this Master's project has given me the opportunity to continually be in close contact with the key players of the TV and digital media industries:

- Within Sony: working on a national level with the French sales company has given me insights on the practical commercial implementations and outlooks for the development strategy I was contributing to at the European level.

- Within industry associations such as the French HD Forum as well as the SIMAVELEC (French consumer electronics manufacturers association), in which the mutation of the sector's role and offerings as well as technical standardization are key activities.

- Through participation to national, European and global events and gatherings, such as the CeBIT in Hanover or the HDTV Summit in London. It has contributed to an "insider" look at the latest trends in digital TV and discussion topics among industry experts.

- Through business exchanges with electronics vendors, broadcasters, pay TV operators, Internet Service Providers (ISPs) and retailers. That way, the current state of the market gets reflected by the different actors within the digital TV value chain, thus enabling a more integrated understanding of the future outlooks.

Such a combined approach has brought the analysis as immersed as possible in the actual industrial environment in which the issues discussed in this report represent a major stake. By adding to this real-life experience the input from the theoretical tools of high-tech marketing and strategy, the goal is to bring a global framework together with a practical, case-focused approach on digital TV challenges.

1.4 Structure of the report

As shown in Figure 1.1, the Master's thesis report starts off by an overview of the theoretical tools and framework in Chapter 2: it gives the general concepts under which innovations have been taking place and why today's is the right time for disruptions to come out on the market.

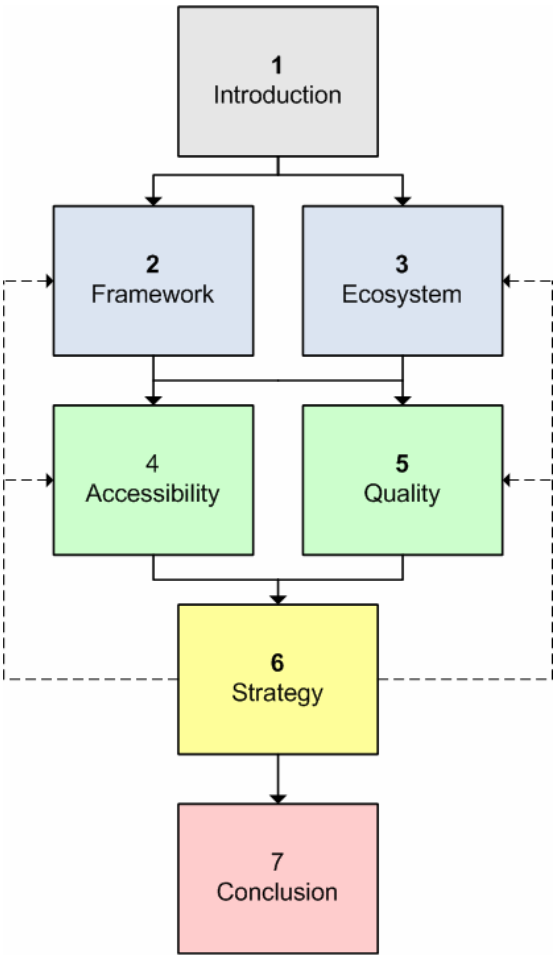

Figure 1.1 Structure of the report

In Chapter 3, a retrospective of the evolution of the digital TV ecosystem is given, and it stresses on the key parameters and circumstances that have established the mass transition from analog TV to digital TV in the 90s. While analyzing this evolution of digital TV, both in the lights of past and current developments, two components have been identified:

- *Accessibility* – Chapter 4. Digital TV allows porting TV broadcasting through alternative access networks more easily – a phenomenon started in the 90s with the advent of digital satellite and digital cable offerings. Today, this movement continued by shifting terrestrial transmission to digital (Digital Terrestrial TV – DTT). Today accessibility is reaching a new dimension by converging with the telecommunications area through IP TV. More than just "yet another" way of getting TV access, IP TV is an emerging but radical shift of the packaging, transmission and end-user equipment.

- *Quality* – Chapter 5. An R&D and engineers' dream for many decades, High Definition is finally shaping itself as a reality in Europe. The move from Standard Definition (SD) to High Definition (HD) is not just simply a matter of increasing the number of lines in a TV picture: it is a profound change for the whole industry, and it shows already today the potential to significantly reshape how added-value is defined for TV.

Those two axes create the core structure of the report regarding the current situation in the digital TV sector. Indeed, while ultimately impacting on the end-user's experience, they simultaneously influence the development and evolution of each actor in the evolving digital TV value chain: while the two issues of accessibility and quality are by essence distinct in their origin, they are deeply correlated in the impact they have for the future.

Chapter 6 integrates the lessons learned from the current market: it shows the conditions, format but also challenges under which new business models and value chains can be formed that take benefit from the disruptive innovations analyzed in Chapter 4 and 5. More than just predictions, the ultimate purpose is to point out the strategic directions, *i.e.* the key Strengths, Weaknesses, Opportunities and Threats (SWOT) for the industry behind which digital TV is evolving to, as well as relating this empiric evolution to the theoretical frameworks exposed in Chapter 2. All in all, this mix of theory and pragmatic examples aims at exemplifying the challenges and conditions in which the dilemmas of future digital TV can be approached by the different market players in Europe.

2 Theoretical tools and framework

Why was it that firms that could be esteemed
as aggressive, innovative, customer-sensitive organizations
could ignore or attend belatedly to technological innovations
with enormous strategic importance?

Clayton M. Christensen[2]

In addition to the empiric, real-life and "real-time" analysis that will follow in Chapters 3, 4 and 5, this work integrates several theoretical frameworks and analysis tools as a red-line to help explain the complex evolutions and challenges of the digital TV market in Europe. Hereafter are introduced the two key elements which will be applied and referred to throughout the report: a framework for understanding digital TV innovations, and how its adoption lifecycle in the consumer market can be modeled.

2.1 Innovations: the dilemma of disruption

The first key notion that is in need to be defined is that of *innovation*. Especially in a highly technologically-focused industry sector such as the consumer electronics and media industry, innovation is naturally perceived as one of the main factors for both new market successes but also the striking failures of some established market leaders.

Indeed, as Christensen develops[3], what we commonly consider as an innovation can actually be the consequence of two extremely different technological factors:

- *Sustained* technology – This first category represents the type of technologies that improve the performance and overall value of the product(s) on which it is applied. While they can differ in the pace and breadth of change they bring, they have the fundamental characteristics of keeping the existing market structure and general business models of the industry. In short, they help the product in becoming more performing in a continuous way over time and keep the same business paradigm untouched.

- *Disruptive* technology – On the other hand, disruptive technologies bring a new value proposition to the market. The short term effect is therefore that "*disruptive technologies underperform established products, but [...] have other features that a few fringe (and generally new) customers value*"[4]. Just like what transistors were to vacuum tubes in the 50s, digital photography to photographic film and DVDs to VHS among many other

[2] [2] [Chr03] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. (HarperBusiness Essentials, 2003), p. 26.
[3] *Ibid*., Part One.
[4] *Ibid*., p. 264.

examples, disruptive technologies are injecting profound yet not initially noticeable changes in the value chain by creating a discontinuity in the product's evolution.

Those two dual categories have to be seen in both the short and long term time-span for the industry, and looking at their respective evolution outlines the importance of spotting and analyzing the disruptive opportunities and threats, as modeled in Figure 2.1.

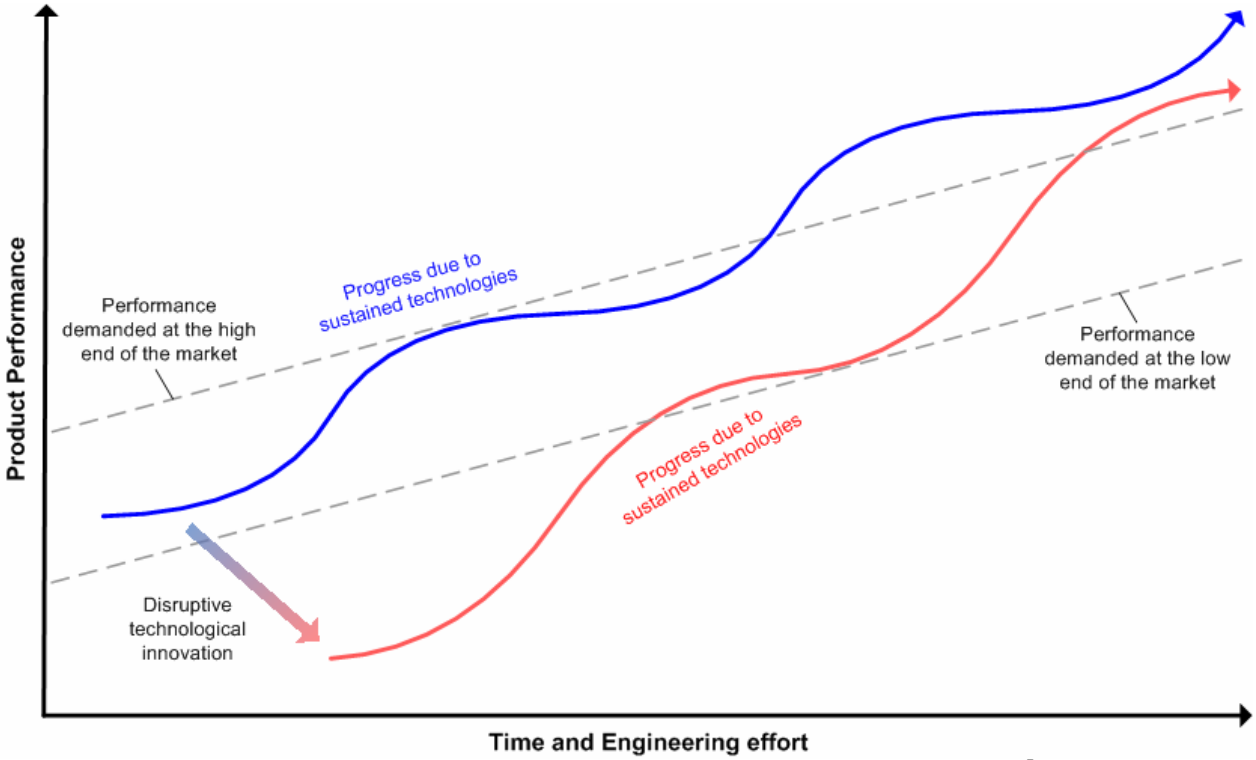

Figure 2.1 The impact of sustained and disruptive technological change[5]

The model shown above highlights the short-term cycles of sustained technological progresses which follow a succession of well-known S-curves, as well as the longer term rise of the disruptive technologies: they start out as a lower performing alternative, but quickly catch up to first meet the demands of the low end of the market, and then progressively meet the requirements of the whole spectrum of customers. This results in the progressive migration of the market from the legacy technology to the disruptive one over time.

This phenomenon is precisely at the crux of the innovation challenge that is dealt with in this report: disruption starts out "*right at the bottom of the market in terms of quality, cost and margins*"[6], which entails that it is often overlooked by the sustained key established market players as a *liability*, whereas some entrants see it as an *opportunity* to enter a grassroots, low-price point niche, before moving up to higher margin markets over time. Hence the *dilemma* in being simultaneously mobile *upwards* to higher margin markets through sustained technologies and *downwards* by spotting the signals of disruptive change in much less attractive markets at

[5] Adapted from *Ibid.*, p. xix and p. 45.
[6] *Ibid.*, p. 103.

first. Such asymmetry in the mobility demanded to high-tech firms is therefore at the core of our analysis of the coming digital TV disruptions that High Definition and IP TV represent, and we will look inside the industry's value network in the coming chapters to better understand its evolution as well as the stakes to successfully negotiate those disruptions.

2.2 Technology Adoption Lifecyle

In parallel as the disruption of technological innovation gradually progresses and grow towards higher product performance and higher market consumer segments, the actual adoption of the derived products and/or services depends on a lifecycle framework whose study help better understand the challenges and opportunities ahead at various stages.

2.2.1 The Lifecycle

The lifecycle framework that will be applied throughout this work is taken from the one Moore develops in [Moo99][7] and [Moo04a][8] for analyzing the dynamics of high-tech marketing, and which can be graphically represented as the segmented bell curve shown in Figure 2.2.

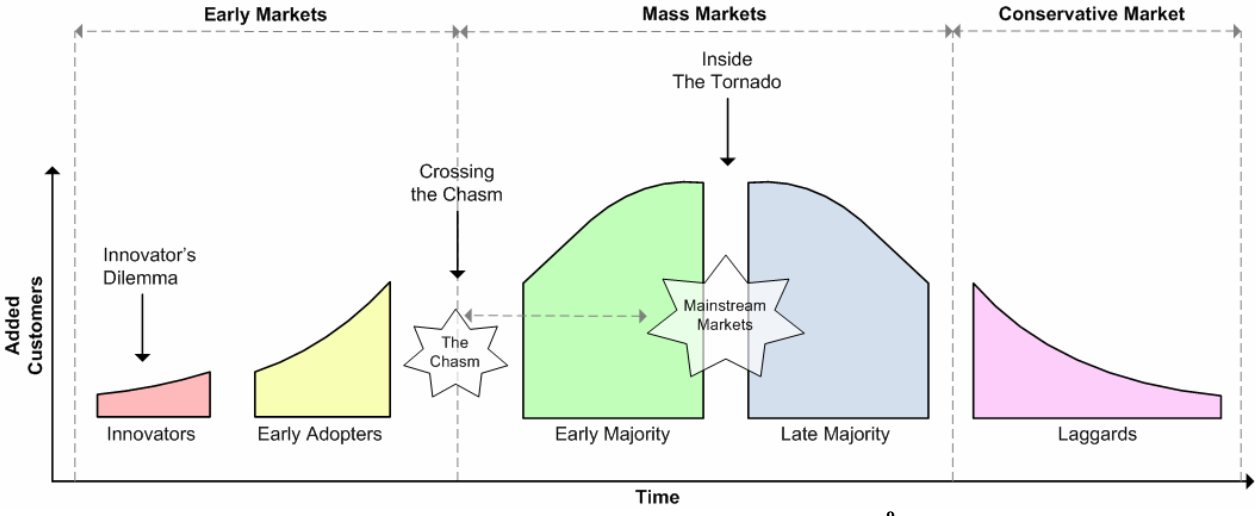

Figure 2.2 The Technology Adoption Lifecycle[9]

As the product becomes more mature and refined, it attracts different segments of new customers, each of whom can be considered as a "*psychographic profile*"[10], *i.e.* a unique mix of demographics, psychology and general behavior as well as expectations towards technology, which makes each of those 5 identified segments different from the others and with the following generic attributes:

[7] [Moo99] Geoffrey Moore, *Crossing the Chasm*. (HarperCollins Publishers, 1999)
[8] [Moo04] Geoffrey Moore, *Inside the Tornado*. (HarperCollins Publishers, 2004)
[9] Adapted from *Ibid.*,p. 25.
[10] [Moo99], p. 11.

- Innovators – They are the first people to adopt and integrate the technology, and as such appreciate technology for its own sake. Such technology enthusiasts take the risk of seeing beyond the imperfections of a not-yet totally polished offering, and they often have a key influence within their corporate structures (in case of B2B) and social networks (in case of B2C), which is precisely why disruptive technological innovations get seeded there in order to get their necessary endorsements to give credibility to the offering.

- Early Adopters – Often seen as visionaries, they are the ones bringing the discontinuous innovation more fully in the early market phase. In their search for breakthroughs, not mere improvements, they are "*easy to sell but very hard to please*"[11], *i.e.* eager to adopt new products but in search of a concrete and tangible return on investment.

- Early Majority – Underlining their strong difference from the early market, they adopt a pragmatic approach to high-tech and rather shun the *revolutionary* and disruptive aspect of the offering to be more sensitive to the *evolutionary* proposal. Hence their focus on market leaders and strong brand as to give steady foundations to their acquisition.

- Late Majority – While quantity-wise a market segment as large as the Early Majority in the mainstream market phase, its members are more likely to have a conservative approach towards technology and disruption. In their demands for simplification and commoditization, the smart bundling and packaging of technological innovations play a central role in winning this segment.

- Laggards – Their high skepticism towards technology makes it more meaningful "*not to sell to them but to sell around them*"[12].

All in all, those 5 segments represent the evolution in terms of targets and demands the technology-based innovations we will describe in Chapters 4 and 5 have to go through. However, more than just responding to each segment's demands, the successful innovation will be the one flexible and risk-taking enough to manage the complex transitions throughout the lifecycle, as exemplified in the following sections. Indeed, the reality is not a smooth and continuous progression between the segments, but difficult and time-sensitive repositionings of the strategy to tackle the new segments. As shown in Figure 2.2, "*the spaces between segments indicate the credibility gap that arises from seeking to use the group on the left as a reference base to penetrate the segment on the right*"[13].

[11] *Ibid.*, p. 35.
[12] [Moo04a], p. 17.
[13] [Moo99], p. 56.

2.2.2 Crossing the Chasm: from early to mainstream markets

While such gaps are reasonably normal parts of the strategic evolution and position shifting, Moore has drawn the attention to the Chasm, *i.e.* the unusually wide gap existing between the early adopters and the early majority. The Chasm represents the profound shift of customer's attention, passing from early adopters willing to bear bugs and imperfection as well as expecting a radical discontinuity to the larger potential base of the early majority, in search of tangible improvements and value propositions and expecting a readily usable and well packaged offering.

Chasm-crossing is a critically difficult and important challenge because it intrinsically consists in choosing a relevant niche in the mainstream market to target as a first outpost position in the mass-market. As Moore cleverly puts it, "*trying to cross the chasm without taking a niche market approach is like trying to light a fire without kindling*"[14]. The goal is thus to focus the industry's resources on a specific point to anchor the innovation in the post-chasm, right part of the lifecycle. In addition to the very choice of niches for the expansion strategy, the value proposition itself is to be reshaped to meet the new demands, as shown in Figure 2.3, which represents the sectional view of the technology adoption lifecycle.

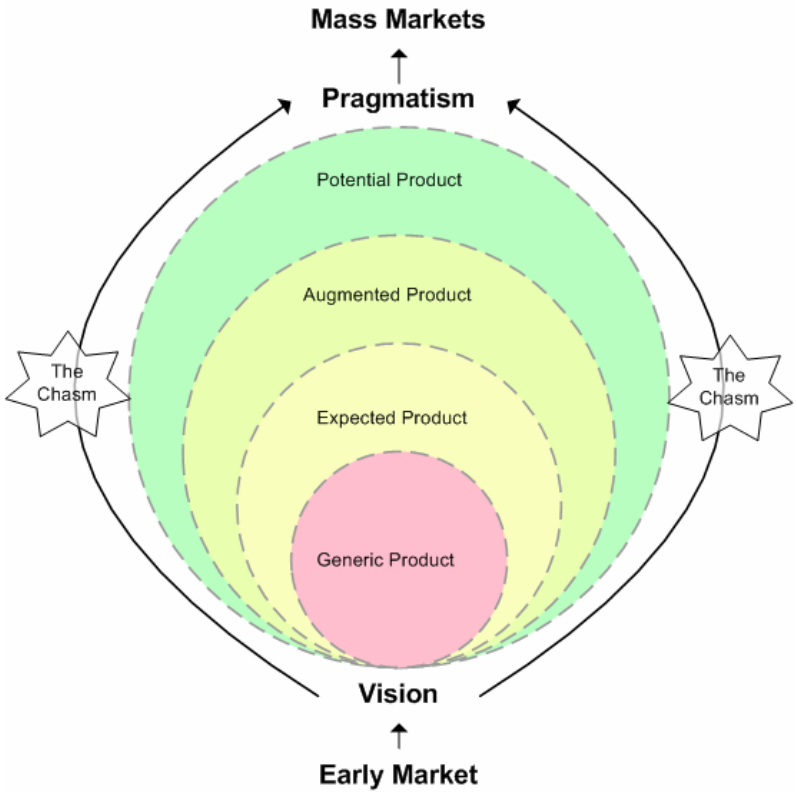

Figure 2.3 The Whole Product Model[15]

It shows the necessary correlation between the marketing and value proposal evolution towards mainstream markets with the actual offering and bundling of the product itself: while the product

[14] *Ibid.*, p. 67.
[15] Adapted from *Ibid.*, p. 109.

itself is at the center of the attention for the innovators, it soon becomes essential to take into account what is *around* it in order to attract post-chasm niches with a *whole product* offering. Figure 2.3 hence details the different stages of product bundling that will lead to having it accepted by the pragmatist mass market.
For instance, starting from barebone digital TV, parameters such as customer service and support, integration and inter-operability with other existing home devices, learning curve and the upgradeability will enrich the minimum configuration for the product and help maximize its "*chance of achieving the buying objective*"[16]. What makes it "*extremely difficult to cross the chasm in consumer market*"[17] such as the one of digital TV we are looking at, as opposed to a business market, is the intransigence of the end-users in adapting themselves to an immature or not-yet wholly-packaged offering: hence the special focus given to how the disruptions of IP TV and High Definition can be packaged for the mainstream markets.

In summary, crossing the chasm means a smart segmentation and a shift of focus from purely performance-centered to marketing-centered value propositions. In that sense, the goal is to positively affect the consumer's vision of the disruptive innovation (*cf.* Figure 2.1) and makes him adopt it faster.

2.2.3 Evolving in the mainstream markets

Looking from a post-chasm perspective, the niche strategy we have outlined as a tool to jump from early to mainstream market does not last long in the consumer market of digital TV we are dealing with. Indeed, in a B2B market, one can leverage on the network accumulated customer references from different niches and use them in a "*bowling pin model*"[18] strategy to demultiply market development. On the contrary, "*the structure of consumer markets does not support bowling alley strategy*"[19] warns Moore: among other parameters, the quasi-absence of price elasticity for consumers[20] makes niche building alone unable to open the way to mass market.

In our case, the framework we propose is one that jumps directly "*inside the tornado*"[21]: taking the leadership of the (hyper)growing market (early majority and parts of the late majority), and securing the later and slower growth (late majority and laggards). This is summarized in Figure 2.4, which shows adoption lifecycle from a "helicopter" perspective, hence underlining the compared evolution between the early market development and the mainstream market development:

- Lowering of the paradigm shock – While the early market is much focused on a specialist customer base, the key parameter for growing in the mainstream market is the adaptation to a generalist market, hence the importance of the whole product approach we saw

[16] *Ibid.*, p. 109.
[17] *Ibid.*, p. 96.
[18] [Moo4a], p. 38.
[19] *Ibid.*, p. 58.
[20] In comparison with industrial business markets, where price *per se* is not taken as a decision factor, and is instead supplanted by the Total Cost of Ownership (TCO).
[21] *Ibid.*, p. 63.

earlier: by bundling the disruption of the generic product, it is "hiding" its complexity and contributes to a faster transition to the Tornado phase.

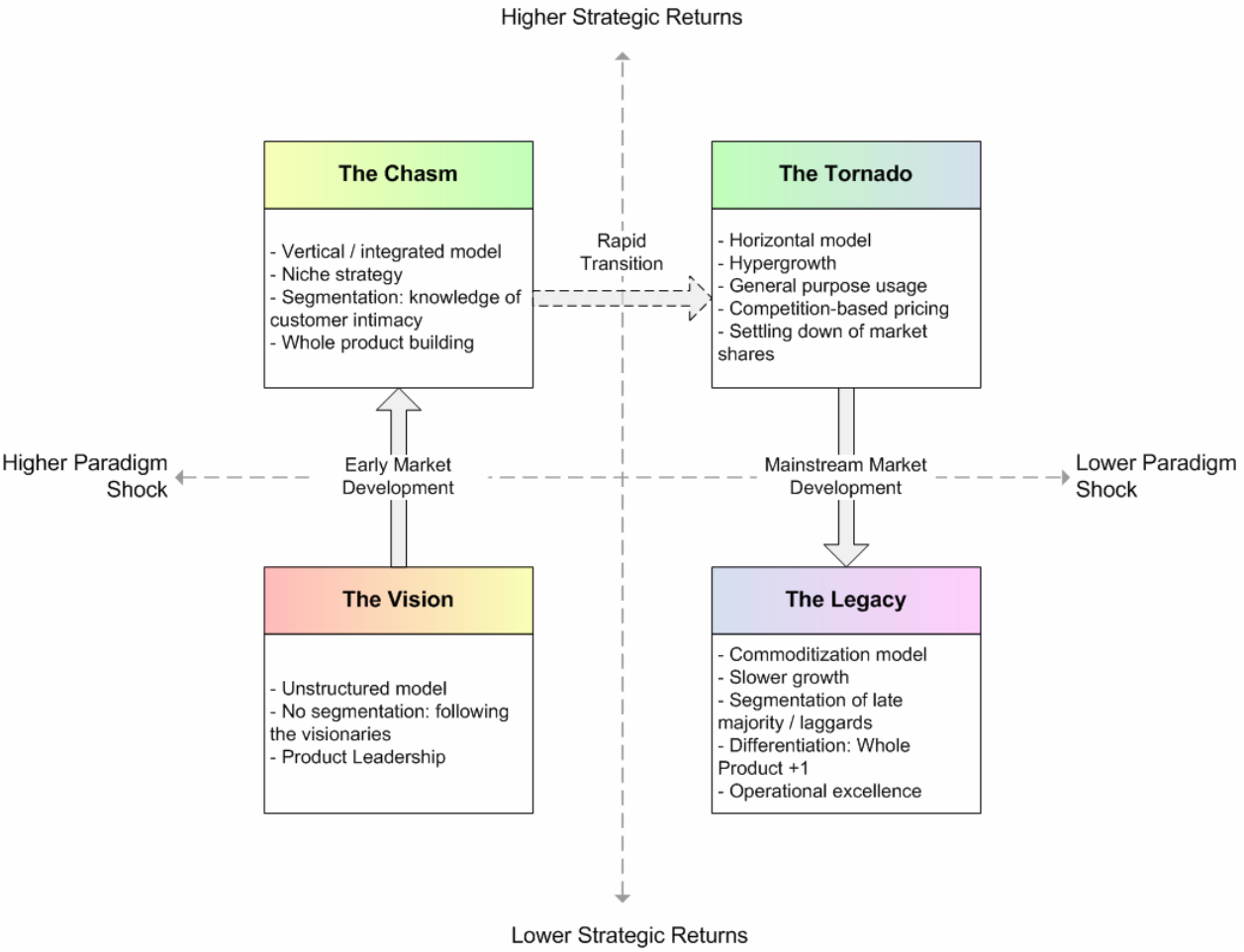

Figure 2.4 Moving to consumer mainstream markets[22]

- Variation of strategic returns – The Chasm and Tornado are the phases where the long-term market structure and industry players' market shares are being settled down. In our consumer market perspective, the mainstream market development therefore follows a reversed approach from the early market development we saw earlier: while early market niches are built to hook to the strategic entry points to the post-chasm phase, the mainstream market sees niches as a marketing extension to the commodity market, in order to reach the late adopters and laggards. This is what Moore calls "*The Whole Product +1*"[23].

[22] Adapted from *Ibid.*, p. 136.
[23] *Ibid.*, p. 111.

3 Evolution of the TV Ecosystem

We live in a discontinuous world,
one where digitalization, deregulation and globalization
are profoundly reshaping the industrial landscape.

Gary Hamel

Before going in details on the current disruptions made by the change in accessibility, quality and quantity available in the digital television environment in Europe, this chapter focuses on describing the context under which the transition from analog to digital was made, and the key parameters that have accompanied this evolution of the economic ecosystem and still have an influence in today's changes.

3.1 Scarcity and monopoly in the analog world

Throughout its more than half century of commercial existence, television in Europe has progressively acquired the commoditized image of an always available service backed by a relatively conservative media industry. Up to the mid 80s, television was indeed synonymous with several components that seemed immutable at the time:

- Analog technology.
- Terrestrial reception.
- A limited choice of free channels subsidized by advertisements and license fees for the public channels.

The operating model was then quite straightforward, with the different actors of the value chain firmly settled in their position, as shown in Figure 3.1:

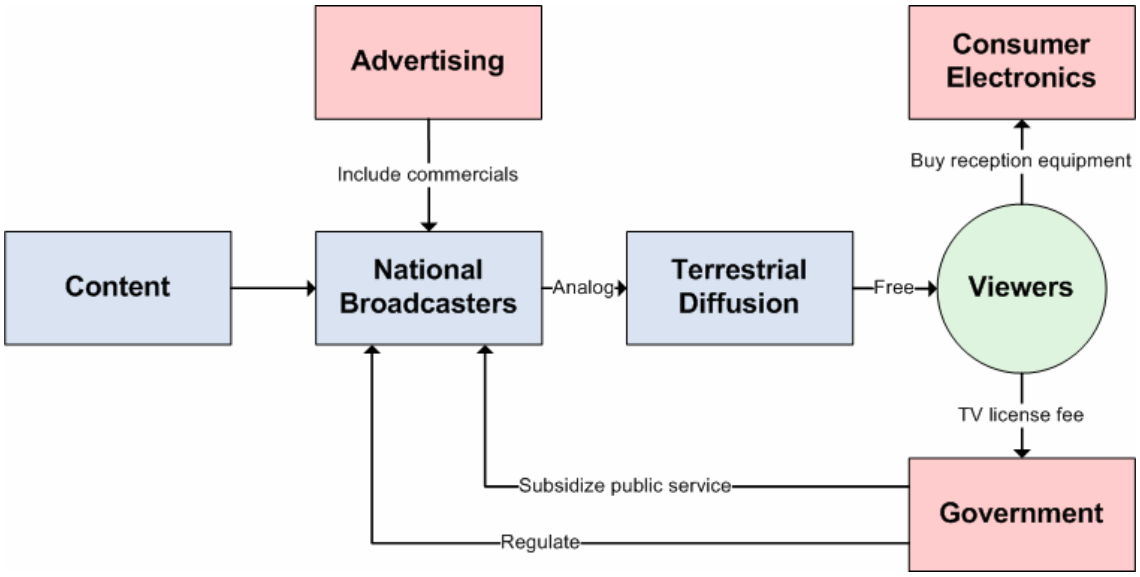

Figure 3.1 Traditional TV value chain

Such a model had remained virtually unchanged in its structure from the first days of commercial TV, with its key players positioning themselves as follow:

- *Content* – Licensing from their respective rights owners (production studios in the case of films, host broadcasters and international sport associations for sport-related events), in-house and third-party production.

- *National broadcasters* – European broadcasters started out as public and government-sponsored organizations, with deregulation progressively taking place in the 80s. As Papathanassopoulos underlines, "*the initial wave of injudicious deregulation included Italy, Luxembourg, France and Germany* [committing] *themselves to massive deregulation by 1986"*[24].

- *Terrestrial Diffusion* – Using terrestrial airwaves as the diffusion network support was the simplest method in terms of backbone infrastructure and technical complexity. Building on the expertise gained from radio diffusion, organizations like TDF ("Télédiffusion De France") in France were built as a monopoly that was faced with deregulation as digital technologies were brought to the market, as we will see in the next sections.

- *Consumer Electronics* – As shown in Figure 3.1, the traditional television value chain was inherently horizontal in its structure: although few independent players were involved, the business model of free analog terrestrial TV was clearly separating the content creation, the packaging by broadcasters and the diffusion.
  In such an environment, the consumer electronics players had an enabling role in supplying end-users with reception equipment – both for viewing (TV sets) and storing (VCRs).

[24] [Pap02] Stylianos Papathanassopoulos, *European Television in the Digital Age*, (Polity Press, 2002), p. 15.

- *Government* – Governments all over Europe played a central role in both subsidizing the public broadcasters as well as tightly regulating the content and operations on a regional or national level.

The key parameters of "*Channel Supremacy*", "*scarcity*", "*monopoly*" and "*single source of revenue*" [25] Griffiths depicts for the American analog terrestrial market are therefore also applicable to the European situation: by essence, terrestrial airwaves are a limited resource, whose allocation has always been managed by the spectrum regulation bodies – the European equivalents of the American FCC (Federal Communications Commission). In the 5 countries that are at the center of our study, they are:

- The CSA (*Conseil Supérieur de l'Audiovisuel*) in France.

- The local Länder and the national ALM (*Arbeitsgememeinschaft der Landesmedienanstalten*) in Germany.

- The AGCOM (*Autorità per le Garanzie nelle Communicazioni*) in Italy.

- The CMT (*Commisión del Mercado de las Telecomunicaciones*) in Spain.

- The Ofcom in the UK.

The scope and role of each of these organizations vary from country to country: for instance, the Ofcom and the AGCOM answer for both broadcast and telecommunications regulations, whereas the two issues are split in France between the CSA for broadcast, and the ART (*Autorité de Régulation des Télécommunications*) for the telecommunications side. Similar differences occur in the extension of the regulatory powers to the private sectors: as underlined by the European Platform of Regulatory Authorities (EPRA), while most regulatory bodies in Europe have powers over both the private and public sectors, others, like in Germany, are restricted to the regulation of public broadcasting.

Despite such differences in the internal structure of the regulatory bodies, their core responsibilities are similar in the sense that they control the broadcasting environment, both in terms of accessibility (by giving and revoking broadcast licenses) and content (by monitoring the audiovisual materials aired by broadcasters and making sure they respect the legal framework in which they have been authorized to emit). Regarding the accessibility, a key element is the inherent limitation of the analog terrestrial to support multi-channel emission, hence the scarcity of the numbers of channels: although the actual technical broadcasting standard (SECAM in France, PAL in the rest of Europe) as well as the dedicated frequency band characteristics differ slightly depending on the country, the common transmission mechanism can be modeled as follow in Figure 3.2:

[25] [Gri03] Alan Griffiths, *Digital Television Strategies – Business Challenges and Opportunities* (Palgrave Macmillan, 2003), p. 4.

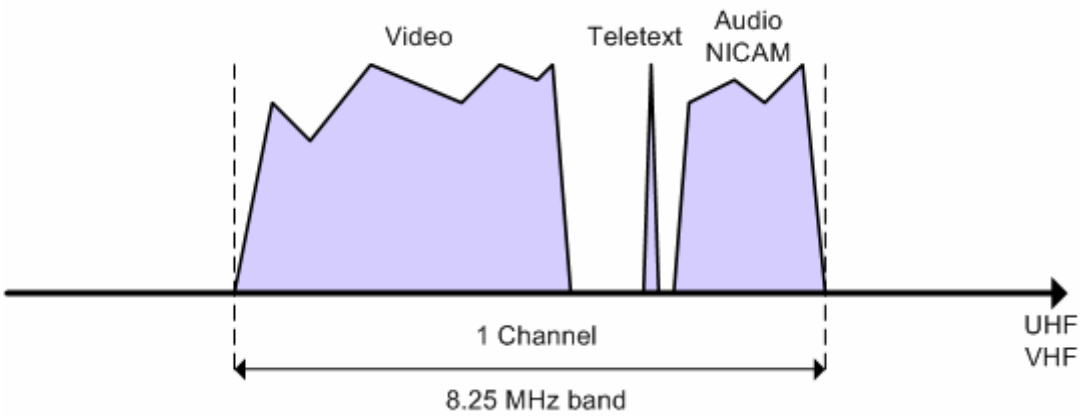

Figure 3.2 Analog channel structure

Without going into deep technical considerations analog TV signals are transported within the VHF (Very High Frequency – 30 to 300MHz) and UHF (Ultra High Frequency – 300 MHz to 3GHz) frequency range, which is divided into a number of 8.25MHz-wide channels, with each channel having the necessary space for 1 audio-video stream. As the VHF and UHF bands are also used for private, military or industrial purposes, the amount of channels actually available for nation-wide TV transmission has limited the diversity of programs broadcast over the air. And indeed, figures show the number of commercially significant terrestrial national channels in European countries ranging from a maximum of 14 in Germany to as low as 3 in Austria[26].

This, added to the generalized single-source revenue scheme for broadcasters, has contributed to creating strong oligopolies, if not monopolies around audio-visual content, a situation that began to be challenged in the mid-80s, as new types of players were allowed to enter the market with differentiated offerings and approaches:

- *PayTV terrestrial channels* – Cloning the extremely successful HBO in the USA, channels like Canal+ in France heralded the deregulation area in Europe. While the success of France's first payTV channel and first new channel since 1972 was far from obvious when broadcasting began on November 4th 1984, its relevance quickly became apparent, with the millionth subscriber being reached in May 1986, a number to be doubled by September 1987 and growing over 3 million subscribers in 1990[27].

  Putting the accent on content, with an especially rich offer in feature films and major sports events, such a channel was quickly followed by others in Europe. This contributed to pushing forward a new revenue model: subscription + decoder renting.

- *Analog cable and satellite* – While the US cable and satellite model was driven by the poor coverage and overall quality of terrestrial reception, European cable and satellite was mainly driven by the premium content made available, with football rights being a major switch-over argument, "*one of the terrestrial broadcasters' weakest spots*"[28] as Griffiths notes. Helped by the lessened bandwidth constraints, analog satellite was indeed

[26] [Pap02], p. 15.
[27] [C+05] Canalplus Groupe, *Historique*, http://www.canalplusgroup.com/pid163.htm
[28] [Gri03], p. 7.

particularly favored by transnational and global broadcasters, hence the emergence of powerful networks "*form*[ing] *alliances to maximize clout in buying programme rights, to share encryption technology and to spread the financial risk*" [29], as underlines Papathanassopoulos. Examples like British Sky Broadcasting (BSkyB) in the UK, Canal+ in France and Premiere in Germany (originally a joint venture between Kirch, Bertelsmann and Canal+) show the supremacy of the then new payTV model as a pan-European strategy, complementing also the free-to-air and unencrypted satellite broadcasting that also became substantially popular.

These two innovations brought together television into the multi-channel area, where the quantity of content was not a technological restriction but the basis for a new business model. In doing that, the role of television switched from that of a reception model to a *platform* model: reception was not a passive and transparent component anymore; it could now be translated to *subscription*, hence creating an alternative channel of revenue, and allowing the emergence of new broadcast players entering the niche markets of thematic and premium channels:

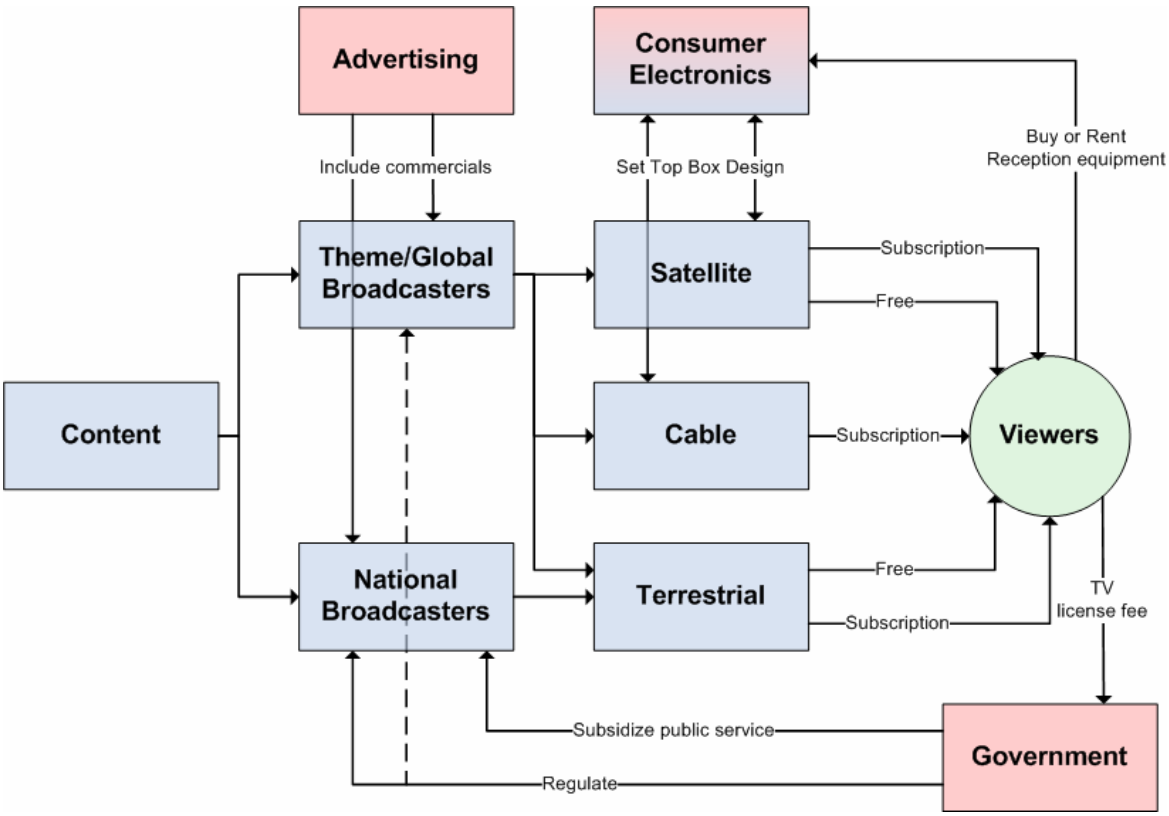

Figure 3.3 Analog multi-channel value chain

As shown in Figure 3.3, what was an entirely horizontal value chain became more complex, with analog cable and satellite platforms creating a more vertical structure – where participating broadcasters, diffusion networks and viewers' consumer electronics devices work in closer

[29] [Pap02], p. 38.

cooperation and integration with each other to create alternatives to national and free terrestrial reception:

- The availability of premium content, the strongest argument in favor of cable and satellite alternatives, was made possible due to the tighter relationships between the "content" and the "container" – as witnessed by the crossed influence and financial participation between content providers, broadcasters and diffusion networks.

- The rental model also spawned extended joint development between networks and consumer electronics vendors: as Set-Top boxes (STBs) were making their first widespread appearance, it became clear managing encryption and the necessary Conditional Access (CA) methods to enforce the subscription model demanded a more integrated process.

This shift of paradigm brought by cable and above all satellite receptions amounted to the fact more than 52 million households in Western Europe were receiving analog cable or satellite in 1994[30], and nearly 60 million in 1996.

3.2 Digitization and disruption

When Canal+ launched its digital satellite bouquet – *Canalsatellite Numérique*, in April 1996, it was Europe's first commercial foray into digital TV, and was quickly joined by the bulk of European countries between 1998 and 1999. As a whole, this phenomenon created the first major disruption of the European audiovisual landscape in several decades, in the sense that it combined a generational leap of technology with a shift of business paradigm. In short, "*digitization is transforming not only the way we watch television [...], but also the way television is made*"[31], as cleverly coined by Chalaby and Segell.

While its impact and consequences are at the center of our study, television was of course not the first mass media to go successfully through the different stages of digitization. The first noticeable digital "revolution" occurred in the 80s, in the music industry, with the technology push of the Compact Disc (CD) technology. We can but notice strong similarities in the motivations, process and market response between the digitization of the music industry in the 80s and the more recent one, and still ongoing, of the broader broadcast industry:

- *Technology as the driver* – Digital coding for CDs were the result of substantial technological leap and strong lobbying backed by the consumer electronics industry, spearheaded by Sony and Philips at the time. The same pattern has been recurring since the 90s for digital broadcasting, with broadened associations like the Digital Video Broadcasting (DVB) and the European Telecommunications Standard Institute (ETSI)

[30] [Eut01] Eutelsat, Eutelsat quarterly newsletter. Issue 43, December 2001, http://www.eutelsat.com/news/pdf/newsletter/BusNews43.pdf, p. 2.
[31] [ChS99] Jean Chalaby and Glen Segell, *The broadcasting media in the age of risk - The advent of digital television*. (New Media & Society, vol. 1, no. 3 pp. 351—368, 1999), p. 352

rallying technology companies to set the standards and push for adoption in Europe. As we will see later on, all the major technological innovations – such as compression and High Definition, were the results of intense mediation and joint developments resulting in a solid foundation for the next generation of broadcasting.

- *Content as the follower* – On the content side, the pattern has until recently been a reaction instead of an active participation in defining the future. By drastically changing the characteristics of the networks the contents are feeding, "*[d]igitization of television has profoundly increased the sources of uncertainties and the level of risks for the rapidly expanding number of players involved in broadcasting*"[32], as Chalaby and Segell warned in 1999. 6 years later, this statement is all the truer, as the dematerialization of content – with IPTV for instance, and the higher quality of reception – with High Definition, have made it harder to control the actual usage and reach of this valuable audiovisual content. From the "walled garden" environment of the analogue world to an inevitably less centralized model as digitization opens new doors, content providers have been more or less willingly made to adapt to different distribution models due to market demand.

- *Consumer as the tipping point* – In the end, the outcome of this "chicken-and-egg" dilemma between digital technology and content is made by the consumers adopting or not the new form of media consumption. A striking example is the failed attempt of introducing full-fledged interactive TV in 1997-2000: despite some clear innovations in the forms of STBs and Web integration as well as the support from strong players like Thomson and Microsoft[33], the lack of consumer response undermined its massive adoption out of the "*early adopters*"[34], using the terminology we saw in Chapter 2.

Hence the duality between technology pushing on one side, and the content-driven business on the other side. This creates an innovation environment very specific to the broadcast industry:

[32] *Ibid.*, p. 352.
[33] [Mic98] Microsoft, *Microsoft and THOMSON Multimedia to Work Together on Interactive TV*. Press release, July 30, 1998, http://www.microsoft.com/presspass/features/1998/7-30thomson.asp
[34] [Moo99] Geoffrey Moore, *Crossing the Chasm*. (HarperCollins Publishers, 1999).

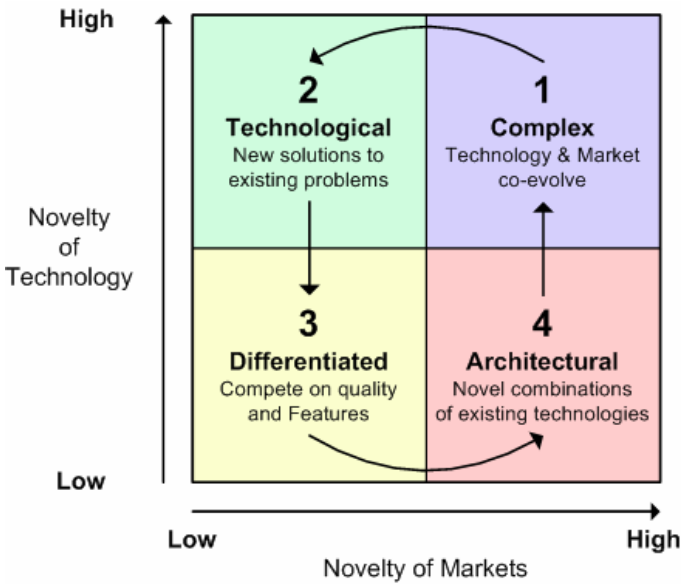

Figure 3.4 Technological and market maturity in the digital broadcast industry

From the traditional marketing process described for instance by Tidd, Bessant and Pavitt[35], Figure 3.4 adds the dynamics and evolution specific to the context of digitization in the broadcast and television sector, and depicts the crossroads the industry is currently at:

- *Complex* – The disruption is both a technological one as well as a market one. This is the situation in which IPTV is today, as we will detail later on.

- *Technological* – High Definition is positioning itself at this level by providing a leap in terms of quality of experience to an existing consumer market.

- *Differentiated* – This is the current state of the Standard Definition digital cable and satellite providers, in a market already consolidated. As the technology has to cope with the installed base, their competition is on the content side for their stalling market shares.

- *Architectural* – Digital Terrestrial Television is being launched today with commoditized technology to hit directly the portion of the market still remaining in the analog world.

Together with the frameworks detailed in Chapter 2, this should be seen as a foundation for the rest of the report, a snapshot of the respective positioning of the different innovations driving the television industry in Europe to the next five to ten years.

[35] [TBP01] Joe Tidd, John Bessant, Keith Pavitt, *Managing Innovation*, (John Wiley and Sons, July 2001), p. 166.

3.2.1 Technological vectors

As we saw earlier on, digitization is a progressive movement, with a generational approach in the technologies being used and replaced as time goes. Out of the vast amount of technologies that have been involved in making digital television a reality in Europe, two key components can be mentioned, due to the ongoing evolution and impact they continue to have in today's developments:

- Digital compression – whether on the cable, satellite, terrestrial or IP networks, bandwidth is a limited resource. Hence the crucial importance of having efficient algorithms and cost-effective on-chip or software solutions to encode and decode digital audio and video streams. In that area, the most significant work has been that of the Motion Picture Expert Group (MPEG), a working group formed in 1988 as a joint activity between the International Telecommunications Union (ITU), the International Organization for Standardization (ISO) and the International Engineering Consortium (IEC).
  In 1992, MPEG-1 was standardized, but the VHS-quality it was achieving restricted to niche applications like low-resolution conferencing and Video CDs (VCD). Two years later in 1994, the MPEG-2 standard finally provided full broadcast quality, and is today *the* standard for digital Standard Definition programs, as it is the compression format of DVDs and of the digital cable, satellite, IP and free-to-air DTT in all Europe.
  The continued work of the MPEG group has given birth to various parts of the MPEG-4 set of standards starting in 1999. This new generation is playing a key role in the rolling-out of High Definition in Europe, as we will detail further on.

- Conditional Access – Digitization separates the data from its actual support, and letting broadcast-quality digital content being streamed is not something content providers are ready to allow without some forms of protection against copy. As shown in Figure 3.3, the vertical and integrated developments between networks platforms and consumer electronics vendors already existent in the analog world became tighter when it was time to develop the digital STBs: it enabled the inclusion of proprietary encryption mechanisms – *e.g.* Viaccess for TPS, MediaGuard for Canal+'s, NDS for BSkyB...
  The Conditional Access concept has grown today to cover the whole Digital Rights Management (DRM), *i.e.* embedding the control and authorization not only on the subscriber's side (such as what was already being done with the subscriber's card inserted into the STB), but in the *media* itself. The tighter integration of digital broadcasting with IP as well as the arrival of High Definition content make it a fundamental step forward in order to conciliate new forms of media diffusion with the higher risks of piracy.

3.2.2 Business Factors

In response to the aforementioned technological vectors of change, the players of digital television in Europe have integrated them in new offerings:

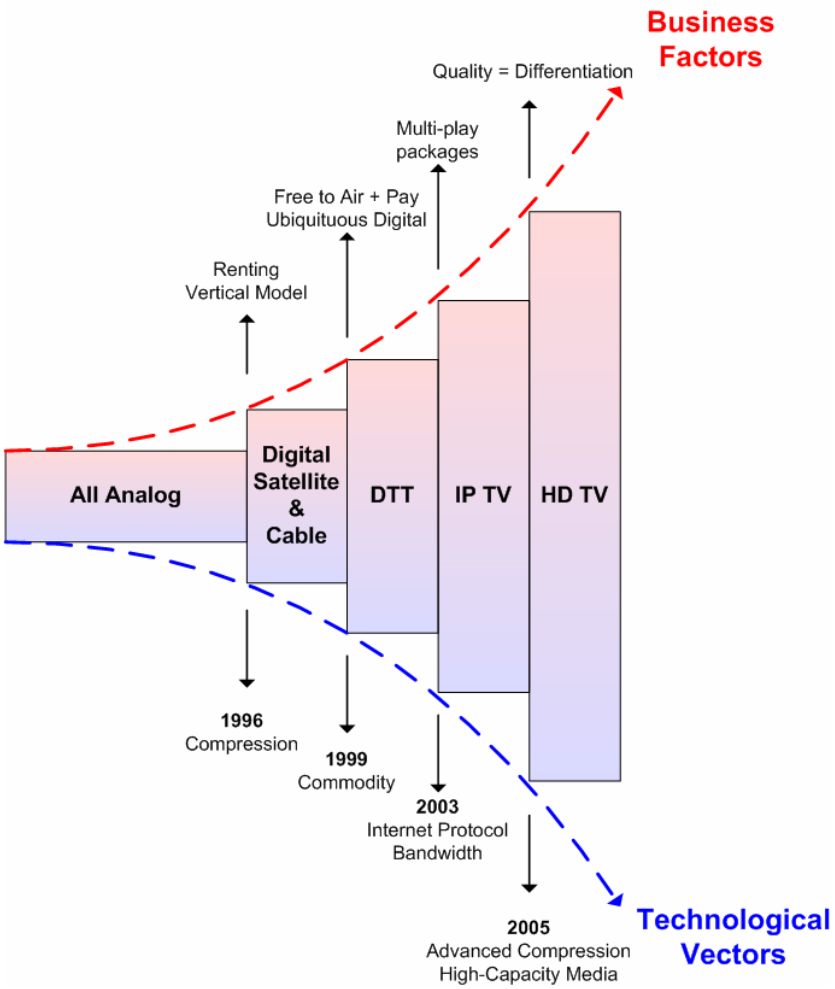

Figure 3.5 Digital TV expansion

As
Figure 3.5 shows, digital television in Europe has been experiencing a major disruption, *i.e.* a new layer in its development every two to four years. This sustained evolution cycle is an important factor in the recent developments of High Definition and IPTV, and has also blurred the very notion of broadcast media as a whole: as Griffiths notes, the diversity and flexibility the successive waves of digital television have brought have made television "*a conduit for branded electronic content*"[36]. This resulted in higher risks, as we saw, and at the same time a deep reshaping of the media sector as new factors appeared with a growing influence over the strategy of each player in the value chain. Further on, Griffiths distinguishes three main parameters of uncertainties in the strategic outlooks of the television ecosystem[37]:

- Market demands – With multi-channel and multi-networks digital television, supply exceeds by far the demand as it was when fewer than ten channels were available. How will the added channels of DTT and IP TV bring differentiation in what clearly appears as a crowded market?

[36] [Gri03], p. 19.
[37] *Ibid.*, ch. 2—8.

- Competition – Alternative diffusion methods and more efficient bandwidth usage attract new entrants in terms of channels and content broadcasting. How will they find their niche in the European audiovisual landscape where the ratings are still strongly favoring the "happy few" analog channels? In France for instance, the leading channel TF1 is consistently over 24% ratings share in the extended multi-channel offer[38], despite the diversified offers of the cable, satellite, and now DTT and IP TV.

- Regulation – While keeping their monitoring and spectrum allocation roles, regulatory bodies over Europe have also pushed digital television by implementing the eEurope2005 action plan of "*creat[ing] transparency as far as the conditions for the envisaged switchover are concerned*"[39]. This resulted in more or less aggressive timeframes for the switch-off, *i.e.* the actual stop of analog terrestrial transmission: as detailed in Appendix C, from an improbable deadline in 2006 in Italy to a remote one in 2015, the conditions vary from country to country but nevertheless bring a positive push to the "TV as a Platform" viewpoint discussed earlier.

In summary, this upsurge of complexity and uncertainty in today's digital television environment is the main parameter that the new disruptions that High Definition and IP TV represent have to integrate in their commercial deployment.

[38] [Med05] Médiamétrie, *MediaCabSat Analysis*. March 2005, http://www.mediametrie.fr/resultats.php?rubrique=tv&resultat_id=112
[39] [eEU02] Commission of the European Communities, *eEurope 2005: an Information Society for All*, June 2002, http://europa.eu.int/information_society/eeurope/2002/news_library/documents/eeurope2005/eeurope2005_en.pdf, p. 18.

4 Accessibility: digital multi-diffusion platforms

Content is not king.
It is just a medium
for the interaction between people.

Douglas Rushkoff

At the same time as audiovisual content itself becomes dematerialized, the networks used to transport and deliver it have switched from being horizontal pipes to more or less well integrated *platforms*, as we saw in the previous chapter with digital cable and satellite in the 90s. This trend has amplified over the last five years with the introduction of two additional digital platforms: Digital Terrestrial Television (DTT) and IP TV. Through their differences in technology, business model and regulations, they represent the newest additions to what is now a four-tiered and complementary coverage of digital television access in Europe, and the four pillars to the building of the next revolution in television: High Definition.

4.1 Digital Terrestrial Television

Although not as disruptive as IP TV, both technologically and business-wise, DTT is positioning itself as the mass-market entry door to digital television. As we will also see, the ongoing deployment of DTT, in France for instance, have strong ties with High Definition.

4.1.1 Making New with the Old

DTT starts off as a very straightforward principle: to use "*the legacy analog terrestrial infrastructure, in part or as a whole, in order to transmit digital signal*"[40], as defined by Boyon. With the frequency space being inherently limited and already crowded, as we saw, the only alternative for finding space for more than 3 to 6 terrestrial channels is to switch to digital technology. Remembering Figure 3.2, we now have the following structure on the DTT platform:

[40] [Boy02] Boyon, Michel, La Télévision Numérique Terrestre – rapport établi à la demande du Premier Ministre. October 2002, http://www.ddm.gouv.fr/IMG/rtf/RAPPORTBOYON.rtf, p. 4.

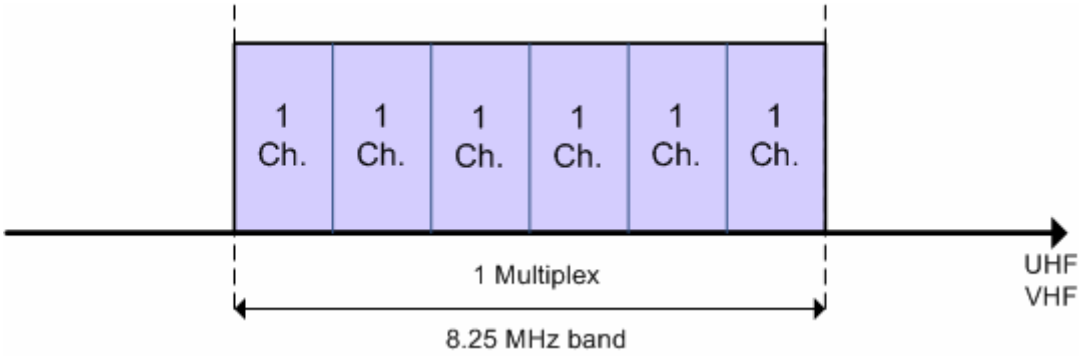

Figure 4.1 Digital multiplexing structure

DTT uses digital compression technology to transmit up to 6 Standard Definition channels on the same frequency band necessary for a single analog channel. MPEG-2 has been up to now in the countries that have deployed DTT, but France will launch the payTV part of its DTT bouquet in MPEG-4, a particularity that makes the country an interesting case study for the role DTT have as catalysis for High Definition. DTT had also opened the way to European-wide broadcasting standardization, as the DVB consortium has made its DVB-T (DVB Terrestrial) specifications the *de facto* standard for DTT in Europe and beyond[41]. As a result, all STBs designed for DTT should be compliant with the DVB-T set of standards.

Beyond the mere technological jump, DTT is an essential, yet complex, part of the national and transnational policy of digital television switch-over all over Europe. As Boyon further underlines, "*the certitude is the abandon of analog broadcast technology [...] and DTT is one of the natural way of development*"[42], as European countries are still in majority counting on terrestrial coverage, as witnessed by the platform graphics in Appendix C:

- DTT is a more open access to multi-channel offers than the already existing cable and satellite solutions. This is especially true for the free-to-air part of DTT, as the main *credo* of the marketing and communication campaigns have indeed been focused on the lack of complex hardware installation (no satellite dish, no cable outlet to activate), as well as the absence of actual subscription or monthly fee to access the service: only a digital STB to buy and then it is "plug-and-play".

- DTT is seen as one of the enabler for a faster and smoother switch-over to digital. For instance, looking at the 79% analog households in France in 2003 (cf. Figure C.2) was one of the main argument in favor of launching DTT in the country.

- In order to further enable the digital switch-over, the regulatory bodies all over Europe have wished to strengthen the position of DTT. This is particularly visible in the *Simulcast* obligation that makes it mandatory for the analog terrestrial broadcasters to simultaneously transmit the same channels in digital form on the DTT network. With

[41] Over 35 countries in the world have committed to DVB standards for digital TV, as detailed in [DVB05] DVB, *DVB Worldwide*, http://www.dvb.org/index.php?id=228. In Europe, a European directive makes it mandatory to DTT services to comply with the DVB-T / ETSI standards.
[42] [Boy02], p. 6.

even deeper consequences are the *must-carry* laws towards cable operators: they have to carry the free-to-air DTT channels at no extra cost to their subscribers.

4.1.2 Challenges and limitations

Despite the obvious advancements DTT brings as a low-cost and low-complexity entry point to digital television, the experience gained from analyzing the previous launches across Europe – in England (first launched in 1999), Spain (first launched in 2000) and Italy (launched in 2004) notably, has outlined several notable limitations and challenges:

- While "digital quality" makes ghosting and echo a thing of the past, it is often touted as an argument by itself[43]. However, the picture quality is in fact lower than DVDs, as noted by Boyon[44].

- On a technical side, the failure of ITV Digital in the UK was, at least partly, due to the insufficient consideration of several important parameters: the imprecise coverage, as well as the fragility of the signal made that only 40% of the 65% of the households that were supposed to be covered were actually able to receive a decent signal. This was responsible for making the churn rate grow to 25% before the re-launch of the service as Freeview in 2002[45], with improved technical robustness.

- On a business strategy side, one of the keys of DTT is to find the correct balance between the free-to-air and the payTV parts. As ITV Digital was launched in the UK, it positioned itself as a direct competitor to the premium cable (NTL) and satellite (BSkyB) offers, with an alignment of its package prices. But while this DTT service was adopting a premium strategy, it was forgetting that it didn't have a critical mass of subscribers nor as long-standing relations with content providers to get the first broadcasting windows or to sustain the 315 million pounds spent in 2001 on sport rights.

This importance of *differentiation through content* has accentuated the downfall of Spain's Quiero TV which was focused on payTV as well. Starting in 2003, it has also led to a rethinking of the economic viability of DTT in the countries yet to launch their own offer. Led by government-organized research and think tanks, the main issue was to find the relevant convergence point between quantity, quality of content and pricing model with the following parameters in mind:

- The actual coverage that could be feasibly reached. It should be noted that this is an issues covering both technical as well as economic aspects. For instance, France targets to reach

[43] [TNT05] Groupement Télévision Numérique pour Tous, *La TNT, La Télévision Numérique pour Tous*, http://www.tnt-gratuite.fr/
[44] [Boy02], p. 8.
[45] [Boy03] Michel Boyon, *La Télévision Numérique Terrestre – rapport complémentaire établi à l'intention du Premier Ministre*. February 2003, http://www.ddm.gouv.fr/IMG/rtf/boyon_complementaire.rtf, p. 34.

80 to 85% of DTT coverage by 2007 through the use of 110 transmitters[46]. The fact that most of the eastern part of France is left uncovered is due to the fact that those regions are bordering Germany and Italy, where DTT has already started and hence the risk of interference.
It is also estimated by the tower companies that to reach the current analog terrestrial coverage, *i.e.* over 99% of the French national territory, several *thousand* additional transmitters would have to be upgraded to digital, making it economically unrealistic.

- The growth of the STB and integrated Digital TVs (iDTVs) market, *i.e.* TV receptors with built-in DTT tuners.

- The ability of the DTT channels – both the legacy channels and new entrants, to attract viewers with content providing a viable alternative to premium cable and satellite.

- The evolution of the advertising market.

4.1.3 Case study – DTT in France

Being to date the most recent major European market to launch DTT on the March 31st 2005, France is an interesting case in terms of how the project was structured in relation to the mixed success in other countries.

DTT investigation was officially launched on August 1st 2000, with the publication of a new audiovisual law creating the framework for DTT[47]:

- National allocation of 6 multiplexes (only 5 effectively allocated in part or in total), with R1 being dedicated to public service broadcasting.

- Historical public and private TV channels (France Télévisions, TF1, Canal+, M6) were granted a *bonus* channel in addition to the Simulcast broadcast of the existing channel.

- To favor the entrance of new players in the audiovisual landscape, private TV operators were allowed to launch new channels on DTT at the condition that they didn't own more than 49% of the shares.

After several pilot tests and experiments in 2003, 2003 and 2004, it was decided to launch DTT in two steps:

- Free-to-air DTT launch on March 31st 2005. 14 channels as of now[47, 48], with 4 newly selected free-to-air channels to start broadcasting later this year[49].

[46] [TDF05] TDF, *La TNT en quelques dates*. March 2005, http://www.tdf.fr/filemanager/download/347/
[47] [CSA05a] CSA, *La télévision numérique terrestre*, http://www.csa.fr/themes/zoom/tnt/index.php
[48] *Cf.* Figure 4.2.

- PayTV DTT launch between September 2005 and March 2006. 11 channels as of now.

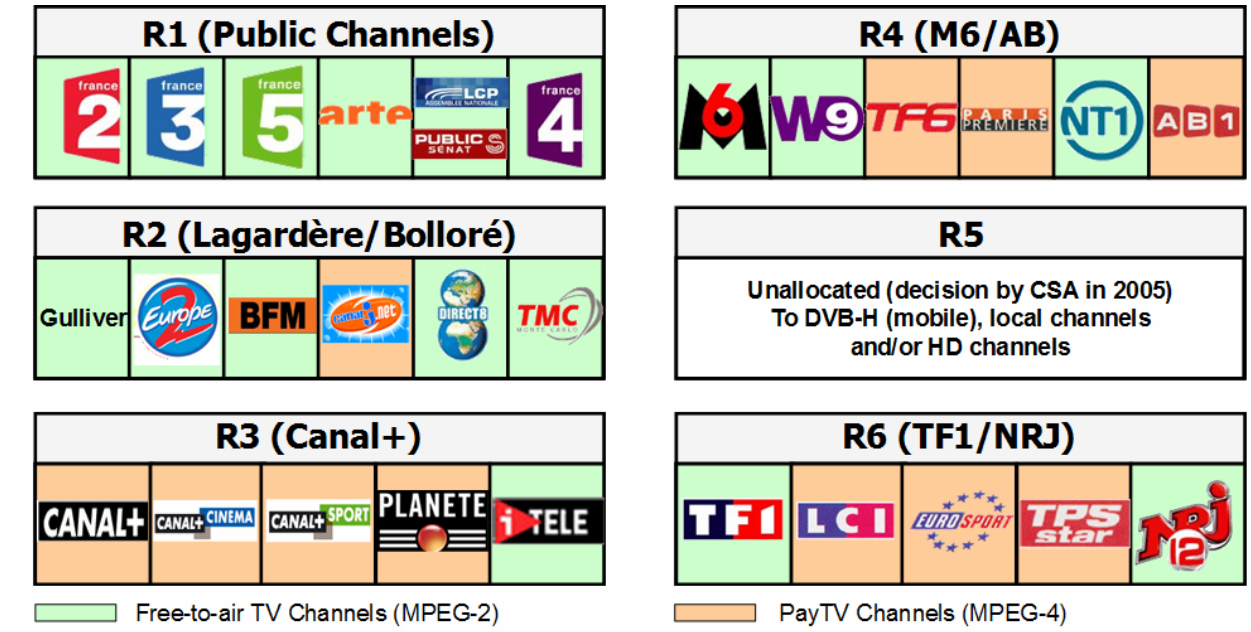

Figure 4.2 Multiplex allocation in France[50]

What makes the situation in France unique in the world is the choice of two different technical standards for free-to-air and payTV channels. Indeed, on December 23rd 2004 the government decided the following:

- Confirmation of MPEG-2 compression for free-to-air channel.
- MPEG-4 for payTV channels.
- MPEG-4 for High Definition channels (free-to-air and payTV) when they arrive on DTT.

This dual choice has enabled the launch of free-to-air DTT as early as possible, as MPEG-2 is a technology well harnessed throughout the production, transmission and reception chain. At the same time, the voluntary push of the next generation of compression technology, *i.e.* MPEG-4[51], has a major impact in the future of digital television in France:

- It is an enabling factor for consumer electronics vendors: MPEG-4 silicon is already available from chip vendors such as STMicroelectronics. However, the integration in STBs and iDTVs is boosted by this move, and the strong presence of both SD and HD MPEG-4 STBs at this year's CeBIT is a clear sign that the later arrival of France in the

[49] [CSA05b] CSA, *TNT : Sélection de 8 nouvelles chaînes*. Press release, May 9, 2005, http://www.csa.fr/actualite/communiques/communiques_detail.php?id=25563
[50] As of May 14th 2005.
[51] *Cf.* Appendix B.1 for details.

DTT arena was compensated by the adoption of innovation, at least for the payTV part of it.

- As a more advanced compression technology, MPEG-4 also opens up the possibility for more channels within the 6 multiplexes. This is especially relevant for R5, currently unallocated, but able to host 5 High Definition channels in addition to several mobile DVB-H channels.

From a market perspective, free-to-air DTT has already attracted 300 000 households to equip themselves with a STB[52]. This quick response should however be seen in the light of the structural factors and uncertainties currently surrounding DTT:

- *Coverage* – Only 35% of the households are covered (17 transmission sites), a figure set to expand to 50%, with 32 active transmission sites. As we saw earlier, the practical limitation is at around 85% of the population, the remaining 15% having to rely on alternative digital platforms.

- *Content* – While one of the initial objectives set forward by the CSA was to open the audiovisual landscape to new entrants, one can but see that only two channels are actually backed by newcomers in the sectors: NRJ12 and Direct8. Moreover, one can be skeptical when looking at the diversity of the themes, as the bulk of new channels are heading towards a (mini)-generalist model in order to compete with leading generalist channel TF1.

- Even more serious for DTT is the fact that major cable, satellite and ADSL ISPs have announced the availability of the new DTT channels in their respective digital platforms in the very near future.

- *Technology* – Because current STBs are only MPEG-2 and without any Conditional Access mechanism, they will not be able to decode the payTV channels when they start their emissions later this year. Therefore, the amplitude of the migration of the installed base of STB towards MPEG-4 STBs is a parameter that is still uncertain.

- *Regulation* – The move towards High Definition (and to DVB-H) is still an open question, and the regulation that will bring an answer to it is not scheduled to be settled before the end of 2005 at the earliest.

[52] [Reu05] Reuters, *300.000 adaptateurs TNT on été vendus*. April 21, 2005, http://www.reuters.fr/locales/c_newsArticle.jsp?type=techNews&localeKey=fr_FR&storyID=8250042

4.2 IP TV

IP TV takes the issue of television service from an entirely different approach as DTT does: instead of relying on an existing broadcast network, it is pushed by the telecommunications players as a new entry point for digital services. It is therefore important to understand the context in which Internet Service Providers (ISPs) are launching those services as part of their global strategy for broadband services.

4.2.1 From speed to content

First, a word of clarification: although IP TV literally means television services delivered over the Internet Protocol (IP), independently of the actual physical Internet connection – wired or wireless, the vast majority of residential IP TV services in Europe are today being served over consumer ADSL subscriptions, and in rarer cases[53] through FTTH. That is therefore why the development of IP TV services – and more generally of advanced residential Internet services, is so closely tied with the parallel growth of the penetration of broadband in European households[54].

And indeed, since the first commercial 128Kbps ADSL "Light" offers in 1999, the situation has evolved a lot in the 5 European countries of our study: thanks to the technical evolution of the DSLAM equipment as well as the regular upgrades of the ISPs backbone networks, the speed achieved by commercial residential DSL lines have grown from a maximum of 512Kbps in 2001 to true ADSL at 8Mbps in mid-2003 up to 20Mbps ADSL2+ today, as shown in Figure 4.3. It should be noted that the bandwidth is a determinant factor in terms of services that can be launched:

- ADSL "Light" – Web surfing, e-mail. Low-quality audio streaming.
- ADSL – 1 SD video channel in MPEG-2 (3 to 5 Mbps), videophony, online games.
- ADSL2+ – 2 SD channels in MPEG-4 (1.5 to 2.5 Mbps) or 1 HD channel in MPEG-4 (6 to 9 Mbps). 3D applications.
- VDSL – several HD channels in MPEG-4.

[53] Such as with Fastweb in Italy, *cf.* Appendix C.4.2.
[54] Even the Web-based TV and video services are dependant on the evolution broadband penetration rate.

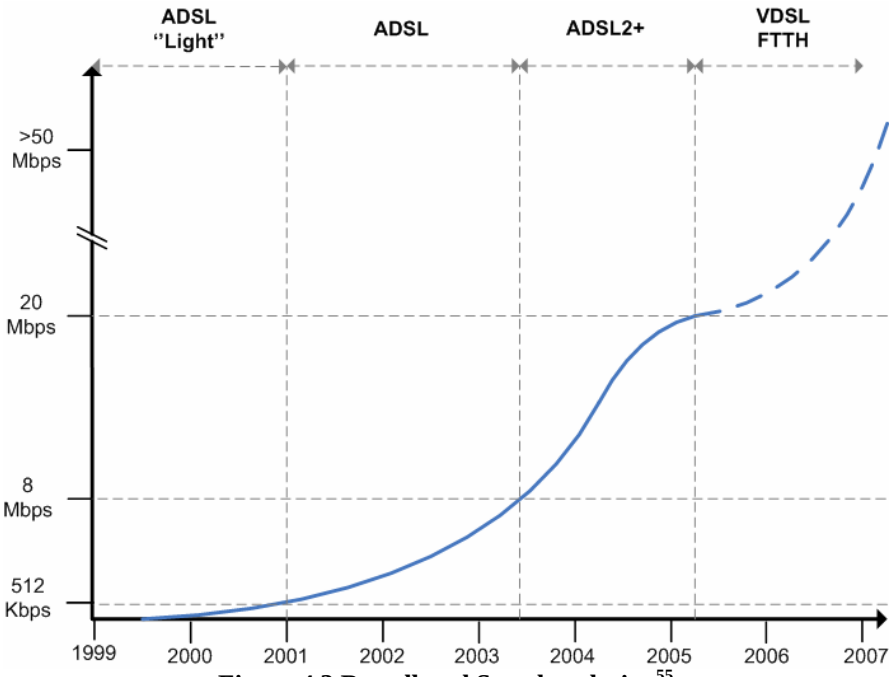

Figure 4.3 Broadband Speed evolution[55]

It should be noted however that such bandwidth are "best effort" and "best case" situations, and have to be considered as the theoretical maximum for a subscriber sufficiently close to its DSLAM[56]. Experience and practical testing show however that out of an 8Mbps ADSL connection, 4.5 Mbps of video streaming can be guaranteed with proper ISP network infrastructure[57]. Figure 4.3 can also be seen from Christensen's perspective as the trajectory map of the progress of the sustained innovation of broadband[58]: while the applications allowed by 512Kbps or less were severely limited to online surfing and e-mail, the spectacular increase of the mass-availability of broadband through ADSL technology is a driving factor for the on-going adoption of advanced online entertainment services such as IP TV.

A correlated factor to the speed increase is the constant price decrease for Internet access. For instance, a study of the price evolution in France shows that from the early 2001 to late 2004, the average price for a typical connection has decreased by 40%. It is even more meaningful when keeping in mind that the average "cursor" for broadband bandwidth has during the same period evolved from 128Kbps to 8Mbps today. The detailed price/speed evolution varies from country to country and is clearly dependant on the ISPs push for technology as well as the regulatory involvement, such as with Local Loop Unbundling (LLU), as detailed in Table 4.1.

[55] [Broo05] Paul Brooks, *Breaking the DSL Speed Limit*. Commsday Summit 2005, March 3, 2005, http://www.commsday.com.au/Paul%20Brooks.ppt
[56] *Cf.* Appendix B.3 for technical details on DSL technologies.
[57] Source: ISPs.
[58] [Chr03] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. (HarperBusiness Essentials, 2003), p. 104.

Country	Highest Bandwidth	Price / month	Technology	ISP
France	20 Mbps	29.90 €	ADSL2+	Free
Germany	5 Mbps	49.9 €	ADSL	Alice
Spain	4 Mbps	69.95 €	ADSL	ya.com
Italy	10 Mbps	39.90 €	FTTH	Fastweb
UK	4 Mbps	50 €	ADSL	HomeChoice

Table 4.1 Broadband price/speed comparison[59]

Despite the visible differences in terms of speed and pricing, the 5 European countries have responded positively to these always faster and always cheaper broadband offers. This has boosted the development of the broadband market as a whole, and increased the penetration of broadband in European households: if only 9% of them had broadband in 2003, 19% of them have it as of today, a figure forecast to grow over 30% by 2008[60].

4.2.2 Unbundling and Integration

At the heart of IP TV success is the fact that the broadband speed and penetration increase have also noticeably impacted the way consumers use their connection. Over the years, market researches as well as ISPs offer have demonstrated a clear shift from *speed* as a determining factor to value-added content and services. This is especially true in as the LLU has opened the door for alternative operators to build their offers independently of the incumbent national operator. This boost of competition has aligned the offers in terms of speed – with 4 Mbps being available almost everywhere in Europe, and convenience, with an always-on connection and security provided by the ISP.

Therefore, as shown in Figure 4.4, the diffusion of broadband towards the mass-market has put the focus on entertainment and content-related offers:

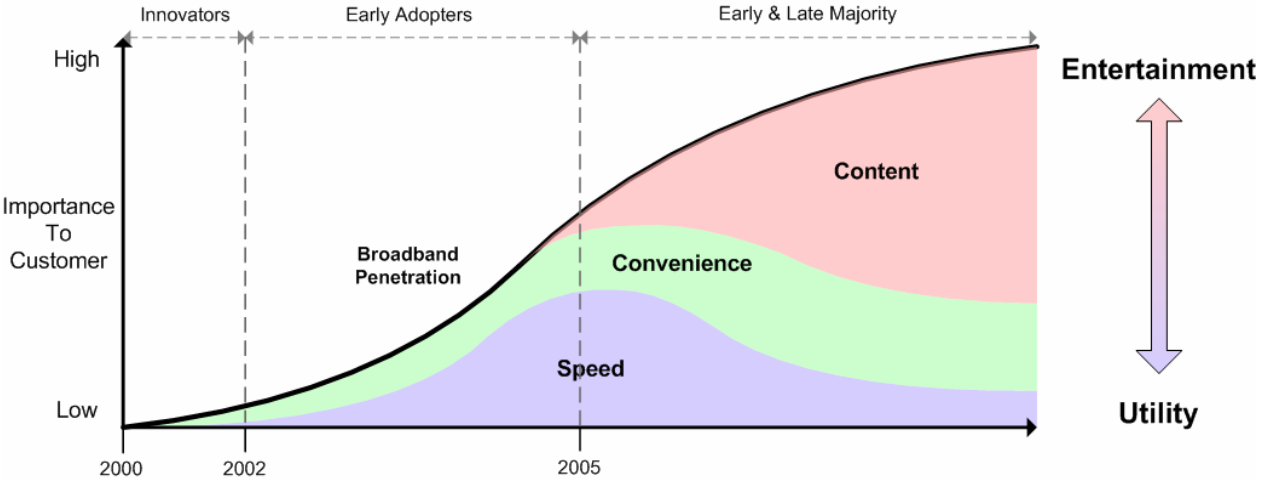

Figure 4.4 Emergence of mass-market broadband entertainment

[59] Source: ISPs' respective commercial websites. Up-to-date as of April 10th 2005.
[60] [Jup04] Jupiter Research, *European Broadband Forecasts – 2003 to 2009*. June 11, 2004.

Today in 2005, we are at a turning point in terms of broadband service and IP TV plays a key role in it: fast Internet access alone gives minimal customer loyalty and does not help in increasing the ARPU (Average Revenue Per User). Due to the lack of differentiation, ADSL churn in Europe was at all-time high 22% in 2004[61]. To take benefit of the growth phase broadband is currently as it reaches the early & late majority, ISPs all over Europe are packaging several services into so-called "Triple Play" offers, which can be split into three main categories:

- Internet – webmails, wireless access, software and online customer support...
- Communication – Voice over IP (VoIP), videophony, instant messaging...
- Entertainment – IP TV, and also Video on Demand (VoD), interactive games, music and video downloads...

This generalized move toward Triple Play bundling is therefore a sign of the shift in strategy from telecommunications operators, especially for the former "historic", state-owned operators, also called ILECs (Incumbent Local Exchange Carriers). As the revenues for voice-only services is severely being attacked by mobile phone usage and other VoIP services like Skype, operators are now taking the opposite strategy of *offering* voice communication as part of the Triple Play packaged bundle. That is why these multi-services packages represent more than just *competitive differentiation*: they are the mandatory path on which broadband ISPs in Europe are going to value up their backbone network building and enable better ARPU growth with features and services demanded by the consumer segments, with 81% of European ADSL subscribers being interested in Triple Play packages[62]. This trend is actually translated in the actual usage made of the multi-service bundles: for instance, 70% of Free's ADSL customers are using VoIP and over 45% of the unbundled customers are making use of the IP TV service[63].

4.2.3 IP TV and Triple Play

With the advantages of this concept of Multi-Play, ISPs over Europe have started deploying it. In addition to the technical constraints and parameters, several business development strategies have surfaced in the 5 countries, as shown in
Figure **4.5**.

[61] Source: ISPs.
[62] [Lig05] Light Reading, *Report: Europeans Want Triple Play*. February 24, 2005, http://www.lightreading.com/document.asp?doc_id=68798&site=lightreading
[63] [Ili05] Iliad, *1st Quarter 2005 results*. May 3rd 2005, http://www.iliad.fr/actualites/CP20050503_Eng.pdf

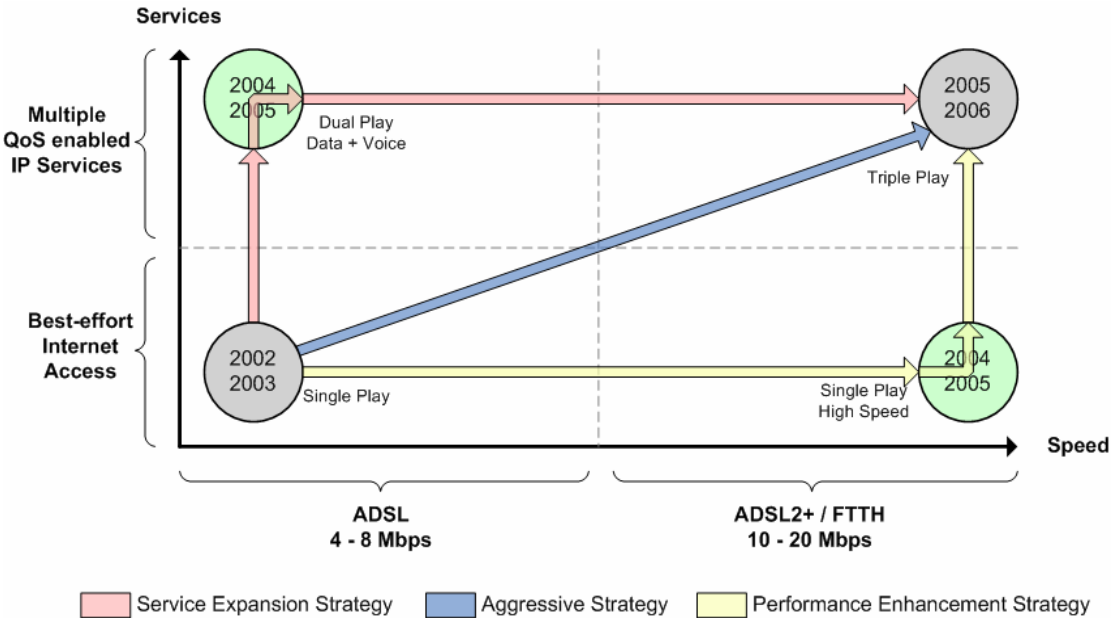

Figure 4.5 Multi-play broadband strategies[64]

This analysis outlines the existence of three main strategies for rolling out advanced services, among whom IP TV:

- *Service Expansion Strategy* – By first rolling out its VoIP home gateway ("Neuf Box") in June 2004, neuf Télécom in France secured the dual Play environment for its unbundled customers. Later the same year, in November, the ISP launched its TV MPEG-2 STB ("Neuf TV") which provides the IP TV part of what has become a full Triple Play bundle.

- *Aggressive Strategy* – Jumping directly from Single Play to full Triple Play is exactly what Free did in late 2003, when it launched its proprietary Freebox STB to its unbundled customers, thereby giving access to VoIP and IP TV through a single hardware device and subscription. The service was further enhanced in late 2004 with the upgrade to 20Mbps ADSL2+.

- *Performance Enhancement Strategy* – To different extents, this has been the strategy of BT in the UK and Telecom Italia in Italy, where the ADSL bandwidth is increased (often for free for existing customers), which sets the technical foundation for the later launch of an IP TV service.

No matter which strategy has been chosen, figures show that IP TV, despite being an emerging innovation, is encountering a substantial adoption in the consumer market: as detailed in Appendix 0, at the end of 2004 there were more than 537 thousand IP TV subscribers in France, a figure set to grow steadily and reach 3.5 million subscribers in 2010. The same pattern can be observed in the other countries, with a variable delay due to the later launch of commercial

[64] [Vat04] Vassilios Vatsos, *Broadband & Network Business Expansion*. Zilele Biz Romania, Bucarest, October 21, 2004, http://www.zilelebiz.bizcity.ro/images/upload/prezentari/Seminar.ppt

offers, and the general availability of high-speed (*i.e.* over 2Mbps) broadband access. Those differences take their roots in the respective unbundling policies driven by each European country: in France, the accumulated lag behind in terms of broadband penetration until 2003 was one of the main driver of the strong LLU framework put by the ART, and which, as a consequence, has been driving IP TV growth since then.

4.2.4 Different Approaches

On top of the service provisioning strategies detailed in the previous section, the crux of the IP TV roll-outs in Europe resides in the content and service packaging offered to broadband customers. Here again, we see the following segmentations appearing throughout the various ISPs in Europe:

- *Standard content* – Because IP TV clearly positions itself as a viable fourth alternative for digital TV content delivery, the bulk of ISPs are providing basic packages that mirror the offers available on digital cable or DTT. For instance, both Free and neuf Télécom in France as well as HomeChoice in the UK offer between 40 and 90 channels as part of their standard Triple Play subscriptions, with a channel offer clearly target the Free-to-Air DTT as well as basic cable bouquets.

- *Premium content* – Satellite payTV operators see in IP TV a promising vector of expansion of their subscriber base: they have a minimal infrastructure cost impact and the targeted urban population segments are complementary to the mostly rural satellite households[65]. We will see further on in section 5.5.1 that satellite operators are finding in HD a way of boosting stalling subscriber's growth, and IP TV is another growth vector for them.
  It is therefore not surprising to see operators like Canalsatellite and TPS in France, BSkyB in UK and Sky in Italy putting premium ADSL bouquets through partnership with ISPs. The fact that TPS recruited over 50 thousand subscribers at the end of 2004[66] underlines the validity of the model as a meaningful complement to satellite delivery.

- *Niche content* – Because of its flexibility as a delivery platform, IP TV allows for innovative projects that would be a lot costlier and heavier to pursue on the other three more rigid platforms. An interesting example is that of event-driven temporary theme channels that have been popping up on European IP TV platforms and result from a direct collaboration between content producers and the telecommunication operators: for instance, the four channels dedicated to the Olympic Games on Free's platform attracted more than 78 000 French viewers in a two-week time[67]. The same kind of initiative is

[65] Due in part to the inevitable issues of installing satellite dishes in dense urban areas.
[66] [JDN05] Le Journal du Net, *L'ADSL constitue un vrai relai de croissance pour TPS*. February 3, 2005, http://www.journaldunet.com/chat/retrans/050203_abihssira.shtml
[67] [FT04] France Télévisions Interactive, *Vif Succès de l'offre des Jeux Olympiques de proposé par France Télévisions sur le service de TV par ADSL de Free*. Press release, September 3, 2004, http://www.iliad.fr/actualites/CP_AudienceJO-04-TVADSL-Free-FTVI.pdf

being done in Italy, where Telecom Italia is active in creating theme micro-channels in partnership with content-provider MTV.

- *On-demand content* – Because IP TV beneficiates from an always-on return channel, interactive billing and on-demand pricing and delivery are facilitated and can be deployed more easily than on other digital TV platforms[68]. This has led ISPs to offer on-demand content, whether it is PC-based (*e.g.* Telecom Italia, Club-Internet) or TV-based (Fastweb, HomeChoice, France Télécom, Telefónica). While the catalogues are limited to a few hundred titles at best and viewing windows of content still an issue, it is a clear sign that the focus on content and delivery is shifting towards a more 1-to-1 relationship between content creators and consumers, while contributing to reducing the churn rate[69].

These three approaches show altogether the flexibility of the IP TV as a generic digital platform, and a worthy competitor to the *dedicated* platforms, as shown in Figure 4.6, which synthesizes the different packages and IP TV services offered throughout Europe.

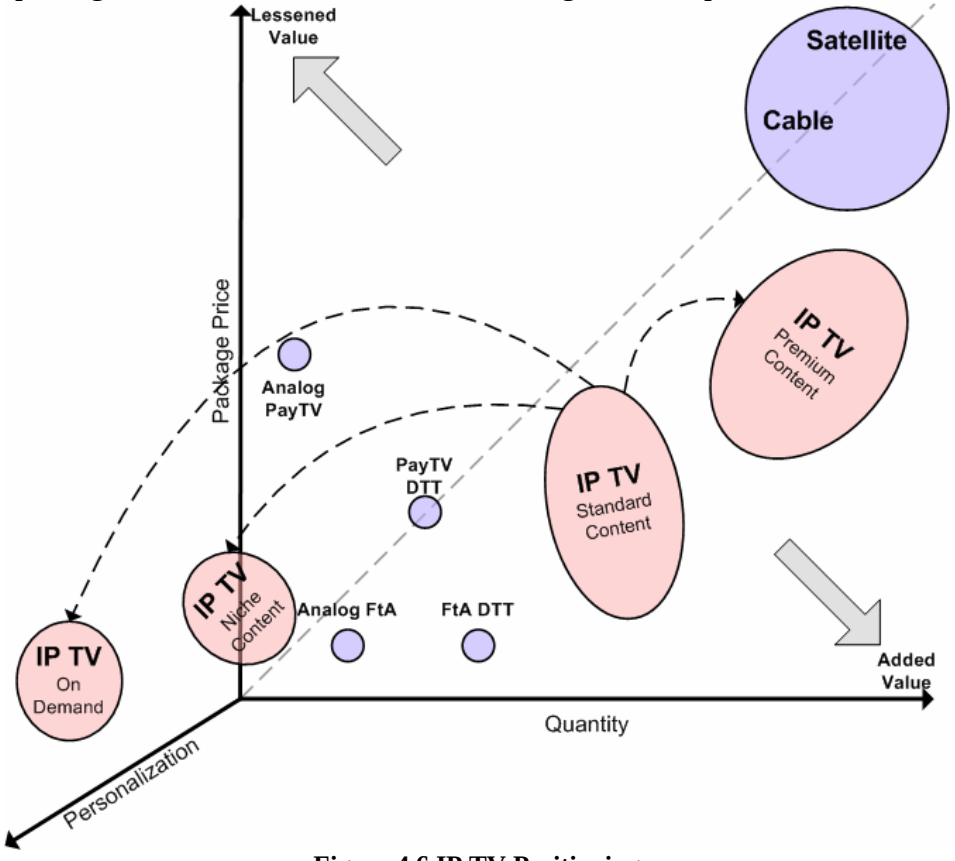

Figure 4.6 IP TV Positioning

It therefore comes at no surprise that IP TV has a true disruptive factor over the other forms of digital TV. Having *Imagenio*, Telefonica's own IP TV service in Spain, under the scrutiny of the

[68] For interactivity to work on satellite, cable and DTT, a phone line (providing narrowband data transfer) must be plugged into the digital STB.
[69] According to SeaChange, it has led to 20% churn reduction in IP VoD systems in the USA.

CMT for possible unfair competition against broadcast networks and traditional telecommunication service providers is more than just an anecdote: it is a proof as how IP TV is starting up a new deal in the digital entertainment sphere. In more precise terms, the *Digiworld 2005* analysis[70] underlines three main spin-off consequences of the generalized uptake of IP TV in Europe:

- *Pushing cable into broadband* – As a response to the arrival of ISPs in the retail TV package offers, cable companies in Europe have put their focus on providing broadband access on top of their digital TV packages – thus prioritizing dual-play service differentiation over the pure selection of channels available in order to compensate with the churn rate with ADSL ISPs competitors. This has led to cable broadband gaining up to 30% of the total consumer market in countries like UK and Spain[71].

- *Shifting satellite's added value* – The traditional asset of channel quantity in the payTV satellite platform is quickly fading away, as ISPs are now providing up to 100 channels in their basic IP TV subscription packages. Moreover, satellite operators have well understood the potential of IP TV as an opportunity to attract new market segments, especially in dense urban areas: the availability on the IP network of the *Premium content* of TPS, Canalsatellite and BSkyB among others shows that those operators are banking on broadband for stimulating their growth. And as Patrick Le Lay, TF1's CEO and a key initiator of the launch of TPS noted in February, "*the dominant TV distributions platforms of the coming years are ADSL and satellite*". And the nearly simultaneous launch of HD in those two platforms is bound to strengthen the payTV operators' positions.

- *Challenging DTT* – With most of the free-to-air DTT channels being integrated in the basic IP TV channel packages, the true market position of DTT is still to be defined, especially in France, where the DTT platform is in its ramping-up phase with a limited coverage not to exceed 60% in September 2005.

All in all, the framework in which IP TV is being built makes it a viable contender in the digital TV ecosystem, both on the free-to-air and payTV segments. Through the customer lock-in strategy of Triple Play, ISPs are re-valuating the fixed line revenues, through a three-tiered dynamics that is encompassing the key players of the telecommunications and media: *Infrastructure* (broadband, whether through DSL variants or emerging alternate technologies such as FTTH or WiMAX), *Content* (expansion and added flexibility in IP content packaging) and *Appliances* (IP STBs and more generally the IP-ready devices that are the building blocks of the IP digital home).

[70] [IDA05] IDATE, Digiworld 2005 – The digital world's Challenges, April 2005.
[71] [BBM05] Informa Media, *Broadband Markets*. April 25, 2005.

4.2.5 Convergence and Divergence

Through its closer relationship it is creating with the broadcast industry, IP TV is involved in making the telecommunications/ICT environment better converge with the consumer electronics & Audio/Video spheres. In parallel, ISPs in Europe are evolving on a thin line between a vertically integrated model *à la* payTV satellite, and the disaggregated and horizontal business model currently in place in the ISP world. As noted by Gillett, this duality opens up a whole new spectrum in terms of business integration between the *Infrastructure*, the *Content*, and the *Appliances*[72]:

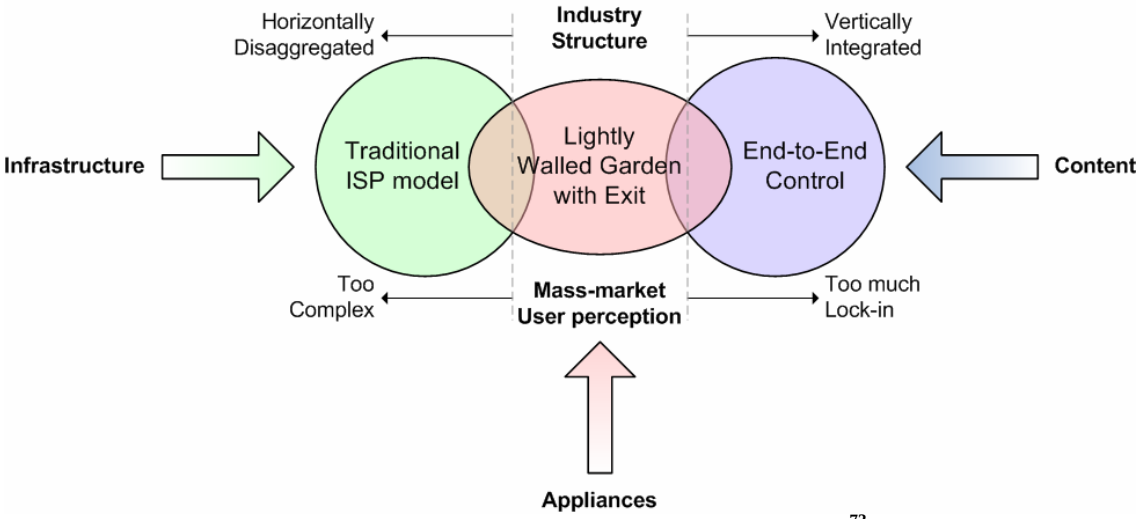

Figure 4.7 Business Spectrum of IP TV integration[73]

As shown in Figure 4.7, IP TV is at the crossroads of two different industry models, and is taking both of them towards a new, hybrid, model that we can call a "lightly" walled-garden, *i.e.* an intermediary between a closed and open business framework: it provides a level of service and product integration (hardware STB) that makes it a complete and full-standing solution; at the same time, the ISPs that are deploying IP TV applications are therefore opening up a platform on which third parties can build upon – for instance with the on-demand content already appearing in Germany (T-Online) and UK (HomeChoice).

It can also be considered as *open* in the sense that its basic building blocks are all standard technological components (namely the IP networks, codecs, and backbone infrastructure), yet the "glue" that holds those parts together – namely the DRM and the middleware, are still creating a *closed* and hardly interoperable at all environment. In that sense, the very meaning of "IP" in IP TV is multiple and translates the complexity and dynamics of this newly-created market:

[72] [GLW+01] Sharon Gillett, William Lehr, John Wroclawski and David Clark, *The disruptive user - Internet appliances and the management of complexity*. BT Technology Journal, vol. 19, No. 4, October 2001, http://www.springerlink.com/link.asp?id=p44m360615819n47

[73] Adapted from *Ibid.*, p. 44.

- IP as *Internet Protocol*, whose ubiquity has given it the status of the common shared protocol across devices and between the telecommunications and consumer electronics industries.

- IP as *Integrated Package*, with the bundling of new services in Triple Play packages.

- IP as *Intellectual Property*, where the push for new content makes DRM a central issue in the negotiation with motion picture studios and content owners, as well as for protecting the substantial investments made in the platform. As the dematerialization of digital content continues, and as the flexibility of exchanging content between devices is demanded by consumers, the building-up of a secure and interoperable framework is a key for the continued expansion of IP-based TV. That is what cross-industry organizations like the CORAL Consortium are doing by promoting neutral DRM systems[74].

- IP as *Innovative Potential*, with the nascent platforms still having much room for improvement as well as for becoming a key player of tomorrow's TV environment.

4.3 Complementarity in the consumer market

As we have seen in detail in this chapter, the four digital TV platforms in Europe – Satellite, Cable, DTT and IP TV, each have their own intrinsic technical characteristics and business ecosystems in which they evolve and grow. Even more than just the technology, the key point differentiating those four platforms is the impact they create at different levels in the consumer technology adoption lifecycle model we saw in Chapter 2. Its application to digital TV platforms is shown in Figure 4.8.

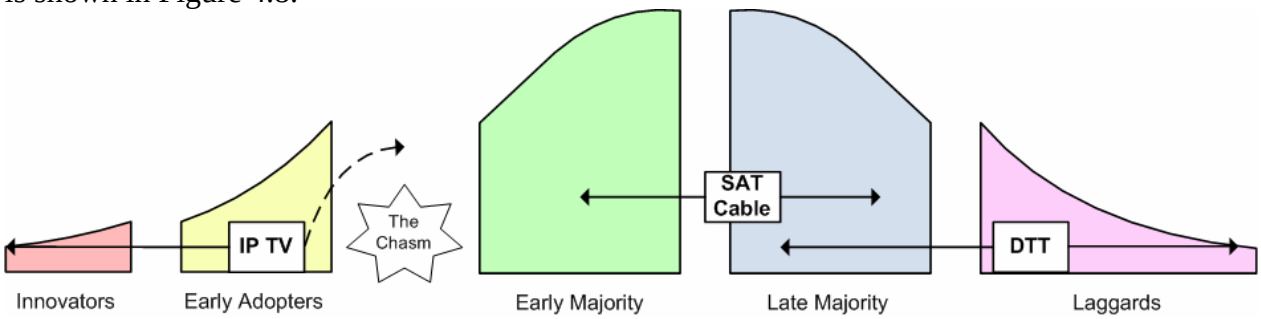

Figure 4.8 Adoption lifecycle of digital TV platforms

As a snapshot of the current Digital TV landscape in Europe, the following positioning of each digital platform is proposed:

- Satellite and Cable – As they are the first two platforms to have switched to digital TV broadcasting in the 90s, satellite and cable have had nearly 10 years spent in growing their digital customer bases in Europe. That is why we can consider them today in a

[74] [Cor04] Coral Consortium, Entertainment, *Technology and Consumer Electronics Leaders Unite for DRM Interoperability*. Press release, October 4, 2004, http://www.coral-interop.org/main/news/pr20041004.html

conservative-market period of development, as underlined by the stalling subscriber's growth pictured in Figure 5.4: they jumped in the Tornado between 1998 and 2001, where the hyper-growth of subscribers settled the market shares. The evolution since then have been due mostly to market consolidation, with operators in Italy and Spain merging together starting in 2001. Having satellite and cable in the slower phase of the mainstream market means that their growth can be sustained by either reducing operational costs or shifting their paradigm towards a disruption earlier in the adoption lifecyle. As we will detail in the next Chapter, it is clear that European payTV operators are choosing the later option – through High Definition, they are building a strategic rejuvenating of their digital platforms.

- DTT – Although a more recent commercial reality and a discontinuous technological innovation (switch from analog to digital broadcasting), the rest of the value chain (production and reception) remains unchanged, at least for the free-to-air part of it. From a market and consumer perspectives, DTT therefore acts as a sustained innovation that is focusing on switching over to digital TV the conservative segments of the European consumer market, *i.e.* bringing the conservative share of the analog world (that still represent 75% of the total market in France for instance[75]) to digital multi-channel reception.

- IP TV – the recent uptake of IP TV as a digital platform since late 2003 has shown the viability of the model, but remains today reserved mostly for the early adopters. Due to usability, communication and technical issues, it still has to cross the chasm and grasp the mass-market in Europe: its current challenge is therefore to repackage itself as a "*whole product*"[76] solution to shift the paradigm from the early adopters to the mainstream market.

This synthesizes the current market situation of digital television in Europe. As we are going to see in the next chapter, the move to High Definition is bound to renew the deal and profoundly reshape the landscape by speeding up the digital evolution to the next stages.

[75] *Cf.* Appendix C.1.
[76] [Moo99] Geoffrey Moore, *Crossing the Chasm*. (HarperCollins Publishers, 1999), p. 108.

5 Quality: High Definition coming of age in Europe

If the Sony were a high-definition TV,
[...] this would be a discontinuous innovation
because you would have to change your normal
TV-viewing behavior.

Geoffrey Moore[77]

In the previous chapter, we realized how much more diversified and complex the television landscape is becoming: the co-existence of four digital platforms has the immediate consequence of making multi-channel and digital reception accessible to a ever broader part of the European population, thanks to the complementarity of each delivery platform. However, as Boudet de Montplaisir[78] underlines, the reception technology in Europe didn't experience any notable improvement[79] since the PAL and SECAM broadcasting systems, both launched in 1967 and offering an interlaced vertical resolution of 625 lines[80]. Hence the recurrent move of the media industry to launch High Definition, or more exactly *higher* definition to increase the quality of experience, and therefore push the sector into a new growth cycle. It is therefore more than anything else, a strong disruption of the economic structure of digital television as:

- It is a premium service, primarily targeting payTV, while free-to-air offers have up to now set the pace of main street adoption of digital technology in Europe, as seen with DTT.

- It requires a complete change of equipment, up from the production side (HD shooting cameras), to the edition (on-line and off-line HD editing tools), to broadcasting (scalable networks), down to the reception (HD Ready displays and HD STB).

- It needs as a result the close cooperation of operators, broadcasters, and equipment vendors.

5.1 From research to commercialization

It should first be noted that HD has been the "red-line" for the industry since the 30s, as the word can be traced back to as early as 1936[81]. The first modern HD system was the Japanese MUSE

[77] [Moo99] Geoffrey Moore, *Crossing the Chasm*, (HarperCollins Publishers, 1999), p. 10.
[78] [BoM04] Daniel Boudet de Montplaisir, *Télévision Numérique et Haute Définition*. Report Commissioned by the Prime Minister of France, October 2004, http://www.premier-ministre.gouv.fr/IMG/pdf/rapport_boudet-2.pdf
[79] That doesn't exclude the progress made "behind the scene", such as the integration of teletext services in the PAL and SECAM standards in the 80s.
[80] A thorough technological overview of High Definition is available in Appendix B.2.
[81] [BBC01] BBC, *History of the BBC – 1930s*, http://www.bbc.co.uk/heritage/story/1930s2.shtml

(Multiple Sub-nyquist Sampling Encoding) system, the result from more than 10 years of cooperation between broadcasters like NHK and an industrial consortium led by Sony. As detailed by Fujio[82], after several years of development in the utmost secrecy, it was offering 1125 lines of vertical resolution and widescreen (16/9) capabilities. The technical achievements led it to be proposed to the status of worldwide standard at the ITU Radiocommunication Sector[83] conference of Dubrovnik in 1986. But the European side refused, as Brown[84] notes: the European Broadcasting Union (EBU) was concurrently developing its own system, D2-MAC (Duobinary Digital Multiplex of Analog Components), later renamed HD-MAC.

HD-MAC was offering 1250 lines of vertical resolution, nearly twice as much as the PAL/SECAM standards. However, despite the coverage of global events like the 1992 Olympic Games in Albertville and Barcelona, HD-MAC failed to cross the chasm of more than a few thousands early-adopting viewers, due to its chronic weakness:

- Limited availability of content.

- Price – around 6000€ for the first receptors, with prices slowly declining due to the low quantities.

- Overall bulkiness of the massive CRT displays.

- Inexistence of a *package media* able to offer HD recording.

While those shortcomings clearly underlined the issues of positioning such an HD offer, the eventual drop of HD-MAC in 1993 came as a result of the awareness of the emergence of digital as the inevitable choice for HD. And while Europe was still going over the failure of its own analog systems, several countries started commercial service of digital HD in the 90s, using MPEG-2 as the compression standard:

- Japan – After pioneering (analog) HD with the launch of its Hi-Vision service in 1991, digital satellite HD in MPEG-2 started in December 2000 with the launch of BS-4b, and HD DTT started in December 2003.

- USA – In 1998, MPEG-2 was adopted as the standard for HD, and the four major broadcast networks (ABC, CBS, NBC and FOX) launched terrestrial HD programs in 1999, followed by satellite the same year and cable in 2000, with Comcast and Dish Networks, followed by DirecTV and VOOM. Today, 70% of the networks' prime time 95% of the pilots are produced in HD[85]. Despite the recent financial uncertainties around

[82] Takashi Fujio, *High Definition Television*. NHK Technical monography, vol. 32, June 1982.
[83] At the time the CCIR – International Radio Consultative Committee.
[84] [WaB87] Adam Watson Brown, *The Campaign for High Definition Television: A Case Study in Triad Power*. Euro-Asian Business Review, Vol. 6, number 2, April 1987.
[85] [Bai04] Philippe Bailly, *L'émergence de la TVHD à l'étranger, Amérique du Nord, Europe, Asie-Pacifique*. La Télévision et les projets RIAM, December 13, 2004, http://www.riam.org/riam/upload/slide_Bailly_RIAM.pdf

the sustainability of VOOM's model[86], the USA remains with not doubt the country with the broadest HD offer.

- Canada – Launch of HD services on the Terrestrial, Cable and Satellite networks in 2003. Due to the supremacy of cable in the country (90% of digital households connected to digital cable[87]), HD coverage in Canada is excellent – with roughly 95% of the population having access to HD content, and 10% actually opting for viewing and subscribing to HD.

- South Korea – All three platforms covered in HD in 2004, with the obligation for the five national channels to broadcast at least 13 hours of HD programs every week, with the threshold increasing to 20h later this year. Commercial launch of a full satellite HD service – Sky HD.

- Australia – The Television Broadcasting Act of 1998 defined the general orientations for the switchover to digital and the ramp-up of HD. All three digital platforms have been covered in HD since 2003.

Therefore, as of today HD services are spread out the following way:

Country/Region	Launch Date	Platform			Number of HD services (number of generalist ch.)
		Terrestr.	Cable	Satellite	
Japan	1991/2000	Yes		Yes	11 (7), including Hi-Vision
USA	Nov. 1998	Yes	Yes	Yes	22 (6)
Canada	Oct. 1999	Yes	Yes	Yes	20 (3), including USA channels
South Korea	Oct. 2001	Yes	Yes	Yes	5 generalists + Sky HD
Australia	2001	Yes	Yes	Yes	5 (5)
Europe	Jan. 2004			~	HD1 pan-European service

Table 5.1 HD services in the world[88]

As of March 2005, 10 million homes around the world were watching HD programs[89]. However, the gap between Europe and the rest of the world is obvious when looking at Table 5.1: only one commercial HD, HD1[90] service has been launched in Europe. Since January 2004, the satellite channel, operated by Alfacam, transmitted on Astra satellite, and sponsored by Pioneer, has sold 85000 access cards, more than half of whom for VARs (Value Added Retailers) wanting to get an

[86] [AP05] Associated Press, "Cablevision Chair to Buy Remainder of Voom", *Forbes.com*, February 10, 2005. http://www.forbes.com/feeds/ap/2005/02/10/ap1820437.html
[87] [NPA05] NPA Conseil, *L'arrivée de la TVHD en France, Opportunités Economiques pour les acteurs et scénarios d'introduction*. January 2005, http://lesrapports.ladocumentationfrancaise.fr/BRP/054000039/0000.pdf
[88] Adapted from [Baj04] Jacques Bajon, *High-Definition TV: Technological Transition or new market?* IDATE, November 2004.
[89] [Ins05] In-Stat, *High Definition TV Service Now in 10 Million Homes*. March 28, 2005, http://www.instat.com/press.asp?ID=1284&sku=IN0501899MB
[90] Formerly known as Euro 1080.

HD source for their in-store showcased displays[91]. As a result, understanding the market challenges around the deployment of HD in Europe is essential to better asses the influence of HD in the coming years: given that forecasts set at over 50 million worldwide the number of households with HD subscription in 200989, what differentiates Europe as a growing HD area?

5.2 Europe strikes back

As we saw earlier, the failure of analogue HD system in Europe in the 90s sent a strongly negative signal to broadcasters and gave them the feeling that HD was a commercially useless system. The first real trigger to quality-awareness in Europe was the massive adoption of digital packaged media, in the forms of the DVD. While of course in Standard Definition and coded in MPEG-2, it shows that consumers respond positively to quality when it is justified from a user viewpoint.

This, added to the already visible success of HD in other regions of the world, led industrials, broadcasters and policy makers in Europe to gather to define the foundations for HD, both from a technological as well as business perspective. Hence the creation of cross-industry associations such as the HD Forum in France. Since its inception on July 8th 2004[92], it has gathered major important players at each level of the value chain:

- Retailers, such as Fnac and Darty.
- Broadcasters, such as Eutelsat and TDF.
- TV and digital platforms operators, such as TF1, M6, TPS, Noos and France Télévisions.
- Consumer electronics vendors, such as Sony, Thomson, Sagem and Philips[93].

It therefore acts as much as possible a platform and operator-neutral hub for HD-related standardization and communication, with the following key roles to boost the development of HD in Europe:

- Involvement in pan-European organizations such as the EICTA and Europe's Information Society, for the establishment of European-wide standards for HD.
- Support of the deployment of an end-to-end HD-compliant chain on all the four digital platforms – cable, satellite, DTT and IP.

[91] [Feh05] Gabriel Fehervari (Euro 1080), *Session 1 – Join the Party... or Miss the Boat*. 2nd European HDTV Summit, London, March 17, 2005, http://www.tvconferences.com/
[92] [Sag04] Sagem, *Creation of the HD FORUM to promote high definition in France*. Press release, July 8, 2004. http://www.companynewsgroup.com/communique.asp?co_id=90015
[93] [HDF05] HD Forum, *HD Forum – La télévision change de définition*. http://www.hdforum.fr/

- Promotion of HD at the professional and consumer levels, through the creation of an HD label.

5.2.1 HD = MPEG-4

The cornerstone of HD development in Europe had been centered from the start on the common adoption of MPEG-4 as *the* standard. The other regions in the world which have already started HD have done it in MPEG-2, as it was at the time the only available technology. Here, Europe integrates the use of an emerging technology to catch up and deploy HD on a large scale.
Such a choice has a number of repercussions in terms of cost structure and bandwidth requirements for the different players of the value chain, as HD needs up to four times as much bandwidth as the equivalent SD signal:

- Satellite operators typically have between 200 and 500 services, which amount to a total bandwidth between 250Mbps and 1Gbps of satellite bandwidth[94], through a number of satellite transponders. Given that 1Mbps cost around 90k€/year [95], the increased compression performance MPEG-4 brings is directly impacting on the bottom line of operators.

- For ADSL operators, MPEG-4 is the only way of enabling HD IP TV, as 1 HD channel in MPEG-3 roughly equals 1 SD channel in MPEG-2 in terms of bandwidth.

- Real-time MPEG-4 SD encoders are already available. Real-time MPEG-4 HD encoders are scheduled for the 2nd half of 2005.

- In DTT, MPEG-4 entails minimal cost, but a delay in the countries having started in an all-MPEG-2 environment for the re-allocation of the channels to enable HD.

- Switching costs from a pre-existing SD STB to an HD STB in the vertical renting market of payTV cable and satellite. On a technical side, silicon vendors are ready to ship MPEG-4 HD decoding solutions.

All of this is even truer when remembering the fact that Europe has deliberately chosen to go beyond what the USA have done in terms of HD: while the later has in many cases made a 1 step jump from analog to HD and, rolled out the bulk of its cable and satellite HD offers first in 720p, Europe has, for the majority of its programs, chosen to make a bigger leap and go directly to 1080i, 2 million pixels full-HD, as shown in Figure 5.1.

[94] Sources: TV operators.
[95] Sources: Eutelsat, Astra.

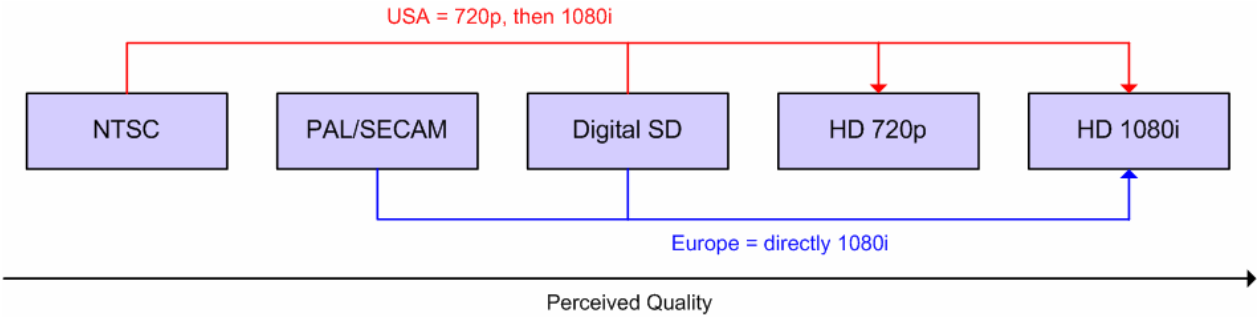

Figure 5.1 US and European HD leaps

Indeed, the lower quality of NTSC in comparison to PAL or SECAM has made the "small" American leap to HD justified. However, with a higher quality SD standard as well a higher Digital SD penetration, a bigger leap directly to 1080i makes more sense.

As a concluded by Boudet de Montplaisir, MPEG-4 is an "*unavoidable standard*"[96] to enable HD to grow in all its forms on every digital platform, both on a vertically integrated market (payTV cable or satellite) or horizontal market.

5.2.2 Enabling Factors

Because High Definition redefines the sets of rules and standards for the broadcast industry, its disruption can only be transformed into a mass-market commercial success if "*three basic components [...] work together: production, broadcasting, reception*"[97], as underlined by Létang. There is a real risk that the model turns into a vicious circle, where end-users delay equipping themselves for HD until broadcasters have a real HD offer, who themselves will not commit until having sufficient live and stock HD production, with said production not starting before having the certainty of being received by a sufficiently large consumer-base.

To break the circle one has to be aware of the external factors positively influencing the development of HD, and which help kick-starting the deployment in 2005, as shown in Figure 5.2.

[96] [BoM04], p. 28.
[97] [LTW04] Vincent Létang, Robert Taylor and Richard Womersley, *Implementation of wide-screen and high-definition television in the context of digital broadcasting*. Eurostratégies, December 2004, p. 30.

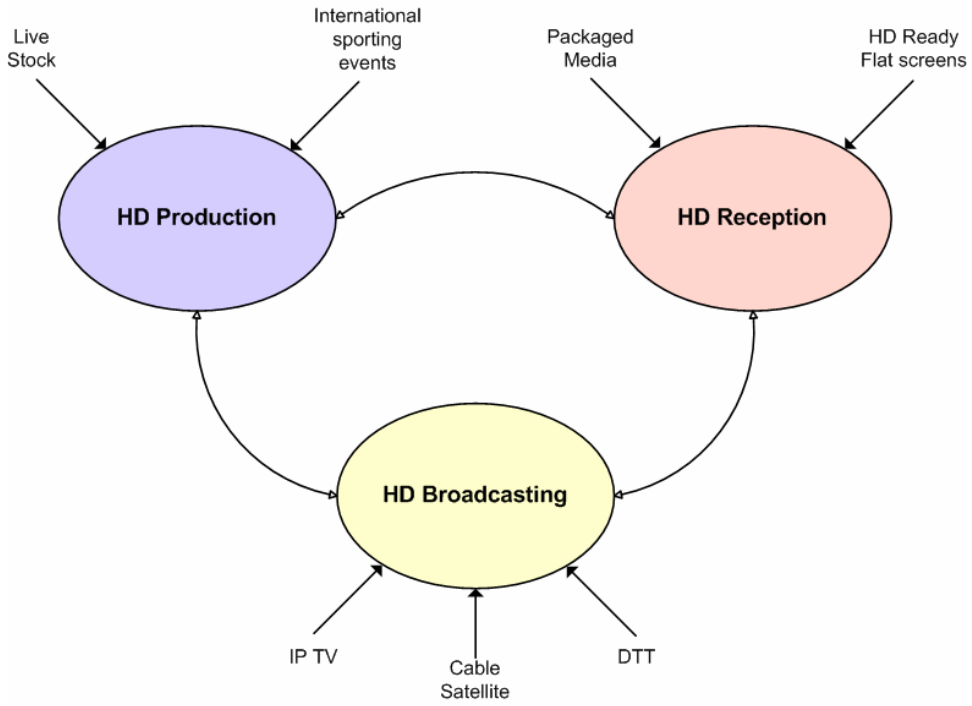

Figure 5.2 HD Virtuous Circle

5.3 Production

On the production side, HD cameras first appeared in 2000, and were quickly adopted for shooting blockbusters films[98]. The same goes for TV-specific productions, most prominently fiction series. It makes sense from an economic point of view, as there are no films to buy nor rushes to develop, and the global program marketplace is now demanding HD programs. Moreover, after a few years of filming in HD, it has created a stock of programs readily available for broadcasters to include in their SD or HD channels.

In parallel, HD production is driven by several major events to be covered fully in HD: just as color television at the time, HD is likely to be triggered commercially in 2006 thanks to the HD production of the Winter Olympic Games in Turin and the FIFA World Cup in Germany. It is important to note that until now, World Cups were dually-produced – for instance 64 matches in SD and 48 in HD in 2002[99], because at the time, HD coverage only interested a minority of broadcasters. In 2006 however, every match will be shot and produced in 1080i, thus giving an important boost for the adoption of HD on the consumer and broadcasting sides[100].

[98] *Star Wars Episode II: Attack of the Clones* was the first film to be shot entirely in HD, using Sony's HD cameras.
[99] [Tel05] Francis Tellier, *The Winning Goal – HDTV and the 2006 FIFA World Cup™*. Revue de l'Electricité et de l'Electronique (REE), Hors Série spécial HD, 2005.
[100] A cumulated 28.8 billion of households watched matches in the 2002 World Cup in Korea/Japan (Source: [Tel05]).

5.4 Reception

5.4.1 Flat screens

The offer in terms of visualization products have been dramatically extended over the course of the past five years. While the CRT (Cathode Ray Tube) TV set was the only alternative back in the 90s when analog HD tried to break even, today the commercial spectrum of products is much more diversified and in par with the performance of the video streams they will display, while not forgetting the design and form factors making large screens more easily integrated into consumers' home environment: LCDs (Liquid Crystal Displays), Plasmas and DLPs (Digital Light Projectors).

While those new technologies were almost insignificant back in 2002 – with barely 2% in volumes being flat screens[101], the number is to grow to 22% in 2005. At the same time, there is a sharp price decline for large screens: 42" Plasmas – the most common high-end size, down by 42% between 2004 and 2005[102], and 32" LCDs – the most common mid-end size, down by 33% in the same time span. As the qualitative difference between SD and HD is really visible with screen sizes over 32", the high-end segment should see a sales boost, which could compensate the price cuts of the smaller sizes.

This is however only possible if there is a true agreement between the screens vendors and the broadcasters. As piracy is already a major concern for content owners, as we have seen earlier with IP TV, the move towards digital HD can only be made a reality if the protection mechanisms as well as the connectivity in the broader sense are collectively agreed upon. From a consumer perspective, it is also important to have some security in making sure that the investment in a new TV set is a "future-proof" buy as much as possible.

Hence the work of the EICTA to define a European label of quality to clarify what is a HD Ready screen able to display the signals sent by HD TV operators. The label is shown in Figure 5.3 and defines a HD Ready screen the following way:

- A widescreen display.
- The HD inputs are able to process 720p and 1080i.
- The display has both an analog YPbPr and a digital (DVI or HDMI) HD input[103].
- The digital HD input is protected by HDCP.

[101] [Bin05] John Binks (GfK), *Who Wants HDTV Anyway? How is the Display Market Developping?* 2nd European HDTV Summit, London, March 17, 2005, http://www.tvconferences.com/
[102] [Som05] Marnix Somers, *HD comes Home – ready when you are*. 2nd European HDTV Summit, London, March 17,2005, http://www.tvconferences.com/
[103] Explanations on the technical details are given in Appendix B.2.2.

Figure 5.3 HD Ready label[104]

With such a standardization label in place, it is forecast that the European total consumer market for HD-Ready screen will go from 2.3 million in 2005 to over 18 million in 2008[105]

5.4.2 Packaged media

Just as digital SD entertainment really took off through the adoption of DVDs, it is expected that HD will truly make sense on the reception side with the addition of the corresponding packaged media offering. Indeed, while the DVD, with 4.5GB of storage per layer and per side, is sufficient to store full-length films and footage in SD, its capacity and transfer bitrates make it inappropriate for HD storage and replay. While there has been a consensus on displays to define common specifications across the industry, two incompatible alternatives have appeared as the next generation of digital packages media:

- Blu-ray Disc – Using a blue/violet laser diode which operates at a shorter wavelength than conventional DVDs enables to store 25GB/layer/side, with prototypes of 8-layer 200GB Discs having been demonstrated. Since announcing the first specifications in February 2002, the Blu-ray Disc Association backing up the format has grown to over 100 members, and includes consumer electronics vendors, IT companies as well as film studios. The first Blu-ray recorder was launched in Japan in April 2003, and the player market is scheduled to take off in 2006 with Blu-ray being integrated in computers and on the PlayStation 3.

- HD-DVD – Chosen as the successor of the DVD by the DVD Forum, it has a capacity of 15GB/layer/side. Because it shares mechanical and optical similarities with the existing DVDs, it is supposed to be cheaper to manufacture and existing DVD manufacturing lines can be retrofitted to press HD-DVDs. The format is backed up by a dozen of consumer electronics vendors and film studios.

[104] [EIC05] EICTA, *EICTA announces "Conditions for High Definition Labelling of Display Devices*. Press release, January 19, 2005, http://www.eicta.org/dls/logon/DBLogon.asp?URL=/Common/GetFile.asp?&logonname=guest&ID=9719&mfd=off
[105] Data sources: Datamonitor, Strategy Analytics and Idate.

Whatever form the format war takes – whose outcome is yet to be determined, it should be noted that both formats support the same set of compression standards – MPEG-2, MPEG-4 and VC1, and offer the necessary capacity for HD.

5.5 Broadcasting

Through the voluntary technical choices made by Europe, High Definition can be realistically integrated in the four digital platforms in a two-year timeframe. However, each platform has specific parameters and characteristics to be taken into account when launching HD.

5.5.1 Satellite

This is the *de facto* choice for launching HD, due to the available bandwidth despite the added initial cost. Beyond the technical feasibility, HD is an important differentiation factor for satellite payTV operators, and a way to create a new growth cycle. Indeed, as all the major satellite platforms over Europe have been launched between 1996 and 1999, they have experienced a dramatic growth of subscribers in the 90s, but now are seeing stalling numbers, as shown in Figure 5.4:

- Satellite reception is often impossible in city centers, due to the difficulty of installing satellite dishes.

- Premium content and a nearly equivalent channel selection are becoming available on IP TV, for a similar if not lower price, as shown earlier in Figure 4.6.

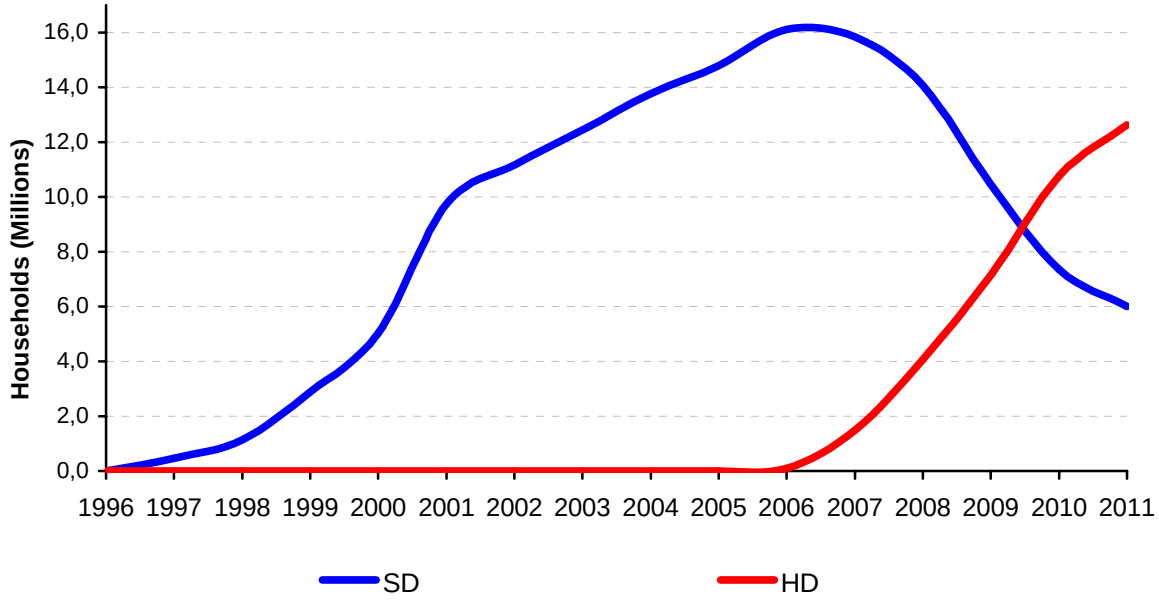

Figure 5.4 Satellite SD and HD payTV subscribers in France, Germany & UK[106]

[106] Data sources: satellite operators.

As shown in the forecast calculated in Figure 5.4, HD is set to ramp up in late 2005 and truly relieve SD from saturation starting in 2006. Indeed, major satellite operators have announced their plans to switch to HD:

- TPS in France, with currently 1.3 million subscribers, will launch its HD offer in September 2005[107].

- Canalsatellite, in France, with currently 3 million subscribers, will launch HD starting October 1st 2005.

- Premiere in Germany, with currently 3.1 million subscribers, will launch HD in November 2005.

- BSkyB in UK, with currently 7.3 million subscribers, will launch HD in early 2006.

5.5.2 Cable

As noted by Bailly, cable platform has the advantage of having broadcast head-end easily adaptable to HD[108]. However, there are significant infrastructure costs related to upgrading the relaying network in order to transmit HD. That is why cable providers, like Noos in France, have already made HD trials and will progressively launch their offer in 2006, as followers of satellite operators.

5.5.3 IP

HD on IP is conditioned by the development of very-high bandwidth networks in Europe:

- ADSL2+ and VDSL for the copper line infrastructure.

- Fiber To The Home.

As we saw in section 4.2.2, the recent launch of ADSL2+ in France for instance, makes it technically realistic on the network side for HD IP TV in MPEG-4. Recent announcements by ISPs in France such as Cegetel and Free among others have hinted end of 2005 or early 2006 as a possible launch of HD in their respective packages.

[107] Details on operators are compiled in Appendix 0.
[108] [NPA05], p. 23.

5.5.4 DTT

As a multiplex can hold 3 HD channels in MPEG-4, the main limiting factor is the spectrum allocation which by essence will restrict the number of HD channels, and will likely not be launched before the analog swich-off. On that issue, France appears as a striking exception and the most likely European country to first launch HD DTT, thanks to the choice of MPEG-4 for payTV and HD from the start of the project. Even on DTT, HD will be first driven by payTV, and marketed as a premium service.

5.6 Towards an HD world

Summarizing the previous analysis, the specific forces that are enabling HD are shown in Figure 5.5.

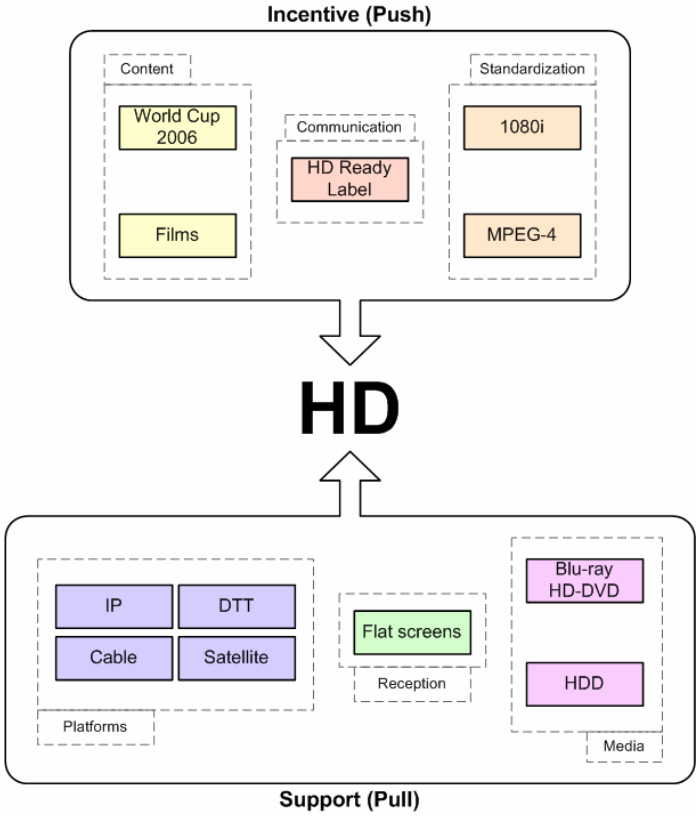

Figure 5.5 Enabling HD

There is a clear momentum around HD that has been created through the several incentive factors that are the soon availability of HD content, as well as the technical standardization marketed around the HD Ready Label. These visible enablers are *pushing* the demand, and they backed by the support of the technology that is *pulling* HD out to the commercial environment, thanks to the digital platforms switching to HD, the flat screens becoming more and more affordable and packaged and storage media being scaled for HD.

This is another empiric evidence of the whole product model we saw in Chapter 2: High Definition in Europe has learnt from its unsuccessful launch in analog form not to be only a technological disruption, but also to bundle itself together with appropriate content, reception devices and "futureproof" communication strategy (HD Ready Label), hence resulting alltogether as a whole product, as shown in Figure 5.6.

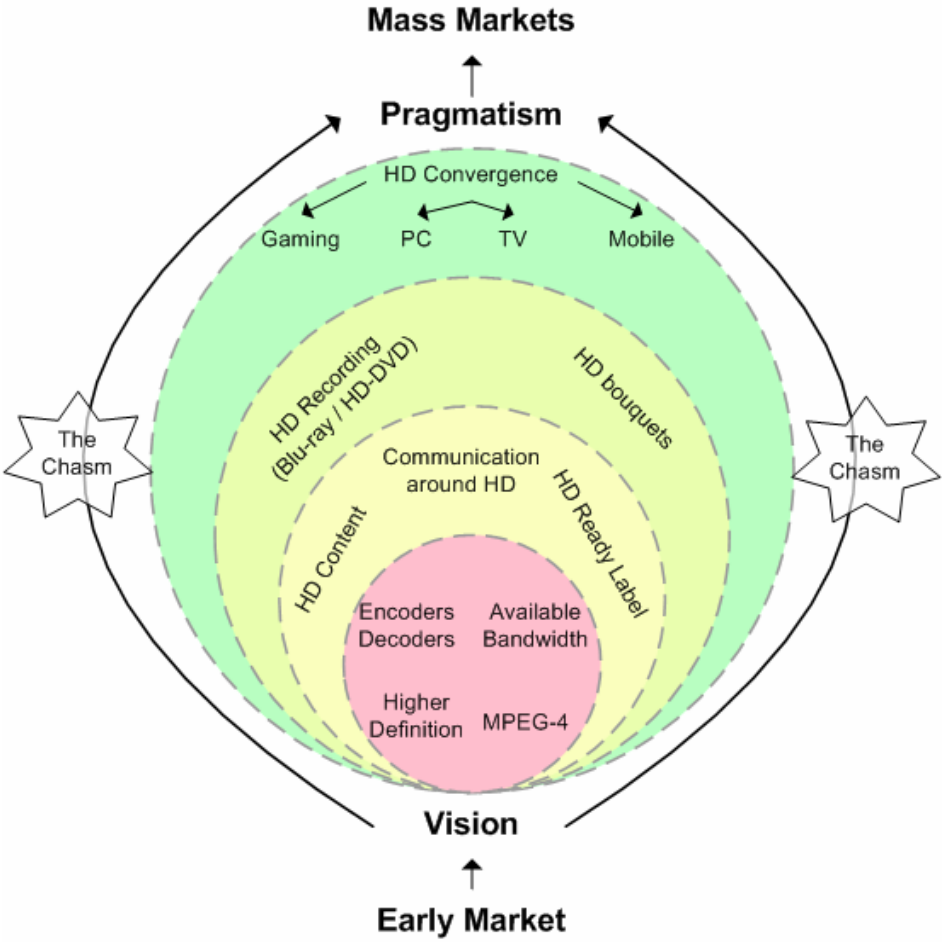

Figure 5.6 High Definition Whole Product

As we see in Figure 5.6, from the purely technological and "dry" factual reality of High Definition, various pieces are being added by the different actors in the value chain, in order to *augment* the technology's appeal and help reduce the paradigm shock for consumers to adopt HD on a mass-market scale.

6 Strategy & Outlooks

Nothing is new except arrangement.

William J. Durant

The lessons we have learned from the current European market structure, and which have been detailed in the previous two chapters, can be summarized as shown in Figure 6.1.

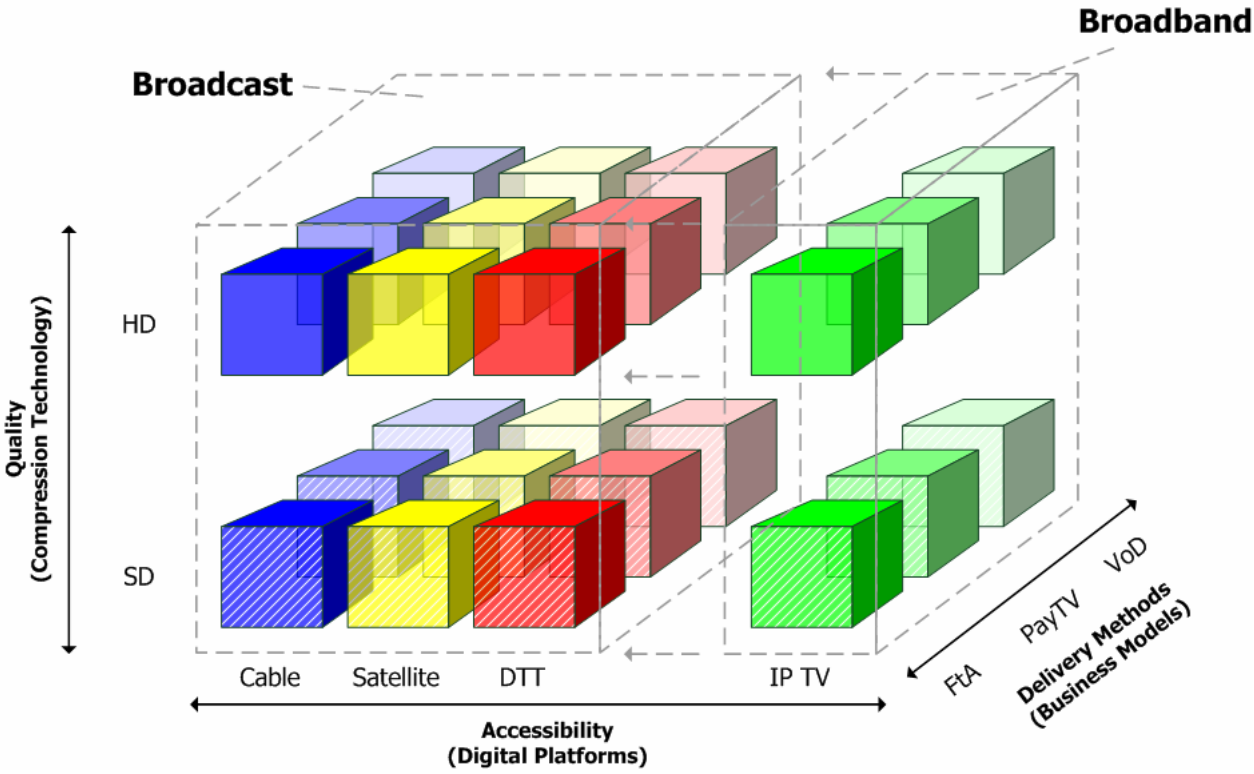

Figure 6.1 Current digital TV matrix in Europe

What we are experiencing is the creating of a three-dimensional digital TV matrix, whose development in Europe is driven by the coexistence of three axes:

- The *complementarity* of four digital platforms – The three broadcast platforms – namely Cable, Satellite, DTT, have now been joined by the broadband side, with the strong emergence of IP TV as a viable and flexible platform, as seen in Chapter 3.

- The *integration* of High Definition as a differentiation factor – As a transversal driver for the transition from basic to advanced digital platforms, High Definition plays a key role in bringing quality as a key component for the ongoing growth of each platform, as seen in Chapter 4.

- The *mixing* of business models – While the traditional vertically integrated digital platforms appearing in the 90s created a clear separation between free-to-air and payTV models, the current growth of DTT and above all IP TV is blurring the technical and marketing frontiers between each delivery model.

As a result, the strategic issue is not anymore in terms of analog vs. digital or free-to-air vs. payTV: for the key players involved in digital television today, the challenge is to integrate the multiple "cubes" pictured in Figure 6.1 in their own strategy. That is precisely why the very structured and stiff value chain in place in the late analog multi-channel days[109] have, in the course of ten years, been disaggregated and are leading to a new and more flexible environment that is better encompassing the increased complexity and digital TV diversity we have just pointed out. The symbolic depiction of this new environment is shown in Figure 6.2 below.

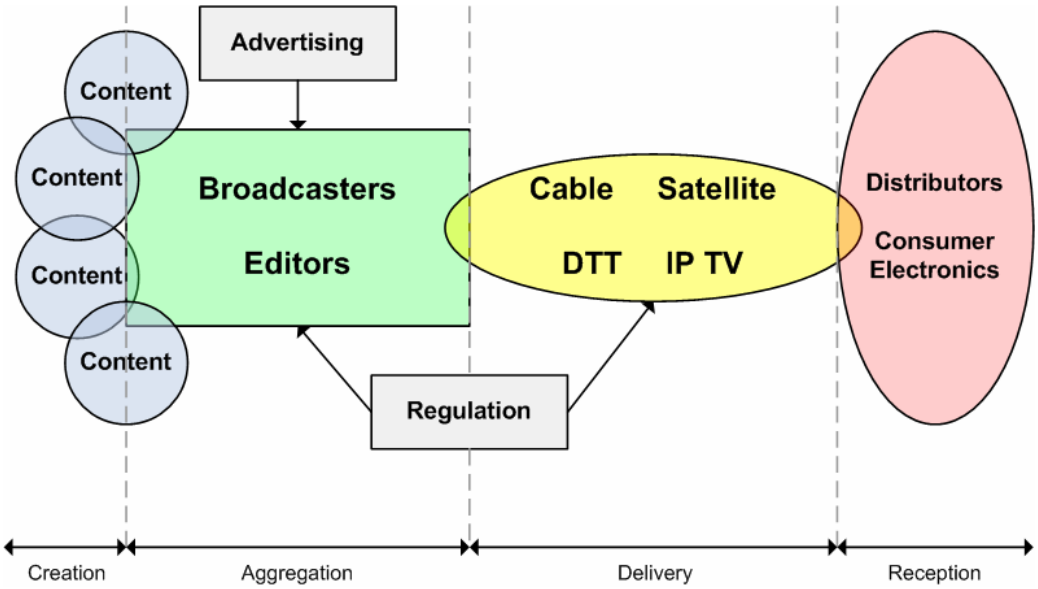

Figure 6.2 Emergent digital TV value chain

The overlapping of the different components is made to show that the distinction between each stage of digital TV is getting more and more blurred with the others in Europe, as the disruptive innovations of IP TV and HD are putting the different players in an increasingly international and complex set of relationships:

- With the move to digital broadcasting being well under way in Europe, content creators and producers are today experiencing this transition between the analog scarcity to the digital abundance. Hence the now closer relationship and inter-dependence they are now building with broadcasters, thanks notably to the deployment of HD as a transversal standard, as detailed in section 5.3.

- Broadcasters are involved in driving the commercial development of digital platforms, as it was already the case with payTV satellite, and it has been strengthened with the launch

[109] *Cf.* Figure 3.3.

of DTT and IP TV which directly benefit from their content rights, advertising power as well as overall brand influence in the field.

- As for the reception part, the co-existence of the whole spectrum between the fully horizontal and fully vertical business models, as seen earlier in Figure 4.7, creates a closer relationship between the consumer electronics and the broadcast actors in the digital TV environment.

To better understand this new combination and the challenges for each of its players, here follows the strategic analysis of each of the key players in the new digital TV ecosystem.

6.1 Strategic Analysis

6.1.1 Creation

As High Definition and IP TV change the scope and conditions in which content is proposed to the general public, content creators and producers alike are looking at it as the push towards a generalized improvement of the quality and flexibility of their content, thereby impacting the diffusion of both cinema footage as well as TV-specific content on those new advanced platforms. Yet, such a transition goes with strategic challenges, as detailed below in Table 6.1.

Strengths	Weaknesses
- Availability of stock content both for HD and IP TV usage. - Flexibility given by full-digital post-production process. - Flexibility in the production phase (digital shooting). - Overhead cost to digital/HD are stabilizing.	- Vague understanding of the long-term economic impact in the valuation of quality (HD) as well as in the new business models for content (on-demand). - Low digital/HD cinema theater equipment delaying the generalized transition. - Variable acquaintance with the new shooting techniques associated with HD.
Opportunities	**Threats**
- HD and IP TV roll-outs in Europe unify the digital platforms worldwide and help license content on an international level. - Revalorization of existing materials (rerun of films & documentaries as a premium content in HD) as well as added flexibility through IP-based on-demand services. - Long-term patrimonial value and reusability of content produced for advanced digital platforms.	- Heavy investment costs to switch to advanced/HD production and edition equipment. - On a short term, HD and IP TV in Europe will attract foreign-made content and productions.

Table 6.1 SWOT – Creation

6.1.2 Aggregation

Channel package operators are facing the generalized shift from the "walled-garden" vertically integrated markets of payTV satellite and cable to integrate the more open IP TV digital platform as a key element of their strategy. At the same time, the push of HD should create a new impulse for a continued increase of TV consumption and a revaluation of the differentiation-through-quality approach, as detailed in Table 6.2 below.

Strengths	Weaknesses
- Strong and decade-old involvement in payTV offers packaging and distribution[110]. - Financial power backed by strong European media groups.	- Industry sector currently in fragmentation / atomization.
Opportunities	**Threats**
- Increase of overall TV consumption. - Attracting new market segments through premium added value (HD) and complementary platforms (IP TV). - Differentiation with competitors. - Long term decrease of operating costs through MPEG-4 HD. - Increased competition between digital platforms makes diversification a relevant move.	- Increasing tariffs of advertising. - Short-term Return on Investments (ROI) improbable. - As a premium intermediary, operators have to renew their value proposition in order to match it with broadband ISPs taking a more central role in TV distribution through IP TV.

Table 6.2 SWOT – Aggregation

6.1.3 Delivery

Digital platforms operators are on the front line in the integration of the new developments that High Definition and IP TV represent in the short and long terms. Due to the increasingly blurring frontier between broad*cast* and broad*band*, the SWOT analysis that follows in Table 6.3 considers delivery as a whole, and forecasts a convergence of the issues between the four platforms, as already exemplified earlier with High Definition[111].

[110] *Cf.* country-specific operators' details in Appendix 0.
[111] *Cf.* section 5.5.

Strengths	Weaknesses
- Customer Relationship Management (billing and subscription) expertise. - Existing experience in entertainment TV & PC portals as well as Push & Pull models.	- Highly dependant on the content made available on the platform. - Inertia due to "installed-base effect" (renewal of consumer's equipment). - ISPs newcomers in building-up relationships and partnerships with content aggregators.
Opportunities	**Threats**
- Increase of ARPU through TV content packaged as a multi-service bundle (Multiple Play)[112]. - Lowering of churn rate. - Differentiation factors through a closer relationship between broad*cast* and broad*band*.	- Increasing broadcasting and content licensing costs. - Substantial investments in backbone infrastructure and content provisioning[113].

Table 6.3 SWOT – Delivery

6.1.4 Reception

In the reception side, consumer electronics, as well as their associated distributors, have advantage of getting direct contact with the consumers. This is one of the key aspects that will determine the acceptation of High Definition and IP TV in Europe, and will orient the technological integration in consumer products, as detailed in Table 6.4.

[112] *Cf.* section 4.2.3.
[113] *Cf.* section 4.2.2.

Strengths	Weaknesses
- Front position for teaching, lobbying and communicating digital TV innovations to the general public.	- Little integration so far between the consumer electronics and the telecommunications side on the home market. - Has to be prepared for the whole spectrum of business models – from horizontal to vertical.
Opportunities	**Threats**
- Quickly growing European market of flat screen TV sets[114]. - MPEG-4 as the technological foundation for building a complete renewal of the installed consumer equipment base. - HD packaged media to have comparable consumer impact as DVD had for Standard Definition Digital content.	- Uncertainty regarding technological choices, especially in terms of DRM and HD packaged media (Blu-ray vs. HD-DVD)[115]. - Inertia of the strategic choices. - Consumer's reaction in front of the technological complexity: Increased need of a *teaching* role to the end-users[116].

Table 6.4 SWOT – Reception

6.1.5 Advertising

All the evolutions analyzed previously remain conditioned to the parallel evolution of the advertising market. While a full analysis of the digital TV advertising market is out of scope from this study, it should be noted that the growth of the total channel and platform offer does not extend to a similar elasticity on the advertising and ratings market: if we take France as an example, the non-terrestrial channel with the highest ratings, RTL9, had an average of 2.2% market share, whereas the leading terrestrial channel, TF1, had nearly 25% of the same market[117]. An opening therefore lies for the advertising market in embracing other forms of communication channels, such as persistent and profiled commercials, as already experienced in the USA on the TiVo PVR platform. The emergence of similar PVR for IP TV and High Definition in Europe is bound to increase the interest and viability of those new forms of advertising.

6.1.6 Regulation

The evolution in the digital TV platforms we have analyzed has a side-effect impact on the regulator's involvement and role in Europe: the planned switch-offs of the analog terrestrial

[114] *Cf.* section 5.4.1.
[115] *Cf.* section 5.4.2.
[116] Especially for the *late adopters* and *laggards*, as detailed in Section 4.3. A successful example is the adoption of the "HD-Ready" label.
[117] [Med05] Médiamétrie, *MediaCabSat Analysis*. March 2005, http://www.mediametrie.fr/resultats.php?rubrique=tv&resultat_id=112

delivery network as well as the emergence of IP TV shift the regulatory model, as shown in Figure 6.3.

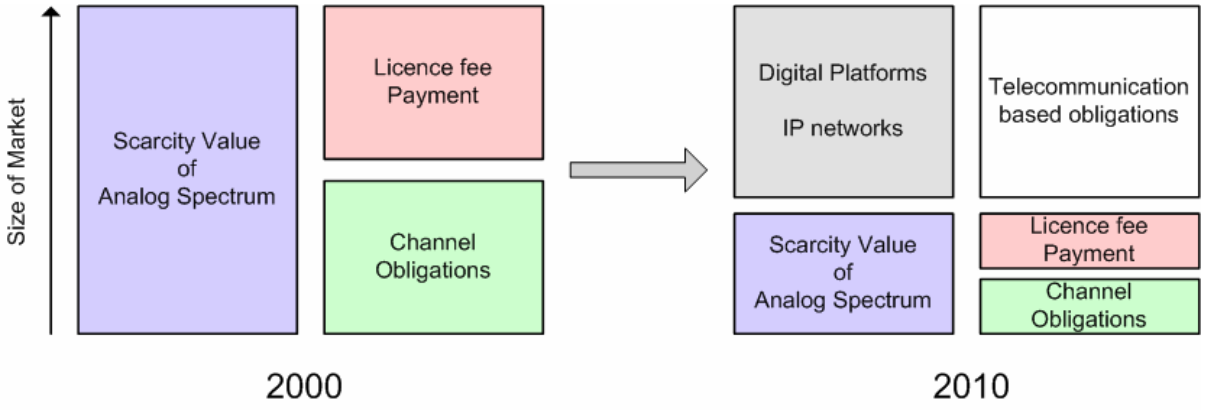

Figure 6.3 Evolution of the regulatory role[118]

- The traditional model in place was described in section 3.1 and its two components were *scarcity* and *monopoly* funding and regulation of the terrestrial broadcasters.

- What Europe is heading at is the inter-implication of regulation from the broad*cast* side (for the TV content streamed on the digital platforms) as well as on the broad*band* side, as a consequence of the closer relationship between *content* and *infrastructure*, as seen in section 4.2.5.

6.2 The new TV cycle of growth

More than just the convergence of *technologies* around advanced digital TV platforms through IP TV and High Definition, it is the convergence of *strategies* between the content (valorization of cinematographic content), the aggregators (higher attractivity of the packaged content offered), the delivery platforms (higher ARPU and total use of their services) as well as industrials (faster renewal of the installed consumer electronics base). And this ultimately results in the consumer pushing himself this transition to having TV delivered in a more flexible way, towards a wider spectrum of appliances and usages.

Looking forward, we can therefore draw a tentative forecast of the adoption of those advanced digital TV platforms, as shown in Figure 6.4, with two mid- and long-term targets:

- 5% of European households with advanced digital platforms in 2010.

- Over 40% of European households in 2015.

[118] [Har05] David Harrisson, *Ofcom – Regulating on-demand content over IPTV*. IP TV World Forum, London, March 8 & 9, 2005, http://www.iptv-forum.com/

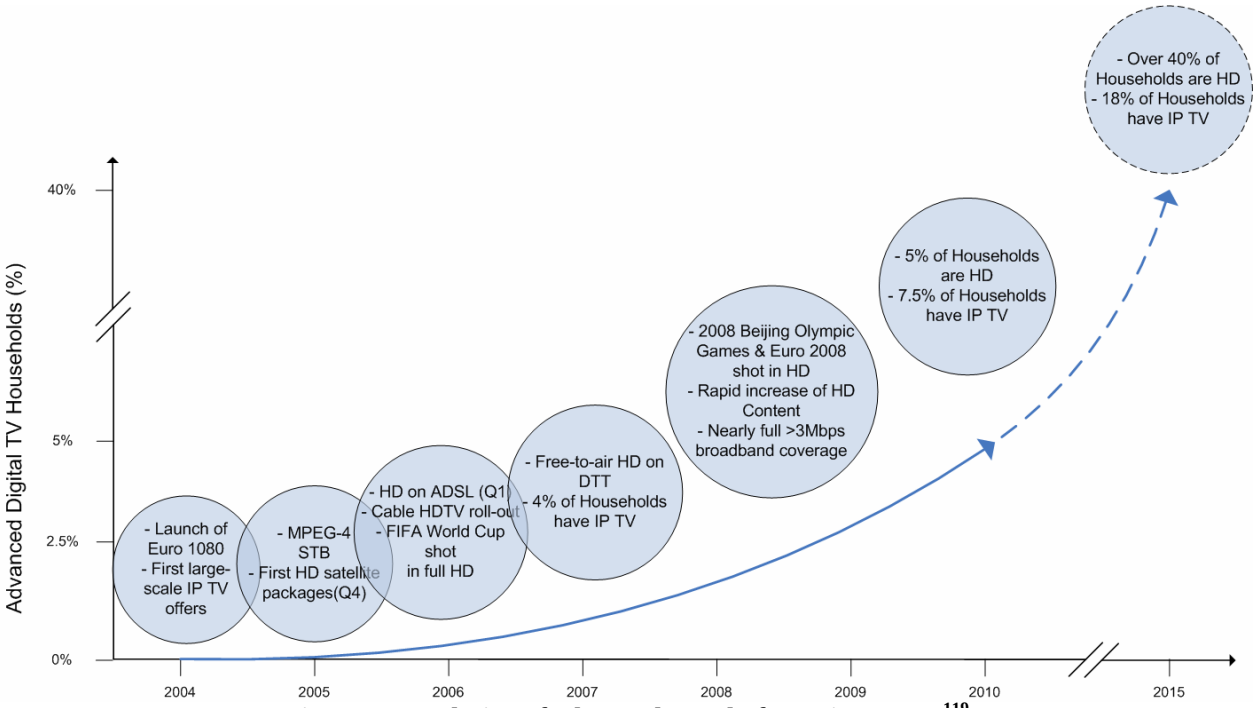

Figure 6.4 Evolution of advanced TV platforms in Europe[119]

6.3 A new cycle of disruption and consumer adoption

This empiric and forecast analysis of the evolution of the European digital TV market leads also to a deeper and more theoretical understanding of the dynamics to expect in the coming years. The first element to consider is the juxtaposition and inter-correlation of both High Definition and IP TV in the shaping of tomorrow's television. Indeed, beyond the differentiation in terms of platforms and technologies, we can cluster the digital landscape the following way:

- *Basic* digital platforms – Taken from the perspective and technological background of the 90s (MPEG-2), they are the current satellite, cable and DTT systems launched throughout Europe. The main difference between the satellite & cable on the one side and DTT on the other side is that the former have been conceived in a payTV, vertically integrated model, whereas the very uptake of DTT comes from its free-to-air component.

- *Advanced* digital platforms – They take benefit from the later innovations of the 2000s by incorporating MPEG-4 and High Definition as well as the dual notion of broadcast and broadband (IP TV) to transport audio-video content.

[119] [Baj04] Jacques Bajon, *High-Definition TV: Technological Transition or new market?* IDATE, November 2004, and [NPA05] NPA Conseil, *L'arrivée de la TVHD en France, Opportunités Economiques pour les acteurs et scénarios d'introduction*. January 2005.

Using the analysis made earlier, we see that basic and advanced digital platforms are evolving as shown in Figure 6.5.

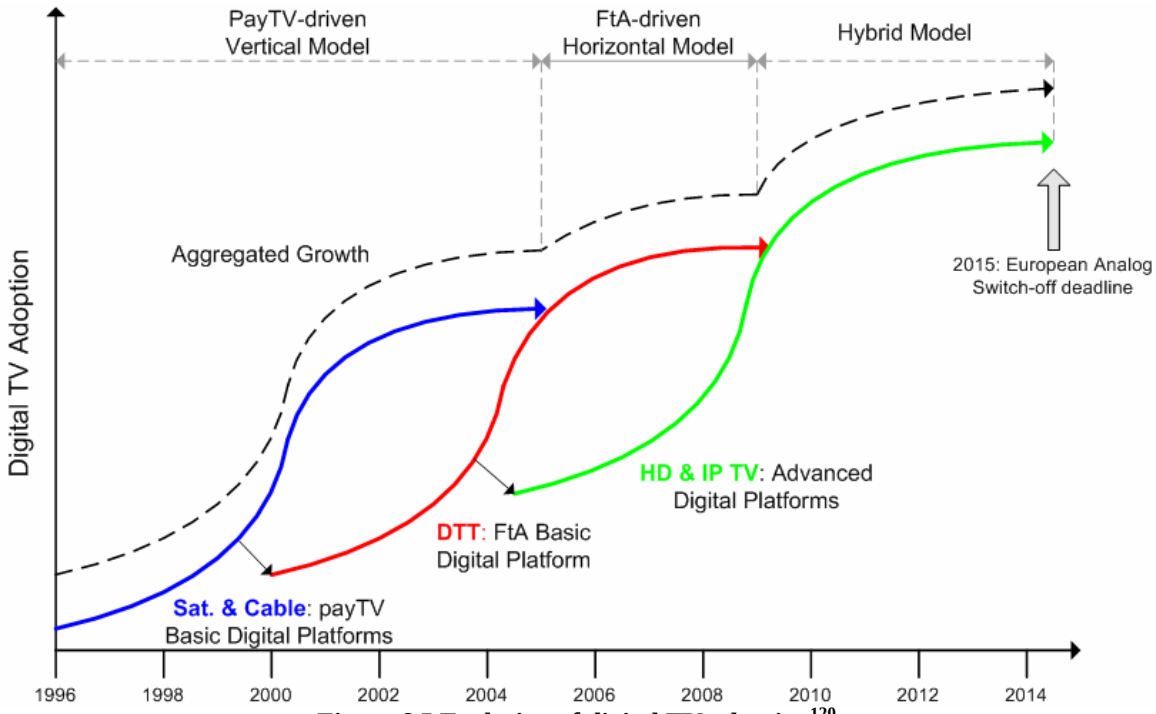

Figure 6.5 Evolution of digital TV adoption[120]

What stems from that is a better evaluation of the cumulated impact from the successive waves of disruption:

- Starting in 1996, the integrated platforms of satellite and cable, as we detailed in Section 3.2.

- The second wave has been relayed through the free-to-air perspective of DTT, starting in 1999 in the UK and still ongoing today (for instance with the hybrid model chosen in France, as detailed in Section 4.1.3).

- Today, High Definition and IP TV are both looming as ready for the migration towards advanced digital platforms. Hence, the disruption created by this new S-curve is at a different level than the one created in the late 90s by DTT, as it is impacting the industry on both a *trans-platform* (satellite, cable, DTT and IP TV are all involved in the making of HD) as well as a *trans-industry* perspective (gathering broadcast and broadband closer to each other, as shown in Figure 6.1).

Such discontinuity in the S-curves HD and IP TV create also has the effect of shifting the attention of the industry towards the market phases with higher strategic returns. Referring to the

[120] Adapted from [Chr03] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. (HarperBusiness Essentials, 2003), p. 45 – 47.

consumer mainstream market model developed in Figure 2.4, the evolution can indeed be modeled as shown in Figure 6.6

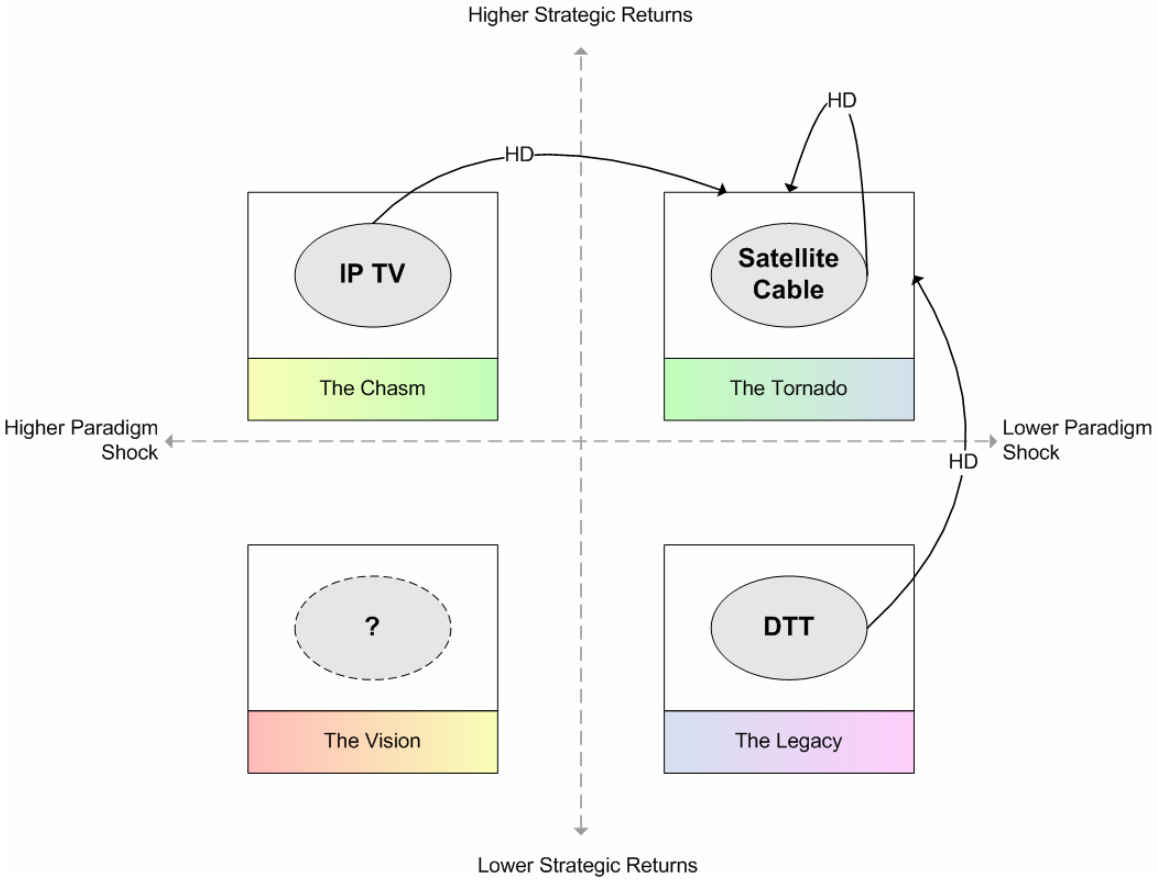

Figure 6.6 Advanced digital platforms model

What stems out of this model is that High Definition is positively influencing the different digital platforms in Europe to warp inside the Tornado phase of the adoption lifecycle:

- IP TV, currently in the middle of the Chasm, takes HD as a positive technical driver in terms of bandwidth allocation as well as an opportunity to take the leadership out of the other three platforms in terms of advanced, high-quality content and services.

- As we saw in Section 5.5.15.5.2, the mature satellite and cable platforms are seeing HD as vector to make them get back from saturation into another high-return, mass-market cycle.

- Though only technically and legally feasible at a later stage, DTT is also bound to be shifted from the conservative market to a earlier and more strategic phase of the lifecycle.

All in all, this tends to signal the parallel deconstruction and reconstruction of the digital TV market in Europe towards a much more dynamic, competitive and complex ecosystem in which

those new advanced platforms have the potential to "*emerge and subsequently to invade established markets from below*"[121].

[121] *Ibid.*, p. 211.

7 Conclusions

Creativity and innovation
always build on the past.

Lawrence Lessig[122]

7.1 Lessons Learned

This report has highlighted the complexity of the European digital television market, and analyzed the two main factors driving this ecosystem forward: High Definition and IP TV. Through this study, several market trends have been put to light and can be summarized with the following three key lessons learned:

- *Complementarity* – The challenges IP TV and High Definition are creating are not so much a simple issue of *replacement* but a more complex one of *complementarity* with the existing multi-channel digital platforms. A characteristic of the mass consumer market at stakes, this transition phase is also showing the new dimensions of complexity that are being added in the European broadcast industry.

- *Technology AND consumers* – At the same time as the technological disruption enables IP TV to set up itself as a new and viable platform and High Definition to facilitate higher quality in a transversal, cross-industry basis in Europe, the long-term viability of those *pushed* advancements will ultimately depend on whether the newly-formed value chain adequates technology with the demand that is *pulled* from European consumers.

- *It's not open, and it's not closed*[123] – IP TV is an essential part of the strategic picture, because it is the first time at this scale that the broad*cast* universe has embraced the ICT side of the broad*band*. It is not to say however that closed and vertically integrated models are gone, nor that the openness is total. But it clearly shows that the total spectrum of operating models has widened thanks to the technological innovations that have emerged. In that sense, High Definition, by bridging together the production, broadcasting and reception under compatible interests, heralds the new direction the industry is taking.

7.2 Seeds to Future Work

By opening new doors and venturing in the territories of the new digital TV in Europe, this report has given an analysis and outlooks on the future of the industry. This reflection is of course a

[122] [Les02] Lawrence Lessig, *Free Culture – Lawrence Lessig Keynote from OSCON2002.* O'Reilly Network, San Diego, CA, July 24, 2002, http://www.oreillynet.com/pub/a/policy/2002/08/15/lessig.html
[123] And *vice versa*.

dynamic part in the more global issue of the new media, and hereafter are some tracks building upon this work and bringing to the analysis several emergent aspects:

- *New active media consumption* – This first suggested track refocuses on the user as the central *actor* in the value chain, more than just the *spectator*. We already mentioned previously the role of TiVo and its clones as a disruptor of the established, advertising-based model in the USA. Today, the same kind of service is being launched in Europe: how will it affect existing players, and will it signify the first real take-off of Video on Demand?

- *From broadcast to broadcatch* – IP TV has a tremendous potential in bridging the content world with the infrastructure world. However, the current model of IP TV in Europe keeps the same distribution workflow as the other platform. With the development of more decentralized technologies – like bitTorrent for P2P content exchange and large-scale video sharing platforms like Google Video[124], what are the implications in terms of distribution of content? How will it impact the traditional valuation and licensing of audio-video content, and how can it be integrated in the European ISPs' Triple-Play business models?

- *The Long Tail of TV* – The concept of the Long Tail presented by Anderson brings forth the idea that Pareto's principle of the 20/80 of the physical market do not apply in the virtualized and online exchange platform that the Internet is, where the niche markets are actually reachable. From mass media at the top of the tail to super-niche media at the farther end, as shown for music in Figure 7.1.

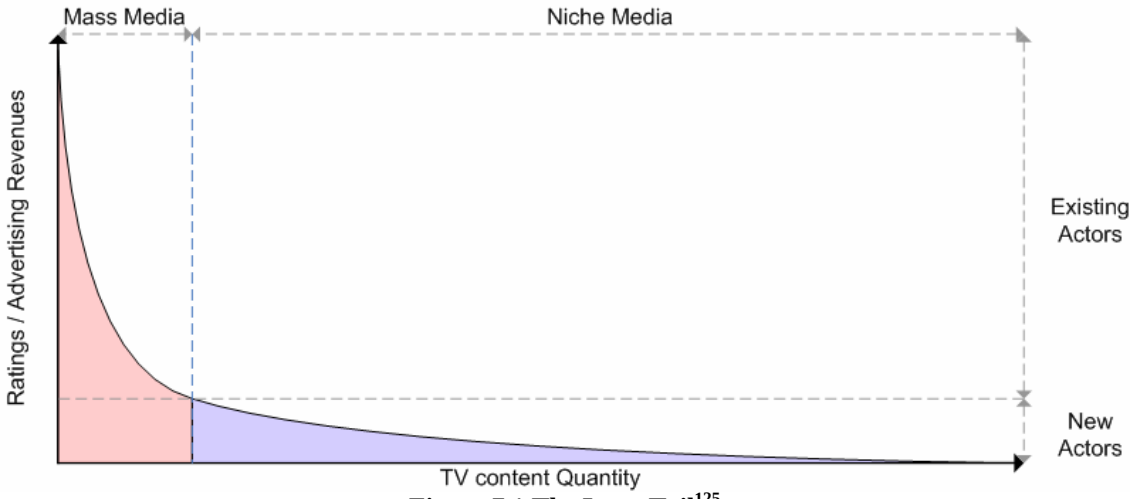

Figure 7.1 The Long Tail[125]

The logical next step is for TV, as "*the sweet spot of all Long Tail forces*"[126], to be in part or as a whole reinvented through a more complete usage of what IP can bring in terms of content availability.

[124] [Goo05] Google, *Video Upload Program*. April 2005, https://upload.video.google.com/
[125] [And04] Chris Anderson, "The Long Tail", *ChangeThis*. December 14, 2004, http://www.changethis.com/10.LongTail

References

All web links were tested and available on May 7th 2005.

[3Pl04] Team 3Play, *Kista IP Triple Play – Final Report*. Communication Systems Design 2004, KTH, Stockholm, May 14, 2004, http://csd.ssvl.kth.se/~csd2004-team15/reports/3p_doc_fr_1.0.pdf

[AGJ+02] Anderson, Ben, Caroline Gale, Mary Jones and Annabel McWilliam, *Domesticating broadband - what consumers really do with flat-rate, always-on and fast Internet access.* BT Technology Journal, Vol. 20 No. 1, January 2002.

[And04] Chris Anderson, "The Long Tail", *ChangeThis*. December 14, 2004, http://www.changethis.com/10.LongTail

[And05] Chris Anderson, "Only You Can Save Television", *The Long Tail – A public diary on the way to a book*. March 27, 2005, http://longtail.typepad.com/the_long_tail/2005/03/more_long_tail_.html

[AP05] Associated Press, "Cablevision Chair to Buy Remainder of Voom", *Forbes.com*, February 10, 2005, http://www.forbes.com/feeds/ap/2005/02/10/ap1820437.html

[Bai04] Bailly, Philippe, *L'émergence de la TVHD à l'étranger, Amérique du Nord, Europe, Asie-Pacifique*. La Télévision et les projets RIAM, December 13, 2004, http://www.riam.org/riam/upload/slide_Bailly_RIAM.pdf

[Baj04] Bajon, Jacques, *High-Definition TV: Technological Transition or new market?* IDATE, November 2004.

[BBC01] BBC, *History of the BBC – 1930s*, http://www.bbc.co.uk/heritage/story/1930s2.shtml

[BBM05] Informa Media, *Broadband Markets*, April 25, 2005.

[BGP02] Bourreau, Marc, Michel Gensollen and Jérôme Perani, *Economies of Scale in the Media Industry*. July 2002.

[Bin05] Binks, John, *Who Wants HDTV Anyway? How is the Display Market Developping?* 2nd European HDTV Summit, London, March 17, 2005, http://www.tvconferences.com/

[BoM04] Boudet de Montplaisir, Daniel, *Télévision Numérique et Haute Définition.* Report Commissioned by the Prime Minister of France, October 2004, http://www.premier-ministre.gouv.fr/IMG/pdf/rapport_boudet-2.pdf

[126] [And05] Chris Anderson, "Only You Can Save Television", *The Long Tail – A public diary on the way to a book*. March 27, 2005, http://longtail.typepad.com/the_long_tail/2005/03/more_long_tail_.html

[Bou04] Marc Bourreau, *Digital Terrestrial Television in France: an attempt to enhance competition in an oligopolistic market.* June 2004.

[Boy02] Boyon, Michel, *La Télévision Numérique Terrestre – rapport établi à la demande du Premier Ministre*. October 2002, http://www.ddm.gouv.fr/IMG/rtf/RAPPORTBOYON.rtf

[Boy03] Michel Boyon, *La Télévision Numérique Terrestre – rapport complémentaire établi à l'intention du Premier Ministre.* February 2003, http://www.ddm.gouv.fr/IMG/rtf/boyon_complementaire.rtf

[Broo05] Brooks, Paul, *Breaking the DSL Speed Limit*. Commsday Summit 2005, March 3, 2005, http://www.commsday.com.au/Paul%20Brooks.ppt

[Bro05] Brown, Allan, ed., *Digital Terrestrial Television in Europe.* Lawrence Erlbaum Associates, January 2005.

[C+05] Canalplus Groupe, *Historique,* http://www.canalplusgroup.com/pid163.htm

[CAR04] Christensen, Clayton M., Scott D. Anthony and Erik A. Roth, *Seeing What's Next: Using the Theories of Innovation to Predict Industry Change*. Harvard Business School Press, September 2004.

[Chr03] Christensen, Clayton M., *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. HarperBusiness Essentials, 2003.

[ChS99] Chalaby, Jean and Glen Segell, *The broadcasting media in the age of risk - The advent of digital television.* New Media & Society, vol. 1, No. 3, pp. 351—368, 1999.

[Cor04] Coral Consortium, *Entertainment, Technology and Consumer Electronics Leaders Unite for DRM Interoperability.* Press release, October 4, 2004, http://www.coral-interop.org/main/news/pr20041004.html

[CSA05a] CSA, *La télévision numérique terrestre*. http://www.csa.fr/themes/zoom/tnt/index.php

[CSA05b] CSA, TNT : *Sélection de 8 nouvelles chaînes. Press release*, May 9, 2005, http://www.csa.fr/actualite/communiques/communiques_detail.php?id=25563

[DVB05] DVB, *DVB Worldwide*, http://www.dvb.org/index.php?id=228

[EIC05] EICTA, *EICTA announces "Conditions for High Definition Labelling of Display Devices*. Press release, January 19, 2005, http://www.eicta.org/dls/logon/DBLogon.asp?URL=/Common/GetFile.asp?&logonname=guest&ID=9719&mfd=off

[eEU02] Commission of the European Communities, *eEurope 2005: an Information Society for All*, June 2002, http://europa.eu.int/information_society/eeurope/2002/news_library/documents/eeurope2005/eeurope2005_en.pdf

[Eut01] Eutelsat, *Eutelsat quarterly newsletter*. Issue 43, December 2001. http://www.eutelsat.com/news/pdf/newsletter/BusNews43.pdf

[Feh05] Fehervari, Gabriel, *Session 1 – Join the Party... or Miss the Boat.* 2nd European HDTV Summit, London, March 17, 2005, http://www.tvconferences.com/

[Fon05] Fontaine, Gilles, *ADSL, Cable, Satellite, DTT: and the winner is...*, IDATE, January 2005.

[FT04] France Télévisions Interactive, *Vif Succès de l'offre des Jeux Olympiques de proposé par France Télévisions sur le service de TV par ADSL de Free.* Press release, September 3, 2004, http://www.iliad.fr/actualites/CP_AudienceJO-04-TVADSL-Free-FTVI.pdf

[Fuj82] Fujio, Takashi, *High Definition Television.* NHK Technical monography, vol. 32, June 1982.

[Gla02] Gladwell, Malcom, *The Tipping Point – How Little Things Can Make a Big Difference.* Back Bay Books, 2002.

[GLW+01] Gillett, Sharon, William Lehr, John Wroclawski and David Clark, *The disruptive user - Internet appliances and the management of complexity.* BT Technology Journal, vol. 19, No. 4, October 2001, http://www.springerlink.com/link.asp?id=p44m360615819n47

[Goo05] Google, *Video Upload Program*. April 2005, https://upload.video.google.com/

[Gri03] Griffiths, Alan, *Digital Television Strategies – Business Challenges and Opportunities.* Palgrave Macmillan, 2003.

[Ham97] Hamel, Gary, *Killer Strategies that Make Shareholders Rich*. Fortune, June 23, 1997.

[Har05] Harrisson, David, *Ofcom – Regulating on-demand content over IPTV*. IP TV World Forum, London, March 8 & 9, 2005, http://www.iptv-forum.com/

[HDF05] HD Forum, *HD Forum – La télévision change de définition*, http://www.hdforum.fr/

[IDA05] IDATE, *Digiworld 2005 – The digital world's Challenges*, April 2005.

[Ili05] Iliad, *1st Quarter 2005 results.* May 3, 2005, http://www.iliad.fr/actualites/CP20050503_Eng.pdf

[Ins05] In-Stat, *High Definition TV Service Now in 10 Million Homes.* March 28, 2005, http://www.instat.com/press.asp?ID=1284&sku=IN0501899MB

[Ita05] Ministero delle comunicazioni, *Decoder digitale terrestre,* http://decoder.comunicazioni.it/

[JDN05] Le Journal du Net, *L'ADSL constitue un vrai relai de croissance pour TPS.* February 3, 2005, http://www.journaldunet.com/chat/retrans/050203_abihssira.shtml

[Jup04] Jupiter Research, *European Broadband Forecasts – 2003 to 2009,* June 11, 2004.

[Leh04] Lehman-Wilzig, Sam, *The natural life cycle of new media evolution - Inter-media struggle for survival in the Internet age.* New Media & Society vol. 6, no. 6, pp. 707—730, 2004.

[Les02] Lessig, Lawrence, *Free Culture – Lawrence Lessig Keynote from OSCON2002.* O'Reilly Network, San Diego, CA, July 24th 2002. http://www.oreillynet.com/pub/a/policy/2002/08/15/lessig.html

[Lig05] Light Reading, *Report: Europeans Want Triple Play*. February 24, 2005. http://www.lightreading.com/document.asp?doc_id=68798&site=lightreading

[LNR99] Ling, Rich, Siri Nilsen and Setphan Granhaug, *The domestication of video-on-demand.* New Media & Society, vol. 1, no. 1, pp. 83—100, 1999.

[LTW04] Létang, Vincent, Robert Taylor and Richard Womersley, *Implementation of wide-screen and high-definition television in the context of digital broadcasting.* Eurostratégies, December 2004.

[Luh03] Shin Luh, Shu, *Business the Sony Way: Secrets of the World's Most Innovative Electronics Giant*. John Wiley & Sons, 2003.

[Med05] Médiamétrie, *MediaCabSat Analysis*. March 2005. http://www.mediametrie.fr/resultats.php?rubrique=tv&resultat_id=112

[Mic98] Microsoft, *Microsoft and THOMSON Multimedia to Work Together on Interactive TV.* Press release, July 30, 1998, http://www.microsoft.com/presspass/features/1998/7-30thomson.asp

[Moo99] Moore, Geoffrey A., *Crossing the Chasm*. HarperCollins Publishers, 1999.

[Moo04a] Moore, Geoffrey A., *Inside the Tornado.* HarperCollins Publishers, 2004.

[Moo04b] Moore, Geoffrey A., *Core & Context – Enabling Innovation and Overcoming Inertia within Established Enterprises*. ICT Entrepreneurship, Stockholm School of Entrepreneurship, Stockholm, October 2004.

[Nath99] Nathan, John, *Sony: The Private Life*. Houghton Mifflin, 1999.

[NPA05] NPA Conseil, *L'arrivée de la TVHD en France, Opportunités Economiques pour les acteurs et scénarios d'introduction.* January 2005, http://lesrapports.ladocumentationfrancaise.fr/BRP/054000039/0000.pdf

[Pap02] Papathanassopoulos, Stylianos, *European Television in the Digital Age*. Polity Press, 2002.

[Reu05] Reuters, *300.000 adaptateurs TNT on été vendus*. April 21, 2005. http://www.reuters.fr/locales/c_newsArticle.jsp?type=techNews&localeKey=fr_FR&storyID=8250042

[Ric03] Richardson, Iain E. G., *H.264 and MPEG-4 Video Compression: Video Coding for Next-generation Multimedia*. John Wiley & Sons, 2003.

[Sag04] Sagem, *Creation of the HD FORUM to promote high definition in France*. Press release, July 8, 2004, http://www.companynewsgroup.com/communique.asp?co_id=90015

[Som05] Somers Marnix, *HD comes Home – ready when you are*. 2nd European HDTV Summit, London, March 17, 2005. http://www.tvconferences.com/

[Tel05] Tellier, Francis, *The Winning Goal – HDTV and the 2006 FIFA World Cup™*. Revue de l'Electricité et de l'Electronique (REE), Hors Série spécial HD, 2005.

[TBP01] Tidd, Joe, John Bessant and Keith Pavitt, *Managing Innovation.* John Wiley and Sons, July 2001.

[TDF05] TDF, *La TNT en quelques dates*. March 2005, http://www.tdf.fr/filemanager/download/347/

[TNT05] Groupement Télévision Numérique pour Tous, *La TNT, La Télévision Numérique pour Tous,* http://www.tnt-gratuite.fr/

[Vat04] Vatsos, Vassilios, *Broadband & Network Business Expansion.* Zilele Biz Romania, Bucarest, October 21, 2004. http://www.zilelebiz.bizcity.ro/images/upload/prezentari/Seminar.ppt

[WaB87] Watson Brown, Adam, *The Campaign for High Definition Television: A Case Study in Triad Power.* Euro-Asian Business Review, vol. 6, no. 2, April 1987.

A Glossary

Following are definitions and general explanations of the various acronyms and technical terms appearing in this thesis.

ADSL: Asynchronous Synchronous Digital Subscriber Line
A form of digital connection over the copper wire of the telephone network. It achieves higher throughput than conventional analog modems by making use of the frequency spectrum unused for voice communication. Advanced modulation techniques have also enabled an increase of the bandwidth: from 1.5Mbps with "ADSL Light" (ITU G.992.2 standard), to 8Mbps for standard ADSL (ITU G.992.1 standard) up to 24Mbps with the newer ADSL2+ evolution (ITU G.992.5 standard), through the use of an ADSL modem.

AGCOM: Autorità per le Garanzie nelle Communicazioni (http://www.agcom.it/)
Italian broadcasting regulation body.

ALM: Arbeitsgememeinschaft der Landesmedienanstalten (http://www.alm.de/)
German broadcasting regulation body.

ARPU: Average Revenue Per User
A fundamental indicator to asses the value and profitability of a service or an application, as well as to compare it with the industry's average.

ART: Autorité de Régulation des Télécommunications (http://www.art-telecom.fr/)
The French government body in charge of the regulation of the telecommunications sector.

AVC: Advanced Video Coding
Alternative naming for the H.264 or MPEG-4 / Part 10 video coding standard.

BD: Blu-ray Disc (http://www.bluraydisc.com/)

CD: Compact Disc
The standard Compact Disc ("Red Book") was jointly developed by Sony and Philips starting in 1979 and reached the commercial market in 1983 as the first purely digital packaged media for multimedia content.

CES: Consumer Electronics Show
An annual show, held each January in Las Vegas, and one of the central gathering point for the consumer electronics, as well as for the announcement of new products.

CMT: Comisión del Mercado de las Telecommunicaciones (http://www.cmt.es/)
Spanish broadcasting regulation body.

Codec: COmpression / DECompression (or enCOding / DECoding)

A set of techniques for performing transformations on stream or digital signal, in order to make encode, compress and properly package the raw digital data in a form compatible for its further transport, broadcast or use.

CSA: Conseil Supérieur de l'Audiovisuel (http://www.csa.fr/)
French broadcasting regulation body.

DRM: Digital Rights Management

DSLAM: Digital Subscriber Line Access Multiplexer
The first equipment on which each subscriber's copper-line is connected. It forms the basic node for the connection to an ISP's backbone network, and is the central point in which the LLU process is managed.

DVB: Digital Video Broadcasting (http://www.dvb.org/)

DVD: Digital Versatile Disc (http://www.dvdforum.org/)
The optical disc format that has enabled since 1996 the packaged distribution of video content, using MPEG-2 as its default codec. The DVD standard is currently showing its limits with the commercial launch of HD.

DLNA: Digital Living Network Alliance (http://www.dlna.org/)

DTT: Digital Terrestrial Television

DVI: Digital Video Interface (http://www.ddwg.org/)
Video connector format that enables both analog and digital transmission options on the same connector. It has gained widespread usage in the computer world, and is now appearing in consumer A/V equipments. DVI can be fitted with HDCP.

EBU: European Broadcasting Union (http://www.ebu.ch/)

EPRA: European Platform of Regulatory Authorities (http://www.epra.org/)

FCC: Federal Communications Commission (http://www.fcc.gov/)

FTTH: Fiber To The Home (http://www.ftthcouncil.org/)
Using optical fiber network up onto the consumer's premise is the next step in the broadband evolution, and is a technique already commercially deployed in Japan, Korea and Hong-Kong for reaching up to 1Gbps downstream.

GUI: Graphical User Interface

HD: High-Definition

HDD: Hard-Disk Drive

HDCP: High-bandwidth Digital Content Protection (http://www.digital-cp.com/)
A form of DRM originally developed by Intel as a proprietary standard, which has been licensed and adopter by the consumer electronics industry for the protection of HD content within the digital home environment.

HDMI: High-Definition Multimedia Interface (http://www.hdmi.org/)
An uncompressed and all digital interface for transporting audio and video signal in HD. It natively supports HD and has the support of most motion picture producers as well as payTV operators.

IEC: International Engineering Consortium (http://www.iec.org/)

ISO: International Organization for Standardization (http://www.iso.org/)

ICT: Information and Communication Technology

IEEE1394: Also known as i.LINK and FireWire

ILEC: Incumbent Local Exchange Carrier
The "historic" local telephone company operating the local loop as a monopoly before the opening to the competition which occurred in the late 90s in Europe.

IP: Internet Protocol
Data-oriented communication protocol used as one of the technical building blocks of the Internet and an essential part of modern internetwoking systems.

ISP: Internet Service Provider

LCD: Liquid Crystal Display

LLU: Local Loop Unbundling
The process in which the last part of the copper-line infrastructure, from a subscriber's house to the local connection point to the network (DSLAM) is opened for usage by alternative ISPs instead of being kept the sole property of the ILEC. LLU in Europe has been a reality since 2001, and countries like France now have over 40% of unbundled ADSL lines.

Mbps: Megabit per second

MPEG: Moving Picture Experts Group

NTSC: National Television System(s) Committee
The analog broadcast TV color system used in the USA, Canada and Japan as well as several parts of southern America and Asia.

P2P: Peer to Peer

PAL: Phase Alternation Line

The analog broadcast TV color system used in most parts of Europe, Asia and Africa.

SCART: Syndicat des Constructeurs d'Appareils Radiorécepteurs et Téléviseurs
Also known as Péritel and Euroconnect, it is a standard for the analog transport of video between home equipments such as TV sets, STB and DVD players/recorders.

SECAM: SÉquentiel Couleur Avec Mémoire
The analog broadcast TV color system first used in France as well as in eastern Europe and in parts of Africa.

S/PDIF: Sony/Philips Digital Interface Format

STB: Set-Top Box

SWOT: Strengths, Weaknesses, Opportunities and Threats

TNT: Télévision Numérique Terrestre (http://www.tnt-gratuite.fr/)
This is the French acronym for designating DTT. Can also mean "Télévision Numérique pour Tous" (Digital Television for All)

USB: Universal Serial Bus

VC-1: Video Codec 1
The proposed name for the yet-to-be standardized version of the codec part of the Windows Media technology suite.

VoD: Video on Demand

VoIP: Voice over IP

YUV
Color space model used in the PAL system, which represents colors using one luminance ("Y") and two chrominance ("U" and "V") components.

Wi-Fi: Wireless Fidelity
Also known as the IEEE 802.11 family of standards for wireless networking.

B Technology Overview

B.1 Digital compression

In parallel with the generalized and continuous bandwidth increase of the digital TV platforms, an essential technical parameter for the wide scale deployment of digital audio-video, now in High Definition, lies in the decade-long performance enhancements made to digital compression techniques, *i.e.* to transmit at a lower bitrate while keeping the perceive quality of the content.

The basic concept behind modern *lossy* codecs used in digital video broadcasting is to remove the subjective redundancy from the original, uncompressed signal, *i.e.* the components that are not necessary for the faithful reproduction of the data. It involves taking into account how audio and video content are perceived by the human viewers and listeners, as well as understanding the subjective criteria for quality. In the case of video, a codec mainly works on three sides:

- Spatial redundancy – making use of the similarities between different areas of the same fixed image.
- Temporal redundancy – modeling motion and animation to reduce the overhead in successive frames.
- Statistical ("entropic") encoding – having an efficient way of representing the data to minimize the amount to send.

This is of course a very general overview of the internal workings of a digital encoder (and its inversed counterpart on the reception side – the decoder): as already mentioned in3.2.1, international working groups, most notably the MPEG and the ITU, have been standardizing successive improvements over MPEG-1 since 1992. While MPEG-2 has been massively adopted as the *de facto* standard for digital video compression in the 90s, the actual codec performance have dramatically evolved from the first generation encoders in 1995 to the current newer generations that incorporate additional compression techniques backported from the MPEG-4 set of standards. As shown in Figure B.1, a video sequence that output over 7Mbps with first generation MPEG-2 encoders can now be stripped down to nearly 2Mbps today at the same quality level.

It should however be noted that the progress margin of MPEG-2 is today almost non-existent, whereas MPEG-4, as a completely updated codec, has several areas in which actual implementation improvements will further increase its performance. This is especially important for High Definition encoding, as the ability to deliver it on the four digital platforms is directly dependant on the compression efficiency. As detailed in Table B.1, there is a substantial progress margin for real-time HD encoders, whose first generation is scheduled to begin mass production in September 2005. As a result, the operators' target of achieving 6 to 8Mbps for HD is bound to be a reality in late 2006.

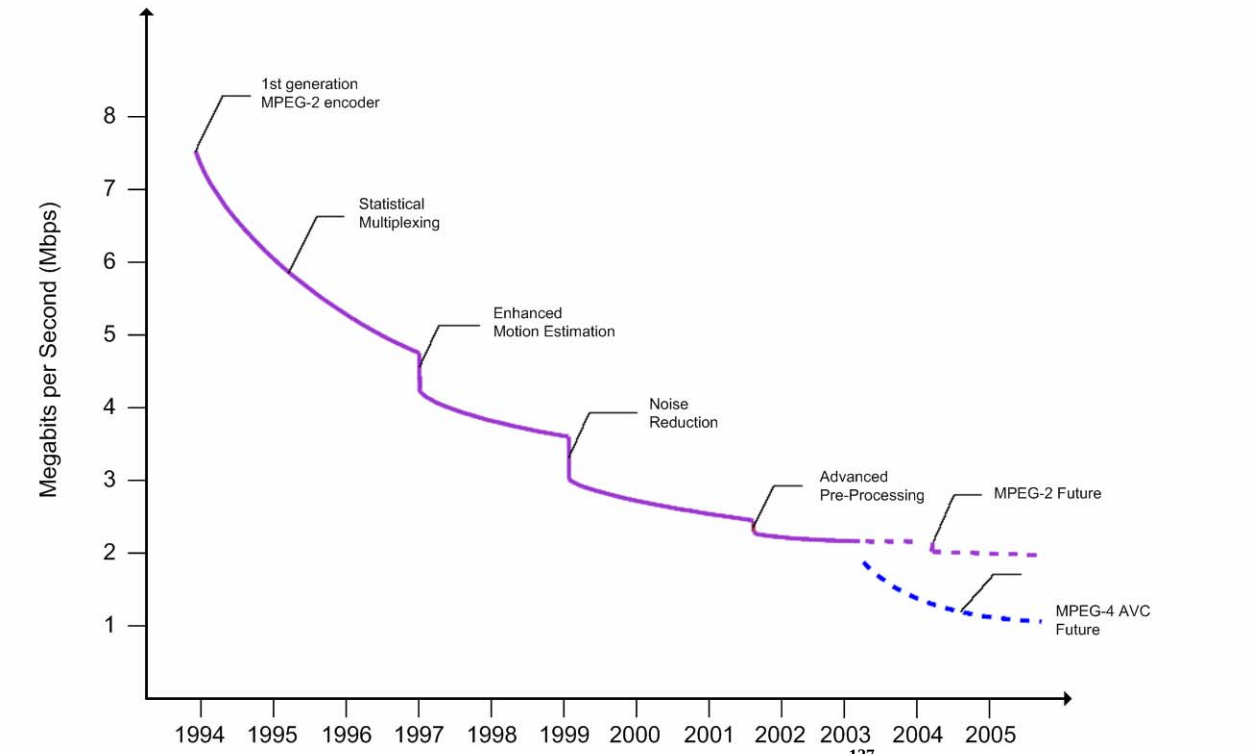

Figure B.1 MPEG performance evolution[127]

	September 2005	2nd Half 2006	2nd Half 2007
MPEG-2 HD	12 - 18 Mbps	12 - 18 Mbps	12 - 18 Mbps
MPEG-4 HD	8.4 - 12.6 Mbps	6 - 9 Mbps	5 - 7.6 Mbps
MPEG-4 Gain	30%	50%	58%

Table B.1 Performance evolution of real-time HD encoders[128]

B.2 High Definition

B.2.1 Picture Formats

As we saw in 0, High Definition is the technological evolution of an increase in picture quality through a finer resolution in the video signals produced, transmitted and displayed. In order to understand the strategic stakes and evolutions of the market, it is important to be aware of the technical background behind the issue of the European standardization of HD.

Generally speaking, a television image is defined first of all by its vertical resolution, *i.e.* the number of horizontal lines that compose each still image. A summary of the commercially used resolutions is given in the following figure.

[127] Data source: Tandberg.
[128] Data source: Thomson.

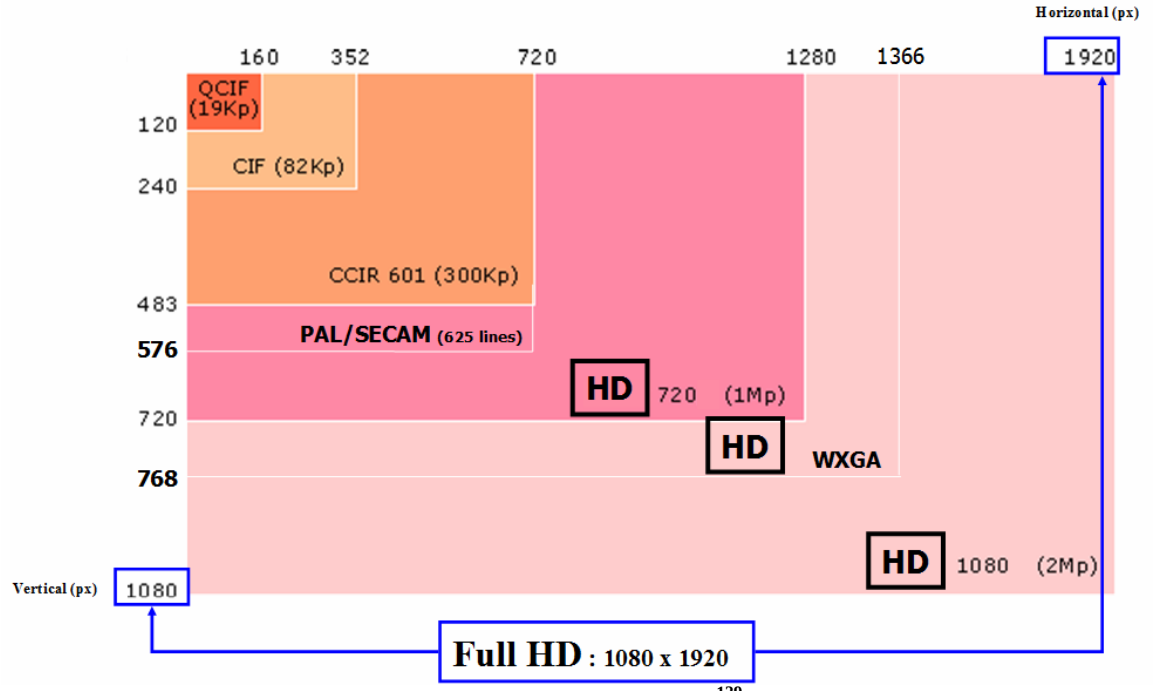

Figure B.2 HD Resolutions[129]

While the Standard Definition PAL has 576 lines (625 lines for French SECAM), two main image resolutions currently exist for HD, as shown in Figure B.2: 768 and 1080 lines.

In addition to the actual image resolution, the second parameter involved is the way the animated video signal is constructed, based on the still images. Here again, two methods coexist, as shown in Figure B.3:

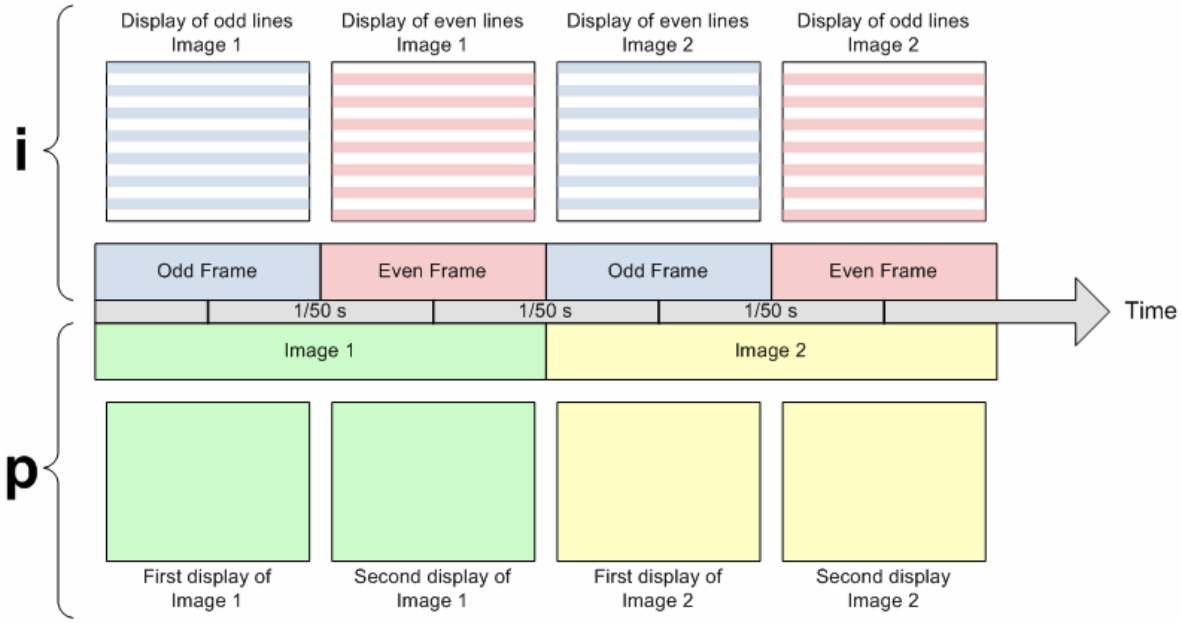

Figure B.3 Interlaced and Progressive formats

[129] Data source: Sony.

- Interlaced – Half the lines of the video signal are displayed on the screen alternatively – first the odd-numbered lines and then the even-numbered lines, with each display lasting for 1/50th of a second.

- Progressive – All the lines are displayed each time.

Interlaced is the traditional method broadcast image have been made, while progressive scan is a more recent technology, necessitating twice the bandwidth at the same resolution. However, progressive scanning tends to produce a superior transcription of movement, with lower flickering and blurring.

As a direct consequence of those parameters, only two HD resolutions are currently technically feasible and commercially used:

- 720p50 – 720 x 1280 lines (921600 pixels), progressive scan, 50 images / second.

- 1080i25 – 1080 x 1920 lines (2073600 pixels), interlaced scan, 25 images / second.

While 1080p50 would be the ideal standard, its bandwidth requirements (twice that of 1080i) make it unrealistic for the time being, especially as HD is aiming at entering the four digital platforms in the near future.

B.2.2 Connectivity

The “HD-Ready” label explicitly refers to the inputs to be present on the display panel in order for it to be connected to the HD STB. As of today, three types of consumer connection types can transmit HD signal:

- YUV (also known as “YPbPr”) – this is an analog connectivity type, already present on most higher-end SD display panels for several years.

- DVI (Digital Video Interface) – DVI comes from the IT world, where it has been widely adopted as the digital replacement to the analog computer display connectivity.

- HDMI (High Definition Multimedia Interface) – Nicknamed “the SCART for the HD world”, it was standardized two years ago by a cross-industry organization. Compared to DVI, HDMI is able to transmit both video and audio signal, and has a higher total bandwidth.

A key characteristic of the two digital connections formats – DVI and HDMI, is to be embeddable with a copy-protection method specifically designed for the protection of HD content: HDCP (High Definition Content Protection). This technology, originally coming from

Intel, has become a *de facto* standard and has been approved by the major labels has a suitable protection scheme. Its general concept is to ensure mutual authentication between the consumer devices manipulating HD signals (HD STB, HD display panel, HD Personal Video Recorder...), to grant flexible rights ("Copy Once", "Never Copy", "Multiple Copy"...), as well as to enable hacked devices to be blacklisted.

In summary, the different connection cases between an HD STB and a TV set are summarized in Figure B.4.

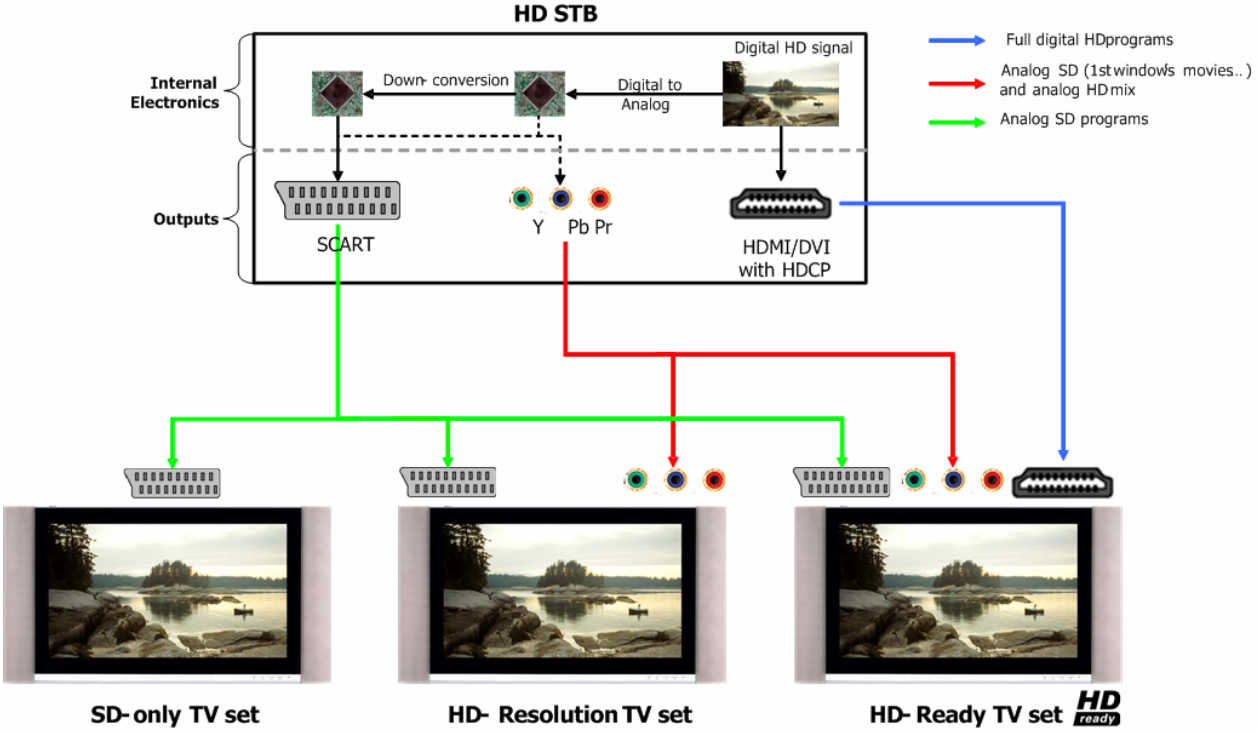

Figure B.4 TV-STB HD Connectivity

B.3 IP TV

The basis of an IP TV digital platform is the use the existing copper-line infrastructure built-up by ISPs to transport TV streams in addition to voice and data content. An overview of the general architecture is given in Figure B.5 below, with the key components as follow:

- Local Loop & Digital Home – Thanks to the Local Loop Unbundling (LLU), the "last-mile" of copper-line infrastructure (from the DSLAM to the subscriber's house) represents the key element for the local distribution of IP TV content. In order to keep the bandwidth usage at a manageable level, the TV content is *multicast* from a DSLAM to all its connected houses, thereby sending a single stream on the last-mile network and therefore avoiding the bandwidth bottlenecks due to multiple subscribers watching TV simultaneously. In the case of Video on Demand, the content has to be sent specifically for each subscriber, and it is therefore a *unicast* stream.

- ISP Backbone Network – The DSLAMs are the local connection points on which the ISP's backbone network (national and international fiber network interconnected at the major European Local Exchange points) is connected.

- Content Provisioning – Whether in a centralized (as pictured below) or a partially decentralized way (with the content mirrored at local level), IP TV content streaming is done in conjunction with the management of the subscriber's STB (Billing, Portal & Interface) as well as the digital protection of the streamed content (through a suitable DRM mechanism). While some content is packaged internally at the ISP level, other TV feeds and multimedia content can be packaged by an external content provider and sent on the same platform (*cf.* the exemple of European satellite payTV operators like TPS and BSkyB making their content available on ADSL platforms).

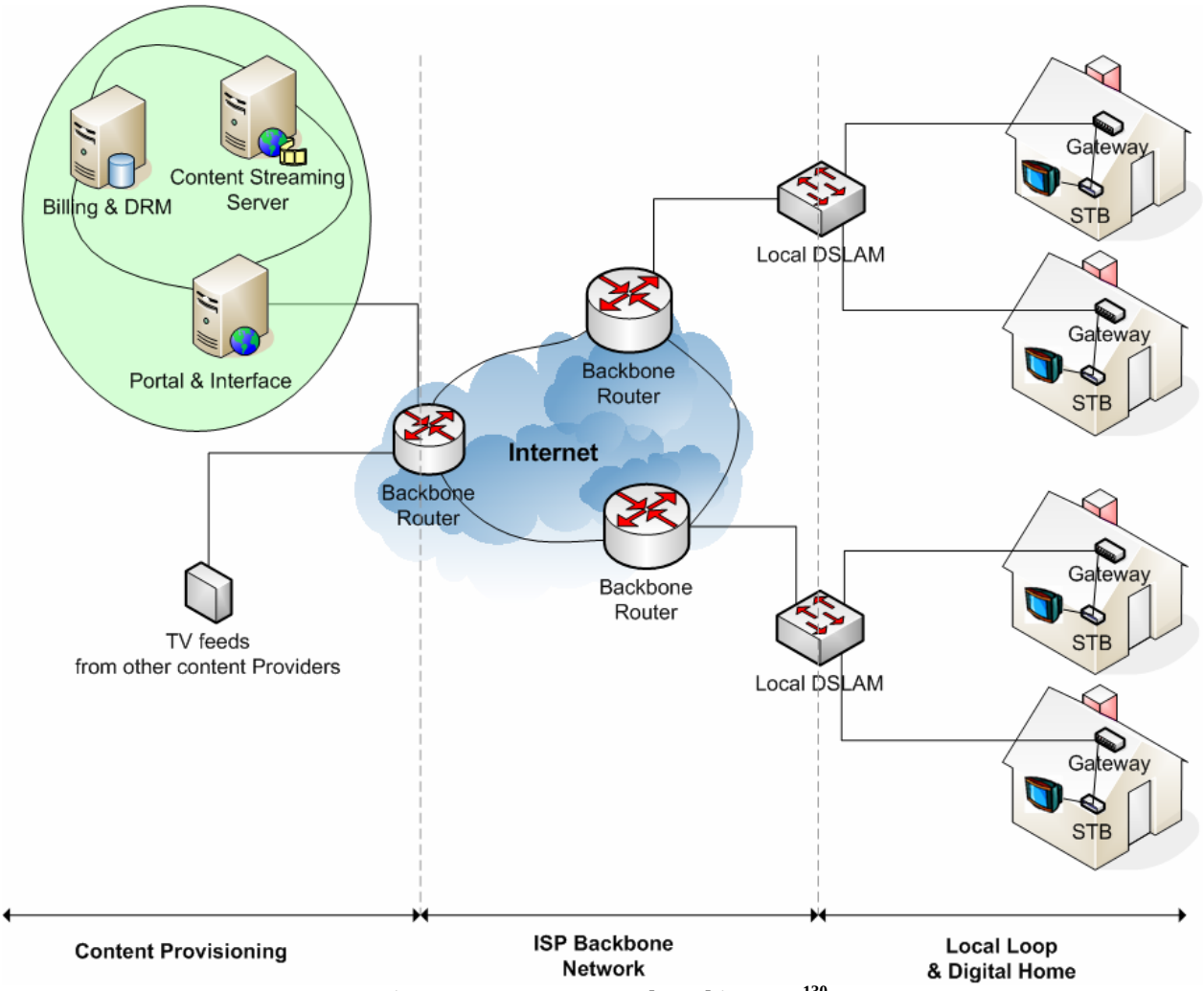

Figure B.5 IP TV network architecture[130]

[130] Adapted from [3Pl04] Team 3Play, *Kista IP Triple Play – Final Report*. Communication Systems Design 2004, KTH, Stockholm, May 14, 2004, http://csd.ssvl.kth.se/~csd2004-team15/reports/3p_doc_fr_1.0.pdf

In summary, IP TV differentiates itself from the common (and often PC-based) “TV over the Internet” in the sense that is mixes the use of an open infrastructure (copper-line) with a closed network usage (the TV content does not flow freely out in the Internet, but is kept within the ISP’s “walled garden”, as detailed previously in Figure 4.7.

C Key European Data and Players

This appendix gives a snapshot of the current market segmentation for digital TV. The figures and forecasts were built using research results from Strategy Analytics and Datamonitor, as well as ongoing investigation and analysis of the countries' markets.

C.1 France

C.1.1 Demographics and digital TV figures

- TV Households: 23.6 million (third largest TV market in Europe)
- Switch-off: between 2010 and 2015.

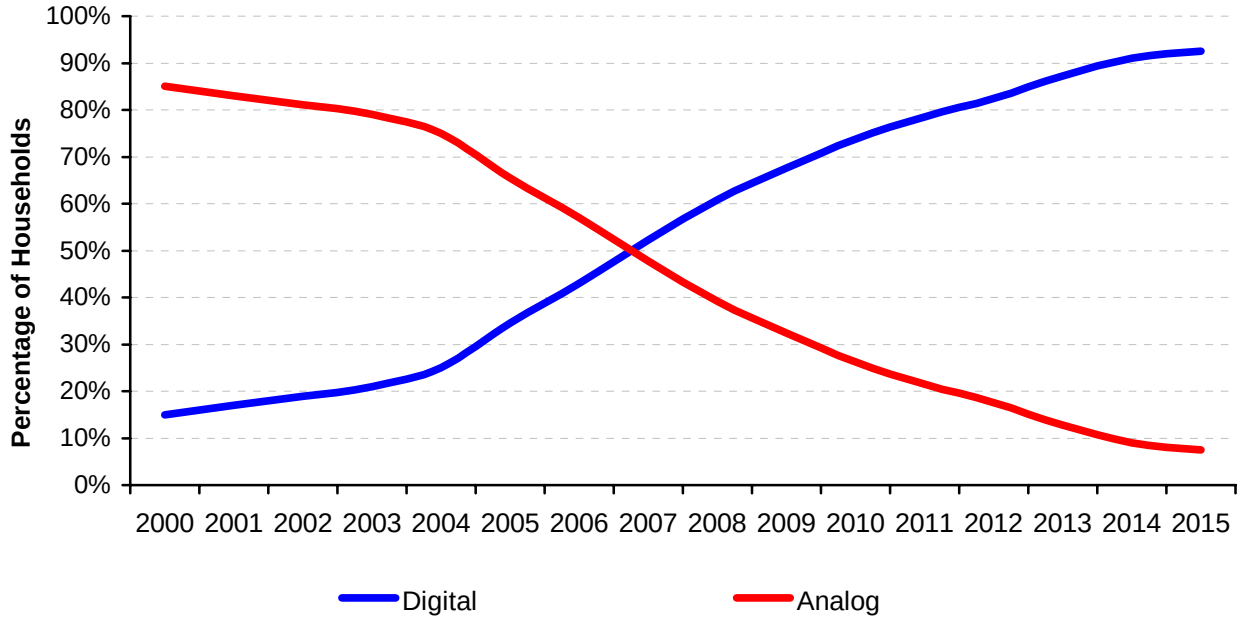

Figure C.1 Digital vs. Analog - France

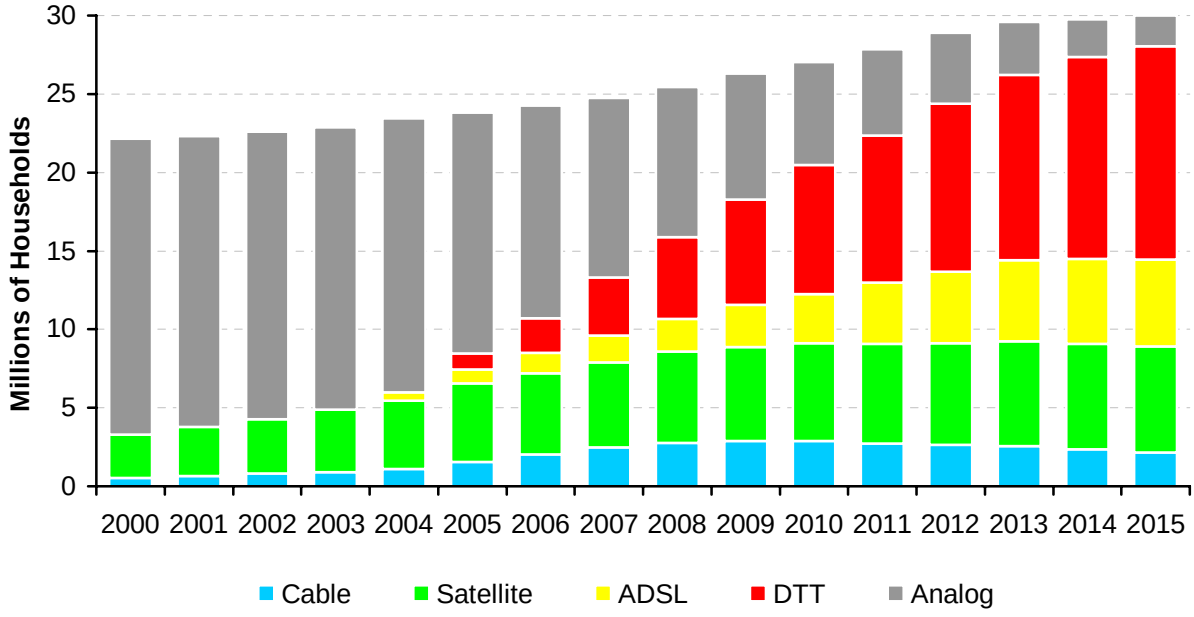

Figure C.2 Digital Platform Segmentation - France

C.1.2 Digital Platforms

- **Cable** – In early 2004, major consolidations happened in the French cable market, as Noos and UPC on one side, and France Télécom Câble and NC Numéricâble on the other merged their cable assets to form two major national cable providers.

    - Noos – http://www.noos.fr/ Started analog cable operations in 1986 and began offering digital cable television in major French cities in 1997. In 2002, Noos launched its multi-service offers on cable, featuring digital TV, broadband Internet access and telephony.

    - UPC – http://www.upcfrance.com/ Part of the UnitedGlobalCom group, UPC France consists of smaller cable operators acquired over the year and unified over a single channel package offer.

    - NC Numéricâble – http://www.ncnumericable.fr/ Majority owned by the Canal+ group since 1997, its service has been entirely digitized since 1996. Despite this, it has been slower at actually upgrading its subscriber base to digital services.

    - France Télécom Câble – Differentiates itself from the over cable providers by providing the entire Canalsatellite and TPS bouquets on its network. Following the merger with NC Numéricâble in 2004, parent group France Télécom almost completely withdrew its interest from cable television, focusing on the then emerging IP TV segment.

- **Satellite** – France was the first country with digital satellite in he forms of Canalsatellite in 1996. Since then, the country has again distringuished itself as being the only European country with two strong satellite players.

    - Canalsatellite – http://www.canalsatellite.fr/ The largest satellite provider, with over 3 million subscribers at the end of 2004. It has announced the launch of HD services for October 2004, and the bouquets are also available on IP TV, through premium subscriptions on Free, France Télécom and neuf Télécom.

    - TPS – http://www.tps.fr/ The second mover in the French market in December 1996, and a joint venture between the two leading national private channels in France – TF1 (66%) and M6 (34%), TPS had a subscriber base of 1.3 million at the end of 2004, and is positioning itself as a very aggressive player on HD, with offers announced for as early as September 2005. The bouquets are also available on IP TV, through premium subscriptions on France Télécom, and neuf Télécom later this year.

- **DTT** – As detailed in 4.1.3, French DTT was officially launched on March 31st 2005. At the moment of writing, only 14 free-to-air channels are proposed, and payTV channels as well as additional free-to-air channels are scheduled for September 2005.

- **IP TV** – France is by far the European country with the largest deployment of IP TV and with the broadest choice in terms of ISPs carrying IP TV services.

    - Free – http://www.free.fr/ France's second largest ADSL ISP with over 1 millions lines at the end of 2004. As detailed in section 4.2.4, Free has opted for an integrated "Triple-Play" approach with a single consumer device. It was also the first ISP in Europe to commercially launch ADSL2+ offers in unbundled areas.

    - France Télécom – http://www.malignetv.fr/ France Télécom has chosen to split the different services: the IP TV offer, called "MaLigne TV", is separate from broadband and Voice over IP subscriptions. It had over 120 thousand customers in March 2005.

    - neuf Télécom – http://www.neuf.com/ neuf Télécom launched its IP TV offer in November 2004, with a STB integrating also a DTT decoder, effectively making it a cross platform device.

    - Club-Internet – http://www.club-internet.fr/ The French subsidiary of Germany's T-Online, it offer for the moment only a PC-based IP TV offer, but has announced moves to a full-blown TV offer for later this year.

    - Cegetel – http://www.cegetel.fr/ Part of the Vivendi Universal group, it has announced the launch of IP TV service in High Definition for October 2005. In May 2005, Cegetel announced its intention to merge with neuf Télécom to create a new operator, neuf Cegetel.

C.2 Germany

C.2.1 Demographics and digital TV figures

- TV Households: 37.8 million (largest TV market in Europe)
- Switch-off: decided by each länder; final switch-off planned for 2010.

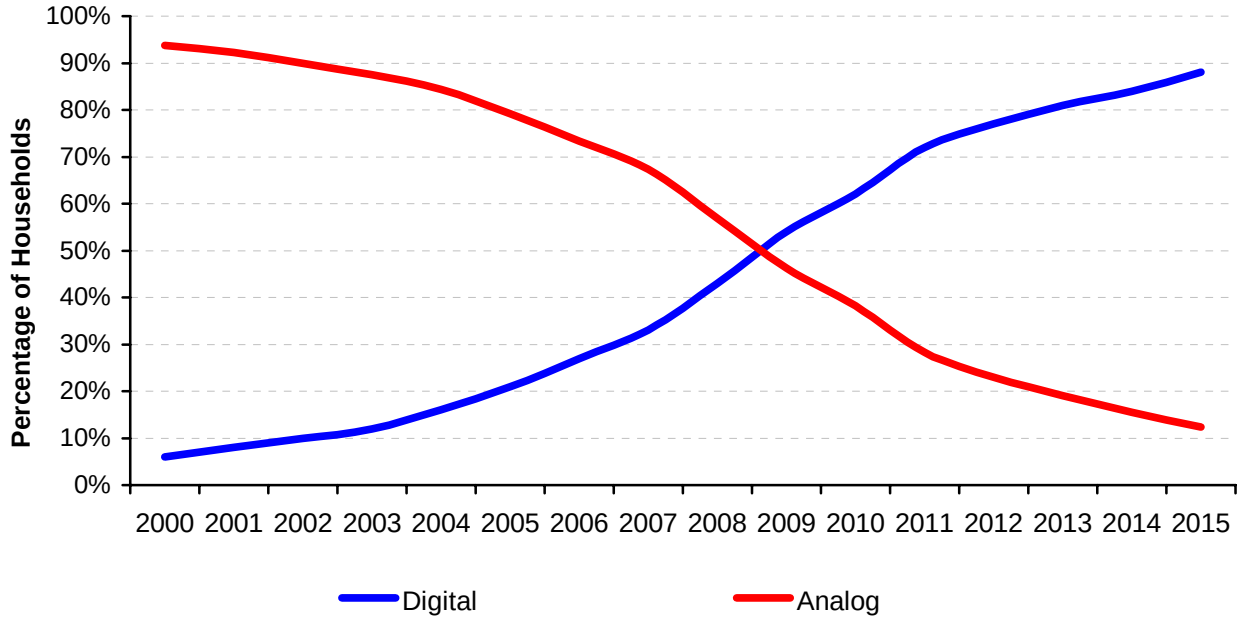

Figure C.3 Digital vs. Analog - Germany

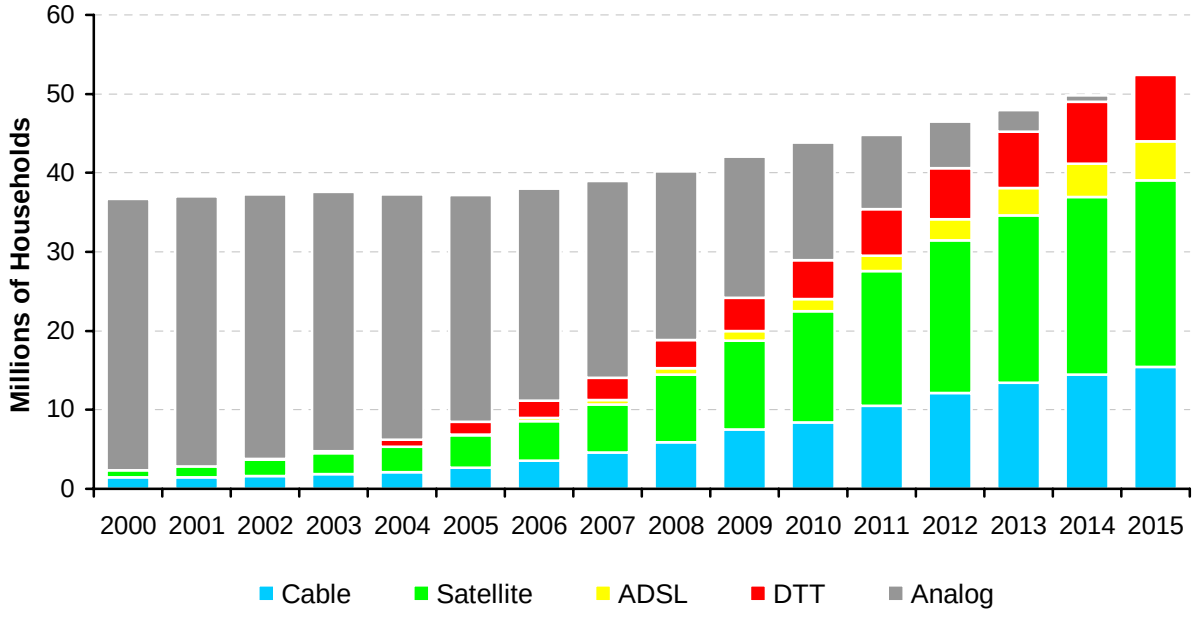

Figure C.4 Digital Platform Segmentation - Germany

C.2.2 Digital Platforms

- **Cable** – More than any other country in Europe, Germany had adopted cable as its main analog network. With the ongoing transition to digital, the cable industry has again complexified itself, and following are only the largest "Network Level 3" cable providers, *i.e.* the ones with local distribution networks.

    - Kabel Deutschland – http://www.kabeldeutschland.de/ Started offering digital cable in August 2002.

    - Ish – http://www.ish.de/ Formerly the cable arm of incumbent operator Deutsche Telekom, it has started to offer digital TV services in November 2003.
    - Regional cable providers

- **Satellite** – The main multi-channel satellite operator is Premiere (http://www.premiere.de/). Historically part of the Kirch media group, it went through a serious financial crisis in 2002. After the switchover to digital completed in 2003, it regained stability, with now over 3 million subscribers. Premiere has also announced the launch of an HD offer consisting of three channels before the end of the year.

- **DTT** – The initiative for the development of DTT was started by the federal government in 1998 as a number of "digital islands" in densely-populated areas. The actual coverage multiplex structure are left up to each länder.

- **IP TV** – Deutsche Telekom's ADSL branch, T-Online, launched in early 2004 its VoD platform, T-Vision (http://www.t-vision.tv/). It has currently no plans to offer live television programs.

C.3 Spain

C.3.1 Demographics and digital TV figures

- TV Households: 12.7 million
- Switch-off: targeted for 2011.

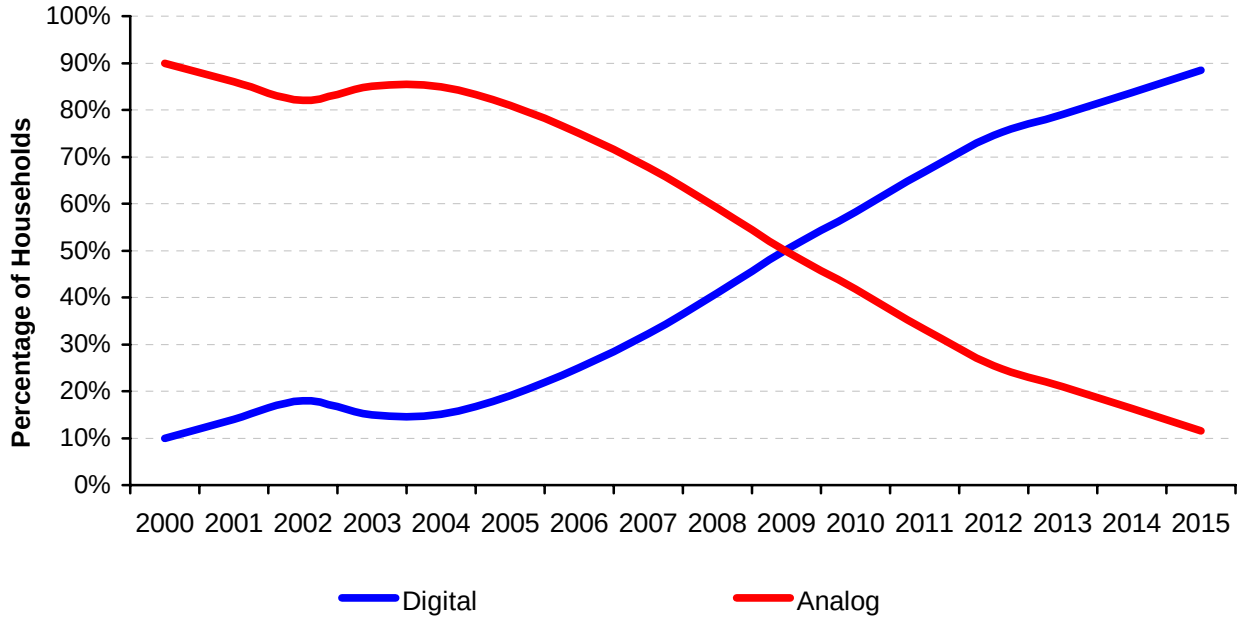

Figure C.5 Digital vs. Analog - Spain

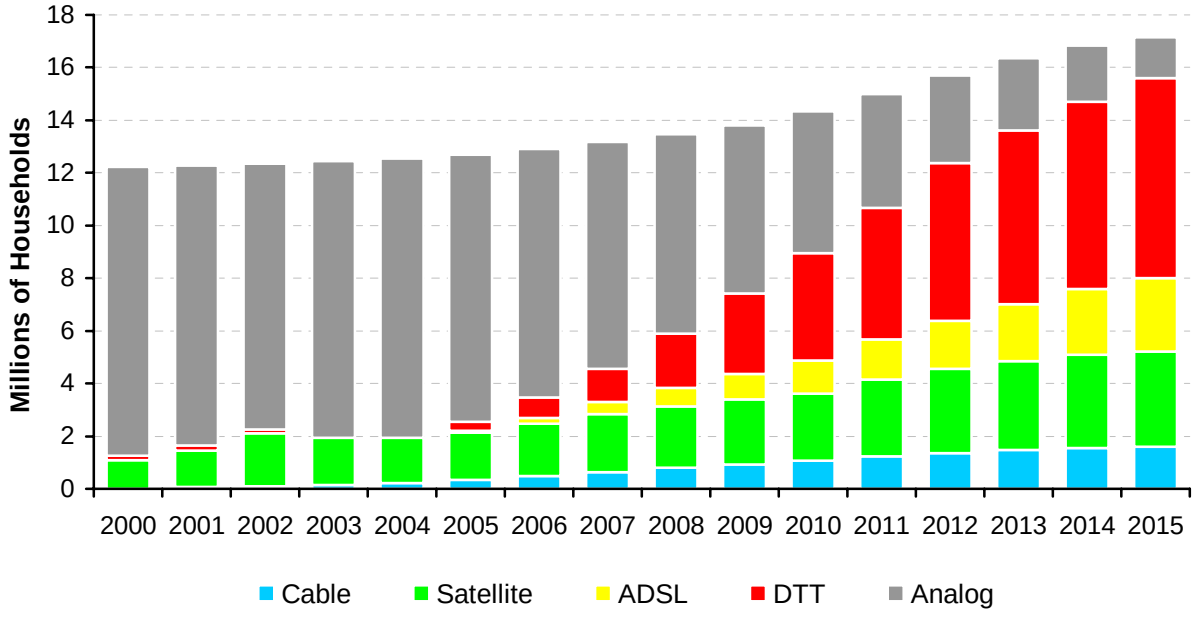

Figure C.6 Digital Platform Segmentation – Spain

C.3.2 Digital Platforms

- **Cable**

    - Ono – http://www.ono.es/ After being handed over to a group of investor companies, Ono launched digital services in June 2003.

    - Auna – http://www.auna.es/ The concatenation of six distinct cable networks all over Spain, it has been operating digital TV services since March 2003.

- **Satellite** – Until 2003, Spain had two major satellite operators, Canalsatellite Digital and Via Digital. The two merged in 2003 and a unified offer was launched under the brand Digital+ (http://www.plus.es/). The complex unification of the technical platforms and customer services entailed an important churn until the end of 2004, as it can be seen in Figure C.5. Digital+ has no announced plan for HD.

- **DTT –** DTT was launched in May 2000, making Spain the third European country to make the move to digital terrestrial. However, it led to a commercial failure and the service was effectively shut down in 2002. It is currently being pushed again by the government, with a recent decision of allocating three multiplexes to DTT.

- **IP TV** – In early 2004, Spanish incumbent Telefónica launched Imagenio (http://www.telefonica.es/tol/imagenio.html), an IP TV service clearly distinct from the actual broadband subscription. Regulatory issues by the CMT over the legality of the bundling of such a digital service have made its future uncertain.

C.4 Italy

C.4.1 Demographics and digital TV figures

- TV Households: 21.9 million.
- Switch-off: initially planned for 2006, although now appears unrealistic.

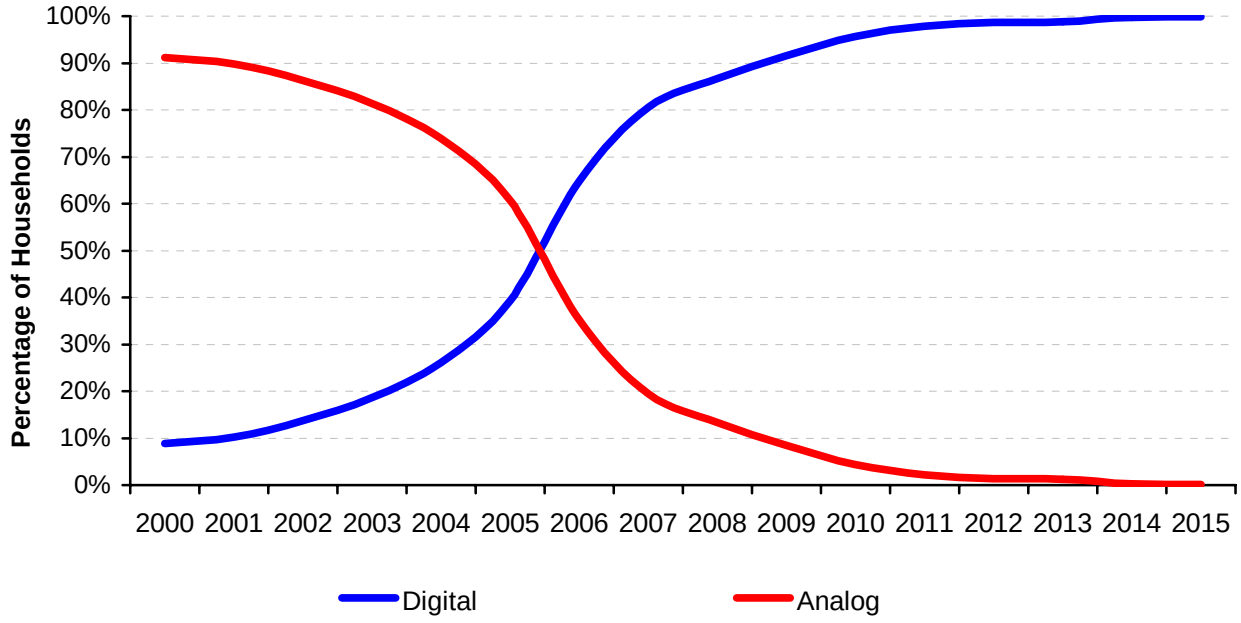

Figure C.7 Digital vs. Analog -Italy

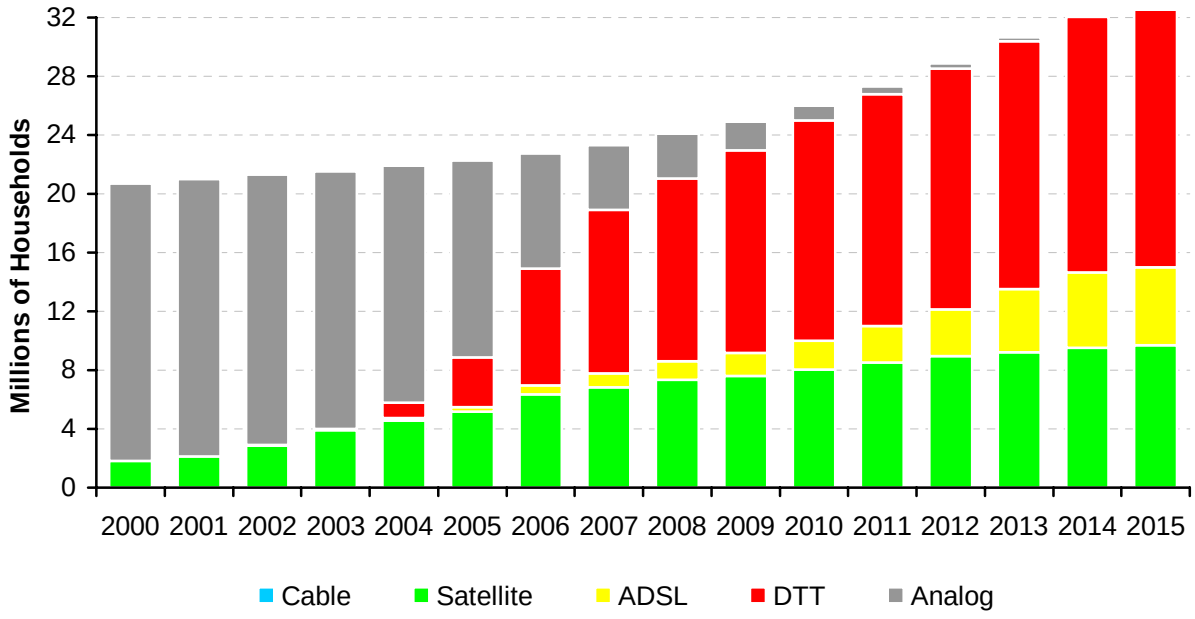

Figure C.8 Digital Platform Segmentation - Italy

C.4.2 Digital Platforms

- **Cable** – Cable television is almost inexistent in Italy, with the move by Telecom Italia to build a digital network being abandoned due to poor customer response.

- **Satellite** – The result of the merger between Stream and Telepiù in 2003, Sky Italia (http://www.skytv.it/) was launched in July 2003 as Italy's digital satellite television platform. A Whole subsidiary of New Corporation, its bouquets are also made available on IP TV, through Fastweb's offer.

- **DTT –** Italy has a very strong analog terrestrial user base. Hence the importance of a successful transition to digital. The first multiplexes went on air in late 2003, with interactivity features being especially stressed upon. In order to boost the transition to DTT, the Italian government is heavily subsidizing STBs[131].

- **IP TV –** Using both its ADSL infrastructure and Fiber To The Home (FTTH) backbone, Fastweb (http://www.fastweb.it/) began to offer VoD in 2001. Now it offers a Triple Play package similar in its structure to Free's in France.

[131] [Ita05] Ministero delle comunicazioni, *Decoder digitale terrestre*, http://decoder.comunicazioni.it/

C.5 United Kingdom

C.5.1 Demographics and digital TV figures

- TV Households: 24.7 million, and one of the largest digital STB market in the world.
- Switch-off: 2010, with UK being the only large European country to have achieved full switchover in 2015.

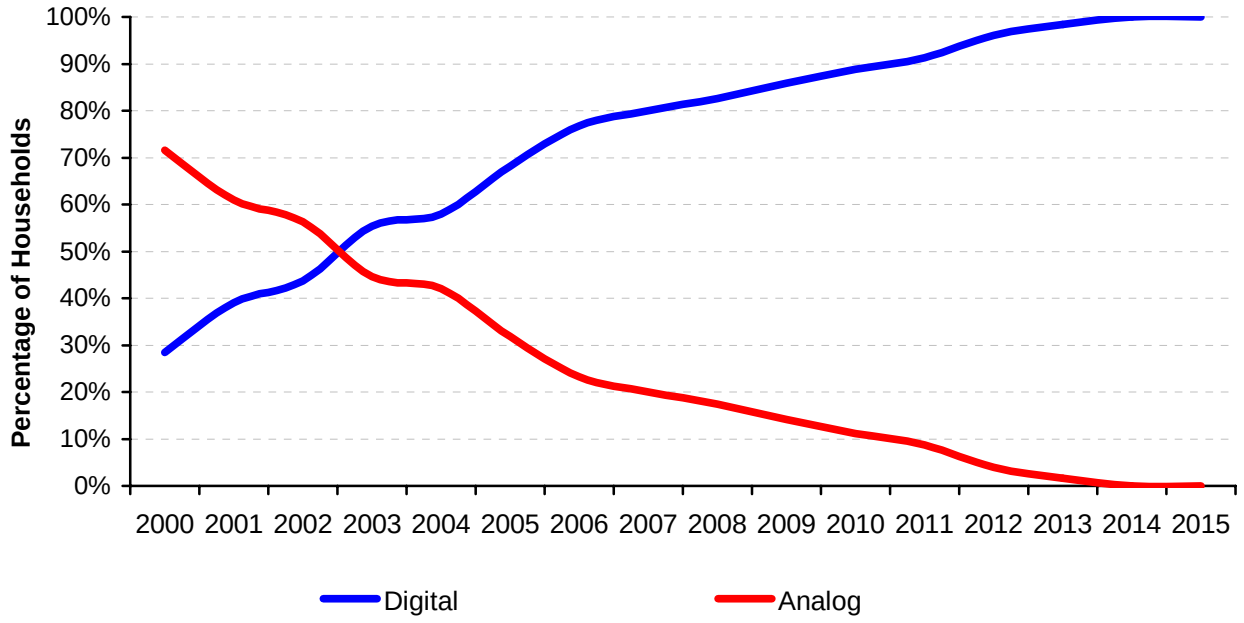

Figure C.9 Digital vs. Analog - UK

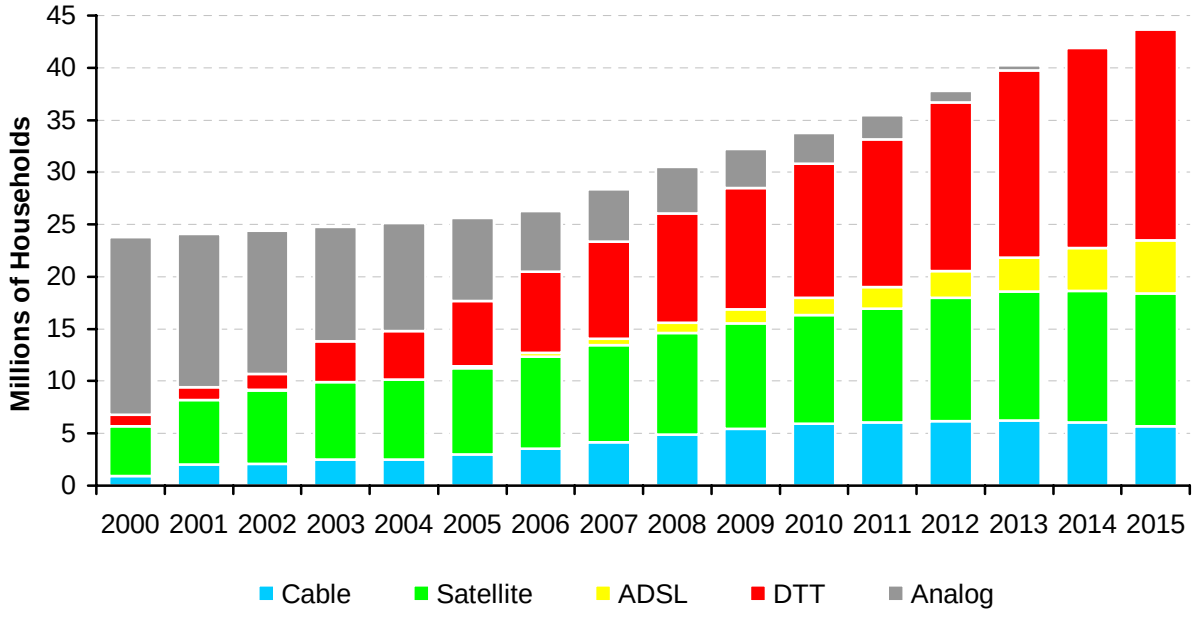

Figure C.10 Digital Platform Segmentation - UK

C.5.2 Digital Platforms

- **Cable**

    - NTL – http://www.ntl.com/ The largest cable and broadband service provider in the UK, NTL has rolled out an extensive multi-play package of TV, broadband and voice services, in order to compensate for the churn the provider is still experiencing.

    - Telewest – http://www.telewest.co.uk/ Telewest has beneficiated from the highest ARPU of European cable companies due to its successful Triple Play strategy.

- **Satellite** – A subsidiary of News Corporation, BSkyB (http://www.sky.com/) was launched in October 1998. As of today, it as over 7.3 million subscribers (all digital), and has announced plans to launch HD services by the first quarter of 2006.

- **DTT** – When DTT was launched on October 15th 1998, UK became the first country in the world with digital terrestrial service. At the time called ON Digital / ITV, the service was a payTV offer; in addition to technical weaknesses, it failed to attract a sufficient number of subscribers.
  As detailed in 4.1, the DTT service was re-launched in October 2002 as a free-to-air service, Freeview (http://www.freeview.co.uk/). In March 2004, the offer was complemented with the launch of a payTV bouquet, Top Up TV (http://www.topuptv.com/).

- **IP TV –** IP TV deployment in the UK is essentially on a regional basis, as seen with the two IP TV operators in the country.

    - HomeChoice – http://www.homechoice.co.uk/ Operating in the Greater London area, HomeChoice has a Triple Play package, which includes ADSL broadband, a selection of TV channels, a phone plan and VoD. As of May 2005, HomeChoice is the only digital platform in Europe offering some channels in MPEG-4 SD.

    - Kingston – http://www.kcom.com/ Present only in the Hull area, Kingston is also serving IP TV (including the BSkyB packages) at a regional scale.

IMIT/TS-LAB-2005-09

www.kth.se