Digital terrestrial TV in Vietnam : an opportunity study into technical regulatory and market conditions for successful introduction

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An Opportunity Study into
Technical, Regulatory and Market Conditions
for Successful Introduction

PHILIPS

Philips Digital Networks

Digital Terrestrial TV in Vietnam

An Opportunity Study into Technical, Regulatory and Market Conditions for Successful Introduction

Master of Science thesis
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Executive Summary

Background

In 1998, the Vietnamese government started an investigation of the possibilities of digital terrestrial television (DTT) in Vietnam. As a result, the Vietnamese government adopted DVB-T as the standard for digital terrestrial broadcasting in 2001.

At the beginning of 2001, HANEL, a Vietnamese electronics company, submitted a request for the supply of a digital transmission system for a DVB-T trial, as well as the assistance of Philips Digital Networks in setting up a set-top-box production line.

In order to make a sound decision in this matter, Philips Digital Networks commissioned me to perform a research concerning the future introduction of digital terrestrial television in Vietnam. A number of subjects have been put forward that should be included in the research. In essence they all served the same purpose, namely to identify the opportunities of digital terrestrial television in Vietnam.

This research is a Master of Science research for the Department of Technology Development Sciences at the Faculty of Technology Management, Eindhoven University of Technology, and is part of the Technology and Society program. The goal of this research is *to inform Philips Digital Networks about the opportunities of digital terrestrial television in Vietnam.* As a result of this research, Philips Digital Networks can decide which role it wants to play in the introduction of digital terrestrial television in Vietnam.

Results

Terrestrial television is the only suitable means of television in Vietnam. Whereas satellite TV is forbidden, cable TV does not exist and television through MMDS reaches only 5000 households, terrestrial TV has the potential to reach 65 million people. Being among the world's poorest countries with a per capita GDP of only USD 400 in the year 2000, TV penetration is relatively high: approximately 10 million of the total 15.6 million Vietnamese households own a TV set.

The Vietnamese television broadcast sector is not a business, but a **propaganda instrument for the central and provincial government**. All TV stations belong to the government. Besides being the central broadcaster, Vietnam Television (VTV) is also the regulator, supervisor and executor of laws and regulations involving broadcasting and propaganda. All provincial TV stations are subordinate to VTV and are in fact subsidiaries of the national TV station. Therefore, VTV can be identified as the most important party in this sector. With regard to the official planning of digitizing of terrestrial TV, VTV is the only party that can make legitimate decisions. In short, the present VTV policy line on digital terrestrial television (DTT) is as follows:

- First implementation of DTT in Hanoi and Ho Chi Minh City.
- Free-to-air broadcast.
- Mobile and portable (indoor) reception is no priority.

- No subsidy of digital set-top-boxes.
- Simulcast period will be assessed per region.
- At first only simulcast of existing Vietnamese programs.
- Many issues still undecided.

Because of the limited prospects of conditional access in Vietnam, there are **no business incentives for the TV stations to start digitizing their terrestrial broadcasts**. The **reasons for digitization** of the TV stations are by no means stemming from business interests but from **political interests**.

For the actual introduction of digital terrestrial TV, I have drawn up the following scenario:

July 2001	VTC, an electronics company, starts a DVB-T trial in Hanoi; the company has a trial license till March 2002. VTC uses the trial as a catalyst for the sales of its digital set-top-box. VTC is the only STB manufacturer in Vietnam.
March 2002	VTC is allowed to prolong its trial till the end of 2002, under the condition that it hands over the equipment to VTV at the end of the trial period.
2nd half 2002	VTV and Ho Chi Minh City TV (HCMC TV) receive a license and an approval of finance for DTT from the Vietnamese government. HANEL that cooperates with Hanoi TV does not receive an approval of finance. The government allows VTV and HCMC TV to make an additional program for digital terrestrial TV, but limits the amount of entertainment to 50%. The other content must be 'education and information'.
Q.4 2002	HCMC TV starts a DVB-T trial in Ho Chi Minh City.
December 2002	VTC trial ends. VTC hands over the trial equipment to VTV which starts upgrading the system for full operation.
April 2003	VTV starts official digital broadcasts in Hanoi. Offered services are the simulcast of the analog terrestrial programs (VTV1, VTV2, VTV3 and Hanoi TV), the international Vietnamese program VTV4 (presently broadcasted via satellite for overseas Vietnamese) and an extra dedicated program 'VTVdigital'.
Q.4 2003	HCMC TV starts official digital broadcasts in Ho Chi Minh City. Offered services are the simulcast of the analog terrestrial programs (VTV1 (VTV2 when VTV1 is off-air), VTV3, HTV7 and HTV9), and an extra dedicated program 'HTVdigital'.
Q.4 2005	Penetration in Hanoi is 3.5 per cent (25,000 households) and 2 per cent in Ho Chi Minh City (20,000 households). The introduction is considered a political success.
Q.1 2006	The government initiates a thorough research of the possibilities for implementation in the rest of the country.

Below, the recommendations for Philips Digital Networks are given.

HANEL – Recommendations for short term (< 3 years) purposes

Commercial opportunities toward HANEL in the short term are limited. In digital broadcasting, HANEL fails to obtain financing, and hence will not be able to purchase Digital Networks' solutions. As for assistance of HANEL in the production of digital set-top-boxes, the indicated figures in the scenario above (45,000 units by the end of 2005) are too small to justify any commitment of Digital Networks. *With regard to the request of HANEL in 2001 the recommendation is therefore* ***negative.***

HANEL – Recommendations for long term (>3 years) purposes

However, **in the interest of future business opportunities,** it is recommended to **find a way to get out of this double 'dead-lock' and *save face*.** Concretely, this means that with regard to **digital broadcasting**, Digital Networks should not expect a concrete order, but should still **be helpful by submitting offers when requested by HANEL.** With regard to the **assistance of the production of STB**, a **detour via Philips Semiconductors** is an option. Philips Semiconductors is already supplier to HANEL in the field of color TV solutions. The business opportunity for Semiconductors is two-fold: on the one hand assistance of HANEL in STB can strengthen the relationship between the two. On the other hand, assisting HANEL can push the market for Semiconductors' DTV solutions.

Semiconductors can first assist HANEL in finding a foreign STB partner. Of course this partner should use Semiconductors' solutions for STB. In the optimistic case that HANEL succeeds in setting up a production of STBs and becomes more technically self-sufficient, Semiconductors can become a direct supplier of HANEL in a later stadium.

TV Stations – Recommendations for short term (< 3 years) purposes

Besides HANEL, there are other important players for Philips Digital Networks. The most important are the TV stations. The commercial opportunity here is the **supply of head-end systems for digital transmission to the TV stations**. In the near future, only the two main cities will broadcast digital terrestrial TV. The concerning TV stations are VTV and HCMC TV. According to the scenario above, VTV will take over the equipment of VTC and upgrade it. Digital Networks will not likely be involved in this upgrading process because VTC purchased its equipment from Tiernan. Therefore, **focus should be on HCMC TV**. If HCMC TV uses only the basic requirements of the broadcasts, turnover for Digital Networks will likely be no more than USD 500,000. Although this means that the short term commercial interest is not so high, the demonstration effect of successful implementation of a Digital Networks head-end system can be great.

Therefore, *it is recommended to **pursue the 'HCMC TV account'** in order to get an **opening to the Vietnamese market**.* In this context it wise to 'create a good relationship' with HCMC TV. This can be done through the Vietnam Representative Office of Philips Singapore Pte. Ltd. in Ho Chi Minh City, where there are already contacts with senior officials of HCMC TV.

TV Stations – Recommendations for long term (> 3 years) purposes

The scenario above forecasts a positive political sentiment towards the implementation of digital terrestrial TV in the rest of the country after the recognition of the political success of DTT introduction in 2005. Because of this presence of opportunity of implementation of DTT in the rest of Vietnam, *it is wise to 'strengthen the relationship' with VTV.* VTV is likely to become the coordinating and perhaps even executing party in the implementation of DTT in the rest of the country. The strengthening of the existing relationship of the Representative Branch Office of Philips Singapore Pte. Ltd. in Hanoi with VTV can be of huge value when it comes to public tenders.

Besides the above, there is another reason to have a strong relationship with VTV. As implied by the forecasted scenarios of previous section, the attractiveness of the content is the most important factor for success. If this factor is changed (for example if the government lowers the restrictions on the content), it can have a large impact on the consumer interest for DTT. This factor is totally dependent on the political decision-making process. Although it is not likely that Philips can exert any influence on this process, **a strong relationship with VTV can result in valuable inside information on this issue.**

STB Manufacturers – Recommendations for long term (> 3 years) purposes

The (potential) players in the digital STB business need a different approach. While HANEL is discussed earlier, **VTC** seems to be **out of reach for Digital Networks**, because it already has a partner. Other electronic companies that might get in to the STB business have a questionable technological capability. If any of the Vietnamese electronics companies would be approached by Philips for the assembly of STB, this should be done through Semiconductors (see recommendations for HANEL).

Market for Philips STB and iDTV – Recommendations for long term (> 3 years) purposes

The final recommendation concerns Philips' own set-top-boxes and integrated digital TVs (iDTV). The indicated figures in the scenario above (45,000 units by the end of 2005) shows that the market potential for the short term is too small. Moreover, this forecast was based on the assumption of low-priced STBs (USD 250). The time to introduce Philips' high-end STB (USD 400+) or iDTV (USD 1000+) has not come yet. However, considering Philips' future commercial interests, *it is wise to monitor the Vietnamese market* that has shown an incredible growth in recent years. This can be done through the representative offices of Philips Singapore Pte. Ltd. in Hanoi and Ho Chi Minh City.

Foreword

This thesis is a result of a Master of Science research for the Department of Technology Development Sciences. This department aims at the development of technology in development countries. Many students at this department started their study with certain idealism, and so was I. For me, this idealism consists of the thought that technology can positively contribute to the development of a society.

At first sight, digital terrestrial TV (DTT) adds little to the development of Vietnam. However, the possibilities of DTT have the potential to bring an enormous change in the political status-quo. Although the government can and will restrict the possibilities of DTT in the short term, I am convinced that in the long term the choice for DTT will inevitably lead to more information, more knowledge and more freedom.

Acknowledgements

I am appreciative to many people without whom this thesis could not be completed. Starting from the beginning, I would like to thank the people who made it possible for me to do research for Philips Digital Networks in Vietnam. In the first place, these are Saskia Repelaer and Emilia van Egmond. They brought me in contact with Robert Martijnse who was CEO and President of Philips Singapore Pte. Ltd. at that time. I would like to thank him for the confidence and the chance he gave me to do this research.

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In Vietnam, I would like to thank all my colleagues of Philips Vietnam in Hanoi and Ho Chi Minh City who have supported me in my research work and helped me adapt to the Vietnamese environment. Several individuals provided valuable information for my research: I would like to thank all respondents and the employees of the consultancy bureaus DV Consultants, GfK, Taylor Nelson Sofres. My special gratitude goes to Dinh Ngoc Hung of HANEL for his cooperation, information and advice. Further, I would like to thank my uncle Mai Huy Tan for introducing me to important officials and for the most valuable lessons in Vietnamese politics and business.

Finally, I would like pay my gratitude to Herman Gaillard, Gert Brussaard and Jan Smits, my university mentors, for their mentoring, coaching and most valuable discussions and comments from the research proposal to the completion of the thesis.

Ân Nguyen
Eindhoven, The Netherlands
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Abbreviations and Acronyms

CA	Conditional Access
CKD	Complete knock-down
DTT	Digital terrestrial television
DTV	Digital television
DVB-T	Digital Video Broadcasting – Terrestrial
EPG	Electronic programming guide
HCMC	Ho Chi Minh City (Saigon)
HDTV	High-definition television
iDTV	Integrated Digital Television
IKD	Incomplete knock-down
NVOD	Near video on demand
SDTV	Standard-definition television
SKD	Semi-complete knock-down
STB	Set-top-box
UHF	Ultra High Frequency
USD	United States Dollar
VHF	Very High Frequency
VND	Vietnamese Dong
VTV	Vietnam Television

Chapter 1 Introduction

In 1998, the Vietnamese government, through the Ministry of Science, Technology and Environment, initiated a project team that would be responsible for investigating the possibilities of digital terrestrial television (DTT) in Vietnam. Presiding over this project team was the Hanoi People's Committee, through Hanoi Electronics (HANEL); Vietnam Television (VTV) was appointed the "main contributor".

In September 2000, a delegation of the team, including representatives of HANEL and VTV as well as representatives of the Vietnamese government made an extensive visit to Philips Digital Networks and Philips Semiconductors in the Netherlands. In the months following, HANEL established contact with Philips Digital Networks Asia-Pacific in Singapore.

Besides a request for the supply of a digital transmission system for digital broadcasting, HANEL requested the assistance of Philips Digital Networks in setting up an STB[1] production line (February/March 2001). In order to make a sound decision in this matter, Philips Digital Networks[2] commissioned me to perform a research concerning the future introduction of digital terrestrial television in Vietnam. A number of subjects have been put forward that should be included in the research. In essence they all served the same purpose, namely to identify the opportunities of digital terrestrial television in Vietnam.

This research is a Master of Science research for the Department of Technology Development Sciences at the Faculty of Technology Management, Eindhoven University of Technology[3], and is part of the Technology and Society program.

This chapter discusses the methodology used for the research that was executed from March 2001 through February 2002. Local research in Hanoi and Ho Chi Minh City took place from May through October 2001, whilst the preparation and analysis took place in Singapore and Eindhoven. Besides the research methodology, the relevance of this research is discussed. The structure of this thesis is presented in the last section of this chapter.

1.1 Relevance

Indisputable evidence for a relation between television and development does not exist. As a part of telecommunications, television is considered to be one of the indicators of economic development. The importance of telecommunications in the development of countries has been stressed in numerous expert studies. There is a close relation between the number of television sets and per capita income[4].

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[1] Set-top-box

[2] For a better understanding of the organizational structure of the commissioner, appendix A gives a short profile of Philips Digital Networks. See also http://www.digitalnetworks.philips.com

[3] See http://www.tue.nl

[4] See also Radstake, M., *The Search for an Adequate Strategy of the Development of Telecommunication in North Kivu (Zaire)*, MS thesis, Eindhoven University of Technology, 1998, and Ekelmans P.M., and M.P. Cloo, *The Role of MIC Tanzania Ltd.*

Social relevance of development of television can be seen in various ways. Besides political and economic relevance, development of television can be relevant for education as well as socio/health purposes.

1.1.1 Political/economic relevance

With television sets becoming quite common in Vietnam, the benefits of information dissemination through television for development are obvious. Television can be used as a communication instrument that supports (governmental) development programs. This opinion is supported by a World Bank Development Report[5] published in 1998. In this report, it is expressed that television broadcasts are an important instrument for poverty reduction and economical development. On page 63 of the report, two statements are made which are of particular relevance to the Vietnamese situation:

'Television remains a powerful and influential medium, because it presents words and images together, reaching people regardless of their literacy.

...

Policymakers thus need to pay due attention to these and other media, provide the right competitive environment, encourage their free development and use, and facilitate the local provision of content."

Undisputable is that Vietnam has a long way to go in the fields of "free development" and "providing the right competitive environment" (see also appendix D, section "Freedom of the Press and Media"). However, the medium of television is generally recognized as an important means for transfer of knowledge.

In respect of recent government policies, the Vietnamese government plans to use television as the way to encourage and promote Vietnamese initiatives in small and medium enterprises. Television can be used to promote the development programs already in place, which help to create a conducive environment for entrepreneurial growth.

1.1.2 Educational Relevance

Relevance of television development for education has been implied in previous subsection. Besides educating and informing the people on specific issues (for example on ways to start and maintain their own enterprises), television can be used as a replacement or supplement to formal education. At the moment, television programs are broadcasted to conduct foreign language courses, math and science classes, instructions on how to use various computer programs, et cetera. For children at pre-school and primary school age, television is used as a supplementary tool to educate children in their homes, by providing story-telling, films and cartoons on Vietnamese legends and famous figures (teaching while entertaining).

(Mobitel) in the Development of the Tanzanian Telecommunication Sector, MS thesis, Eindhoven University of Technology, 1997

[5] World Bank, *World Bank Development Report: Knowledge for Development,* Oxford University Press, 1998

Educational television programming is supported by the World Bank report "The Educational Use of Mass Media" (1981). In this report, several educational experts discuss the salient benefits of the educational use of mass media in less-developed countries like Vietnam. The report discusses how television can be used as an instrument to deal with teacher shortages, to reach greater number of students, to train teachers, to introduce new curricular and to bring high-quality education parity to marginal communities.

1.1.3 Socio/health Relevance

In the light of limited resources for social programs in Vietnam, television can go a long way as a cheap and effective medium that promotes the social well-being of the Vietnamese. In a situation of less available social services, preventive medicine becomes a very important and powerful tool. The earlier quoted "World Bank Development Report: Knowledge for Development" states that progress in information technologies, like (digital) television, when used correctly can accelerate the dissemination of medical knowledge and sanitary information, spreading medical advice faster.

Programming aimed at improving the health of the poorest in the community can certainly be considered a short to medium term solution to the weak social services. An example is the knowledge on how to treat simple ailments as diarrhea which kills thousands of children each year. Knowledge of oral dehydration therapy has proven to reduce infant mortality rate. The report further states the example of a 1986 study in northern Brazil which found that parents who regularly made use of mass media, regardless of the mother's years of schooling, had healthier children. Besides disseminating health care information, television can be a tool used to disseminate important basic information such as improved agricultural techniques and environmental preservation.

1.1.4 Scientific Relevance

Besides the above-mentioned social relevance, research on the opportunities of digital terrestrial television in Vietnam also has a scientific relevance. It contributes to the knowledge on the opportunities of implementing high-tech applications in Vietnam. Furthermore, it can provide a basis for research concerning the implementation of digital terrestrial television in other (developing) countries.

1.2 Theoretical Issues

1.2.1 Research Aim and Problem

The goal of this research is *to inform Philips Digital Networks about the opportunities of digital terrestrial television in Vietnam.* As a result of this research, Philips Digital Networks can decide which role it wants to play in the introduction of digital terrestrial television in Vietnam. In order to achieve this goal, the following research problem has been formulated:

Under which technical, regulatory and market conditions can digital terrestrial television become a success in Vietnam?

A number of research questions have been formulated to tackle this research problem:

1) What are the options for the digitization of television transmission?

2) What are the advantages of digital terrestrial television for Vietnam?

3) What is the role of television in Vietnam?

4) How is the present situation in the television and broadcast sector?

5) Who are the main parties involved in the introduction of digital terrestrial television, and what are their interests?

6) What are the basic investment requirements for digital terrestrial television?

7) What is the market potential of digital terrestrial television in Vietnam?

The above-posed questions are illustrated in the theoretical framework of this research.

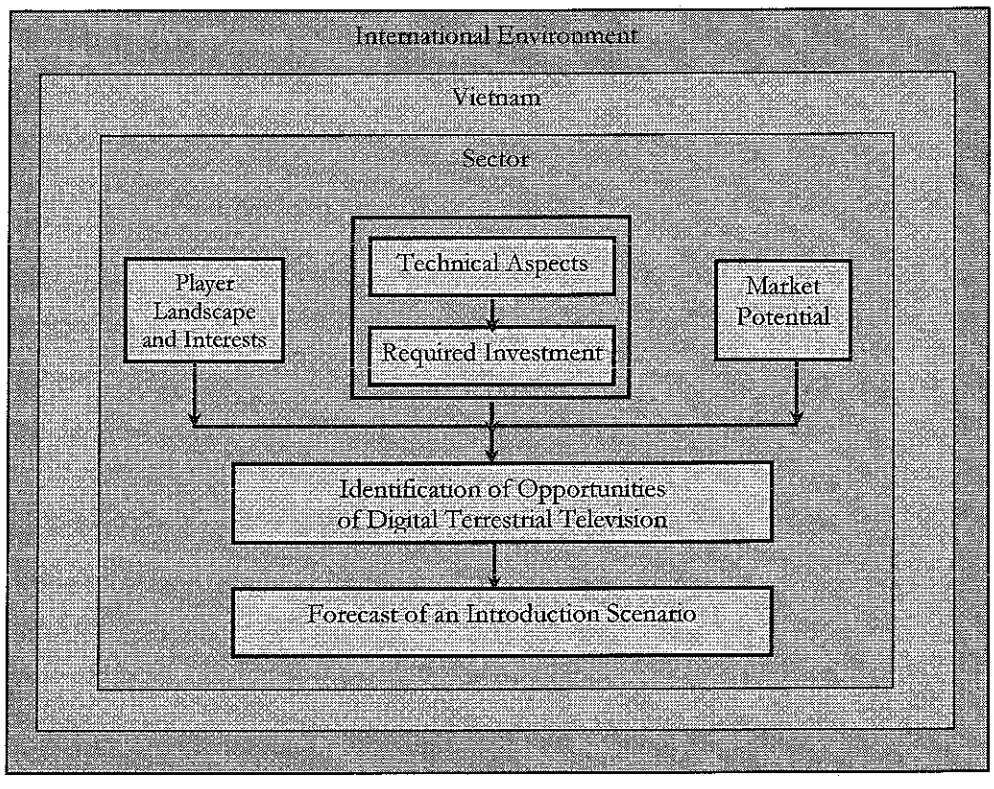


Figure 1-1 Theoretical Framework

1.2.2 Defining Key Concepts

In the following, the concepts in the theoretical framework will be defined to avoid ambiguity.

International Environment

Digitization of television transmission is a global trend. Television signals can be transmitted in various ways. The main broadcast transmission systems are terrestrial, cable, satellite and microwave. The international effort in digitizing these delivery systems has brought considerable merits for each of them. As in any other country, the present local infrastructure, the regulative environment as well as the market set the scene for the discussion of the relative merits of each of these delivery systems in Vietnam.

Vietnamese Environment

Vietnam is considered a developing country. This becomes evident when one looks into the basic economic indicators. Further, Vietnam is one of the few remaining communist countries. The regulative environment, which exerts influence on various aspects on daily life as well as business, is a derivative of the political system. Another derivative of the political system is the role of television in Vietnam which is of eminent importance for this research.

Sector

The sector in case is the Vietnamese television and broadcast sector, which consists of two sub-sectors as defined in the United Nations ISIC classifications[6]:

Class 9213 Radio and television activities

Class 3230 Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods

The sector is the 'playing field' of the parties interested in digital terrestrial television.

Player Landscape

The parties interested in digital terrestrial television make up one of the three pillars of the research into the opportunities of digital terrestrial TV in Vietnam. The main parties are Vietnam TV, Hanoi TV, Ho Chi Minh City TV, VTC and HANEL. These parties and their interests are put in a 'player landscape' in order to have a modeled image of the situation.

Technical Aspects and Required Investments

Investment requirements are derived from the most likely technical requirements (for digital terrestrial transmission as well as manufacturing of digital terrestrial receivers). Investment requirements include infrastructure, production capacity as well as the necessary training requirements.

[6] Statistical Office of the United Nations, *International Standard Industrial Classification of All Economic Activities, Third Revision*, New York: United Nations, 1990

Market Potential

The potential of the Vietnamese market for digital terrestrial TV is limited to the two largest cities in Vietnam: Hanoi and Ho Chi Minh City. The living standard, market size and the consumer and viewing behavior are included in this third pillar of the research.

On the basis of the 'fundaments' (Digitization, Vietnam, Sector) and 'pillars' (Landscape, Investment, Potential), the opportunities of digital terrestrial TV are identified and an introduction scenario is drawn up.

1.2.3 Operationalizations

The key concepts of the theoretical framework were operationalized and resulted in several checklists. These checklists are the research instruments for this research and can be found in appendix B.

1.3 Empirical Issues

1.3.1 Population and Research Units

For this research, two populations are defined:

1. The main parties interested in digital terrestrial television. The main parties are Vietnam TV, Hanoi TV, Ho Chi Minh City TV, VTC and HANEL, which are the research units. No sampling is applied since all these parties are important for the research.

2. The households in Hanoi and Ho Chi Minh City. Factual data of these research units (the households) have already been gathered in various researches by Philips Vietnam, Taylor Nelson Sofres, GfK and DV Consultants. Therefore these organizations have functioned as so-called key informants on the households of Hanoi and Ho Chi Minh City.

1.3.2 Methods of Data Collection

Primary research for this report consisted of the following data collection methods:

- Personal interviews with senior officials of TV stations (A)
- Personal interviews with engineers and project managers of electronics companies (B)
- Personal, telephone and fax interviews with industry experts (C)
- Personal, telephone and fax interviews with individuals who are active in the consulting business (D)

Secondary research for this report consisted of the following data collection methods:

- Collection of existing data in reports, legal documents, statistical records, newspapers, magazines and other documents (E)
- Attendance at presentations of officials, managers, engineers and consultants (F)
- Background research of relevant issues, sourced from books, magazines, theses and the Internet (G)

Where possible, observation (H) was used as a data collection method. Apart from that, it served as a check on collected data gathered with methods A to G.

Table 1-1 Methods of Data Collection

	Methods of Data Collection							
	A	B	C	D	E	F	G	H
International Environment								
Broadcast Transmission Systems			x		x			x
Analog Terrestrial TV	x				x		x	
Digital Terrestrial TV					x		x	
Experiences					x		x	
Vietnamese Environment								
Geography					x		x	
Political System				x	x		x	
Economic Situation					x		x	
Currency and Exchange Rate					x		x	x
Role of TV			x	x	x			x
Freedom of Press and Media				x	x		x	x
Sector								
Regulatory Framework	x			x	x			
Modeling of Sector in Layers			x				x	x
Present Situation in Content & Contribution	x				x			x
Present Situation in Service & Delivery	x		x					x
Present Situation in Receiver/Household End			x	x	x			
Status-quo of Digital Terrestrial TV			x		x	x		x
Player Landscape								
Identification			x					x
Backgrounds, Profiles and Interests	x	x	x		x			
Technical Aspects and Required Investments								
Head-end			x		x	x		x
Receiver-end		x	x			x		x
Market Potential								
Living Standard				x	x	x		
Market Size			x	x	x			
Consumer Behavior				x	x			x
Viewing behavior				x	x			x

As can be seen in table 1-1, the data for the environmental researches were primarily through collection of existing data and background research. The studies of the international and Vietnamese environment are **base-line studies**. The studies of the sector, the player landscape, investment requirements and market potential are **field studies**.

The data for the sector study was gathered through a mix of collection methods in which the interviews with TV station officials and industry experts as well as observation were the most important data collection methods.

Personal interviews with representatives of the main parties interested in digital terrestrial TV was the core method for drawing up a 'player landscape'. Every party was interviewed at least two times in order to increase the reliability as well as the completeness of the data. The second and following interviews were all more context-specific than the first which was more general. All interviews were open interviews without questionnaires but with checklists (see appendix B). All interviews were conducted in Vietnamese. Besides these interviews, existing data and interviews with industry experts were used as background information as well as a check for the reliability of the data gathered from the representatives of the parties in question.

Industry experts and observation were the main source of data for determining the required investments. Data on technical aspects are also gathered from presentations and background research.

The study on the market potential of Hanoi and Ho Chi Minh City were mainly based on researches of consultancy bureaus and Philips Vietnam. The consultancy bureaus in question, Taylor Nelson Sofres, GfK and DV Consultants are highly respected in Vietnam and abroad. The fact that the data needed for this part of the research already existed was the main reason for taking this approach. Another reason is the available time and money for this research that was absolutely inadequate for the execution of an own research of the market potential.

1.3.3 Techniques of Data Analysis

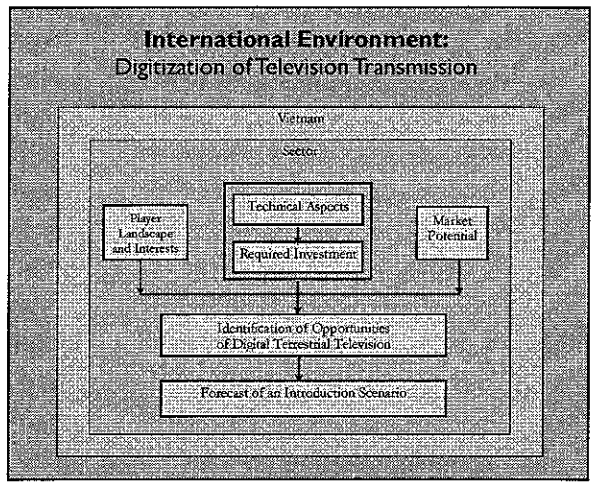
The usual descriptive statistical techniques are used to analyze the obtained data.

1.4 Structure of the Report

The structure of this report is derived from the theoretical framework (figure 1-1). The international environment, the Vietnamese environment, the broadcast and television sector, the player landscape, the investment requirements, and the market potential are discussed in chapter 2, 3, 4, 5, 6 and 7 respectively. At the beginning of each chapter, the place in the theoretical framework is depicted in an illuminating figure. The last chapter of this report contains three introduction scenarios as well as the final conclusions and recommendations.

Chapter 2 Digitization of Television Transmission

Digitization of audio and video systems is not new to the electronics industry. Consumer electronics started to digitize in the 1980s with the Compact Disc (CD) and CD player, replacing the traditional LPs and gramophones. The professional side of the industry started digitizing even before the digitization of consumer electronics. Digital processing of pictures and sound in studios, as well as digital control (e.g. microprocessors) in equipment have been used since the 1970s. Ever since, digitizing of analog technology is seen as the only way to achieve significant gains in performance without enormous escalation in costs.



After the introduction of the CD, less successful digital consumer electronic products such as Digital Audio Tape (DAT), Digital Compact Cassette (DCC) and MiniDisc (MD) entered the market. More recently, the Digital Versatile Disc (DVD) technology has gained wide acceptance in the world market, promising to achieve the same success the CD has enjoyed. The versatility of DVD with an enhanced picture and sound quality, a wide range of extra features that are not available with a Video Cassette Recorder (VCR) or Video Compact Disc (VCD), as well as the possibility to use it with a Personal Computer (PC), will be the most important reasons for its success.

This balanced, wide range of benefits of the DVD technology can also be achieved with Digital Television (DTV). DTV shows an enormous promise to achieve mass market acceptance. This chapter illustrates the benefits of DTV, with a focus on Digital Terrestrial Television (DTT). Before that, the choice for focusing on digitizing terrestrial television in Vietnam rather than one of the other delivery systems is explained.

2.1 Broadcast Transmission Systems[7]

The main broadcast transmission systems are terrestrial, cable, satellite and microwave. Before comparing these modes of delivery, an overview of these four systems is given.

2.1.1 Terrestrial

Terrestrial television has three major advantages: it's widely **available**, easy to **access**, and more **affordable**. These can be called the three A's. **Availability** of terrestrial TV services in Europe is over 95%

[7] General information for this section is partly derived from CDG Consultants Ltd., *Digital Terrestrial Television in Europe – Full Report*, London, 1998.

and in Vietnam the coverage is over 80%. Easy **accessibility** of terrestrial TV manifests itself in the fact that no special equipment or installation is required – a television set and antenna are sufficient. This, and the fact that mostly services are free-to-air[8] (which is also the case in Vietnam), make terrestrial television relatively better **affordable.**

Around the world, terrestrial transmission is the most widely adopted delivery mode for television services. Broadcast towers placed at strategic locations are used to deliver the services to the households. Main transmitters cover wide geographic areas, generally enclosing the main population centers. Relay transmitters are used to extend coverage to smaller populations in more remote areas. Services are received using directional roof-top antennas, and in case of a high signal strength, set-top antennas. Depending on the local circumstances, up to six or seven services can be accommodated through analog terrestrial transmission.

Terrestrial television services were the first to be broadcasted in each country and were mandated to fulfill a public service role and be made available to the widest possible audience. In Vietnam, this public service role has the form of "informing and educating" the people. Initially, services were funded through the state-treasury. Funding through direct taxation (e.g. TV-tax) or license fees as is the case in many other countries, does not happen in Vietnam. Since *Doi Moi*, the renovation program started by the Vietnamese government in 1986, advertising has become an important way of funding. An elaborate analysis of terrestrial television in Vietnam will follow in chapter 4 and appendix E.

2.1.2 Cable

In many high-income countries, Cable Antenna Television (CATV) was developed to extend the range of viewer choice. The number of services delivered through analog CATV can be up to ten times of that of analog terrestrial TV. However, a CATV system requires the deployment of coaxial cable throughout the community, and each TV household must be individually and physically connected. This makes building a CATV system a very expensive and time-consuming process, and is the main reason why cable television is **not present** in Vietnam.

In other countries, these capital costs have often been subsidized in some way, either from public funds or by delivering telephone services using the same infrastructure. In addition to the physical connection, cable viewers often require a set-top box (STB) to convert the received signals to a form which can be input to their TV set. A monthly subscription fee is paid to the CATV provider to cover the capital and operating costs of the cable network and the set-top box. This monthly payment can easily be enforced, unlike with analog terrestrial TV, through a secure and controllable distribution. Individual households can be disconnected from the system, either by taking back the set-top box or breaking the physical connection.

2.1.3 Satellite

Satellite delivery of television into individual TV-households ('direct to home', DTH) became economically feasible in the 1980s. The key breakthrough in DTH satellite television came with the introduction of

[8] Free-to-air (FTA) means that no fee has to be paid for the reception of the broadcasted program

systems using several medium-power satellites co-located in the same orbital position. This allowed viewers access to a large number of channels with relatively low-cost equipment and a single, moderately-sized dish. At the same time the cost of satellite operations could be spread amongst many broadcasters in several countries. As satellite signals are receivable over a very wide area, satellite can offer free-to-air broadcasters extremely wide distribution almost instantly, and can offer pay-TV broadcasters a very wide potential audience.

Although satellite seems to be a good alternative to terrestrial reception of television signals, there are important disadvantages of satellite reception in Vietnam. First of all, private Vietnamese persons[9] are not allowed to possess a satellite dish. This right is reserved for certain institutions (e.g. Ministry of Culture and Information), hotels and expatriates.

For the people who are allowed to install a satellite dish at home, there is a threshold since reception equipment is relatively expensive. Cheapest prices vary from US$ 200-400 for the equipment needed to receive (less attractive) free-to-air programs via the ASIASAT and PALAPA satellites. To receive the more attractive programs, above the more expensive reception equipment (US$ 1000-1200), an annual subscription fee has to be paid[10].

2.1.4 Microwave

Microwave transmission is similar in principle to terrestrial transmission except that it operates at much higher frequencies. This reduces the range over which transmissions are viable, requiring a much denser network of transmitters. In most countries the frequencies allocated to microwave allow many more channels to be broadcast. The high channel capacity and short transmission range mean that, in practice, microwave distribution shares many of the features of cable, and it is often referred to as 'wireless cable'.

Microwave systems are variously described as MMDS (Microwave Multi-channel Distribution System) or MVDS (Multi-channel Video Distribution System). One drawback of MMDS is that the reception equipment is expensive because the frequencies used are very high (up to 40 GHz) and the market for such equipment relatively small.

In Vietnam, MMDS is available in Hanoi and Ho Chi Minh City. The frequency band used for MMDS in Vietnam is 2.5 - 2.7 GHz.

In Hanoi, MMDS is used to distribute nine channels, with a monthly subscription fee of USD 3 to 7, depending on the program package (USD 16-21 for foreigners). Reception equipment is relatively expensive at about USD 200 for an MMDS antenna and decoder (USD 265 for foreigners).

[9] Exceptions can be made for high government officials

[10] For example, for 33 conditional access programs – including various film (e.g. HBO, Star Movie), sports (e.g. ESPN, Star Sports), news (e.g. CNN, BBC World), documentary (e.g. Discovery, National Geographic) and entertainment (e.g. MTV, Cartoon Network) programs– of THAICOM 2 (Digital KU-band), the subscription fee is USD 450 per year.

In Ho Chi Minh City, the number of distributed channels is 12. Prices for foreigners and Vietnamese are the same here: USD 4 to 36 monthly subscription fee, and USD 200 for the reception equipment (USD 255 for some areas of District 1).

2.1.5 A Comparison

The four above described delivery systems are compared below in table 2-1. The symbolic scores indicate the relative strengths and weaknesses of each system. The criteria in this table are particularly important for the European situation. For the Vietnamese situation, only three criteria are needed to make a decisive choice of a delivery system: potential population reach, national security and affordability.

Table 2-1 Features of the Four Main Television Transmission Systems

Criteria	Terrestrial	Satellite	Cable	MMDS
Potential population reach	99%+	80%+	60%+	70%+
Affordability	▲▲▲	▲	▲	▲(▲)
Regional/local broadcasting	▲▲▲	▲	▲▲▲	▲▲▲
Portable reception	▲▲▲	▲	▲	▲
In-home distribution	▲▲▲	▲	▲(▲)	▲
National security	▲▲▲	▲	▲▲▲	▲▲▲
Copyright protection	▲▲	▲	▲▲▲	▲▲
Analog capacity	▲	▲▲	▲▲	▲▲
Digital capacity	▲▲	▲▲▲	▲▲▲	▲▲

▲ Basic ▲▲ Average ▲▲▲ Superior

Source: CDG Consultants

Potential Population Reach

A major advantage of terrestrial compared with other delivery systems, is its potential to be received by a very high proportion of TV households. The Vietnamese terrestrial transmission networks which have been built over years have achieved nearly 90% coverage of the territory. There is an installed base of simple and inexpensive reception antennas allowing terrestrial broadcasts to be received by over 80% of the Vietnamese population.

MMDS could be used to provide high coverage, but – compared to terrestrial – many more transmitters are required for a given coverage area, since the effective transmission radius is only 5 km. This makes the system economically uncompetitive to serve a large area. Furthermore, only households within line of sight of the transmitter will be able to receive the signal properly. This condition is actually inflicting a lower quality of MMDS transmissions right now in the cities of Hanoi and Ho Chi Minh where many large buildings block the horizon. To achieve a high quality reception for all subscribers, a large, complex and expensive transmitter network would be required.

In some parts of the world, cable has the potential to reach a large audience. The Netherlands is an example of an extremely high cable penetration of 92% and a potential coverage of 95%[11]. In Vietnam however, cable TV is non-existent.

Although potentially a large population can be reached using satellite distribution, in Vietnam satellite television is not an option. Satellite DTH is prohibited for common civilians, which is a matter of national security.

National Security

National security in the Vietnamese context does not only mean that in times of emergency, the government can have reliable means of disseminating critical information to the population. It also means the government can exert direct control over highly influential broadcasting resources. On a day-to-day basis, state broadcasting plays a key role in informing and educating the public, stimulating debate and shaping national culture.

All physical elements of ground based networks (terrestrial, cable and MMDS) are clearly within the legal and regulatory control of the national government. This enhances their value in terms of national security. Satellite networks on the other hand, are obviously outside the control of the national government.

Affordability

Even when satellite TV would be allowed for common Vietnamese civilians, there are likely to be huge economic restrictions due to high capital costs for reception equipment (satellite dish, low-noise block (LNB), decoder, wiring, etc.), particularly now most satellite providers are digitizing. MMDS is also suffering from economic restrictions because of the expensive reception technology and small market. Cable is even a lesser option, as very large investments would have to be made to build up such a network.

Complementary systems

From the above, one could derive that in Vietnam, terrestrial is the only suitable television transmission system. Still, it is likely that a mixture of systems will be used to deliver TV programs to the households. Terrestrial will remain the dominant transmission system. Cable would probably be limited to Hanoi and Ho Chi Minh City, *if* it would ever be developed. MMDS can then be an extension to cable. If cable is not to be developed, which is very likely, MMDS can serve as an alternative to terrestrial. Satellite DTH (direct-to-home) seems to remain forbidden for common civilians as a matter of national security, and will primarily serve hotels and the growing number of expatriates.

In certain perspective, Vietnam is starting from an almost clean sheet, with only terrestrial television developed to a certain stage. The country is yet to invest in new infrastructures, which gives it a "backward advantage" compared with the more industrialized countries in Europe and North America. **The key issue is that Vietnam could skip the investment in analog technologies and start digitizing right away.**

[11] Nozema, *The DVB-T experience in the Netherlands*, December 2000

It is clear that in Vietnam, the digitizing effort should be in terrestrial television. Other countries have already started this process, and it is useful for decision-makers to take a look into their experiences[12].

2.2 *Benefits of Digital Terrestrial Television*

Today, terrestrial television is still mostly based on analog transmission. Only a few countries such as the United Kingdom, the United States, Spain and Sweden have started to transmit their terrestrial television signals digitally. Besides the advantages mentioned in subsection 2.1.1 (the three A's), there are many disadvantages of (analog) terrestrial television today. First, the available spectrum is often nearly or fully used. Second, the number of analog programs is limited (mostly less then seven). Third, the quality of reception is often poor (noise, ghost images). In conclusion it can be stated that terrestrial television needs an improvement in spectrum efficiency and quality.

Digital Video Broadcasting - Terrestrial

DVB-T offers the improvements suggested above, and adds some extra features not earlier available with analog TV. This section will not discuss how this is done; merely a summary of benefits of DVB-T will be given.

Capacity – DVB-T allows the transmission up to 10 television programs in a single VHF or UHF channel (instead of one with analog), thus increasing the content on terrestrial networks.

Quality – DVB-T offers interference-free reception and DVD-quality video and audio (including wide-screen picture and multi-channel surround sound)

Flexibility –DVB-T allows broadcasters a huge amount of flexibility in striking a balance between three variables: technical quality, signal robustness and number of services.

Extra – Other possibilities of DVB-T include:

- Multi-lingual audio and subtitling
- Conditional Access (CA)
- Electronic Program Guide (EPG)
- Interactive and data services

Please refer to appendix C1 for a more elaborate discussion of these issues.

To what extend these benefits are applicable to the Vietnamese situation will become clear in the next chapters.

[12] See appendix C2 for an overview of experiences with DTT in selected countries.

2.3 Experiences

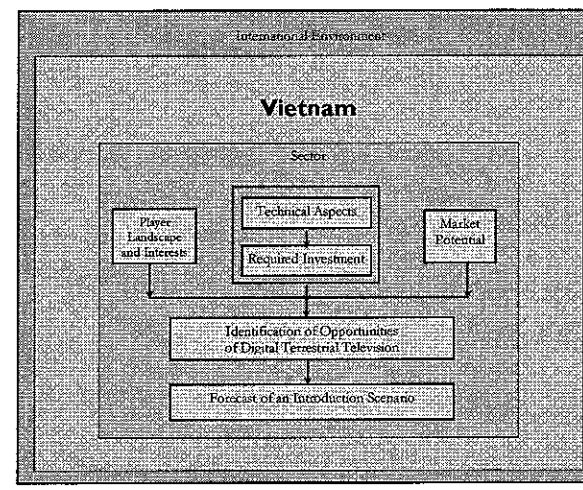
Other countries have preceded Vietnam in digitizing terrestrial television broadcasts. Although each territory has different situations and DTT solutions must be tailor-made, there are some common lessons that may be drawn from the experiences of other countries.

- A dense network of transmitters is needed to assure a wide **availability**;
- Subsidized or rental STBs can help initial take-up since it enhances **affordability** by lowering the entry cost;
- The government can play an important role in ensuring that certain services are still **accessible** for as many people as possible (e.g. by regulating simulcasting and FTA-broadcasts)
- New platforms need a good **content** proposition including both free-to-air and conditional access programs in order to attract the viewer.

For this research, issues above have been investigated for the Vietnamese situation and will be discussed in the next chapters. An overview of experiences of selected countries on the basis of which these lessons are drawn can be found in appendix C2.

Chapter 3 Vietnam

Appendix D considers some issues, stemming from the national environment, that are important for this research. This chapter provides a summary of these considerations. Please refer to appendix D for more details.



Vietnam, a country located in Southeast Asia, has a population of about 80 million and a land area of about 330,000 square kilometers. Its most important cities are the capital Hanoi and Ho Chi Minh City, the former Saigon. The country is divided into eight regions, 61 provinces, 560 districts and 10,320 communes.

This centralized administrative structure is a derivative of the political system that is based on a communist dogma. Despite a new constitution that promulgates a strong and independent National Assembly elected by the people, there is no real democracy. The highest executive power is the Central Government, headed by the Prime Minister. On a national level, this Central Government directly administers the ministries, "organizations under ministerial rank" and "organizations under Central Government".

Further, the Central Government administers the 61 Provincial People's Committees, which are responsible for the governing on provincial level. On their turn, these Provincial People's Committees administer the People's Committees on district level and so on. Also, the Provincial People's Committees are responsible for state enterprises at provincial level.

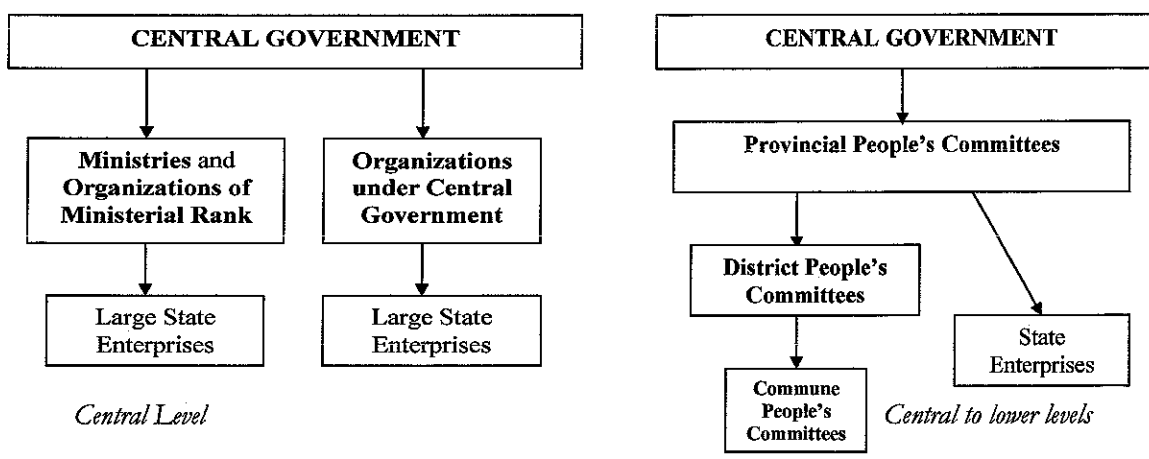


Figure 3-1 Administration Diagram of Vietnamese Government

Vietnam is one of the poorest countries of the World today, occupying the 120th position (between Ghana and Lesotho) in a global list of 162 economies on GDP[13] per capita in the latest Human Development Report of the United Nations Development Program[14]. In the same report, the UNDP ranks Vietnam significantly higher at the 101st place in the so-called "Human Development Index", a broad composite index of social and economic indices concerning human development.

In the few years before the Asian crisis of 1997, Vietnam was one of the fastest growing economies in the world. The situation in Vietnam has changed radically in 1998. The external shock of the East Asia Crisis, together with weakness in management, and the natural disasters that have hit Vietnam in the last years, have all combined to reduce the growth rate of the economy, from an average of 9 per cent between 1994 and 1997 to an average of 5 per cent in the years 1998 and 1999. Despite the slowdown of growth in the US and the rest of the world, forecasts from various sides predict a recovery for the years 2000 to 2002[15] (see table D-2 of appendix D).

The Role of Television in Vietnam

Television in Vietnam has always had the primary purpose to educate and inform the people. Private television is forbidden and the advertising limit is 5 per cent of the airtime. The attitude of the Vietnamese government with regard to television is amply expressed in a governmental decree[16]:

"Vietnam Television is a central Television, an organization under the administration of the Government. It has the functions of an agency for disseminating Party and State's policies"

Besides this, the decree also states that Vietnam Television is "responsible for state management of television technical development throughout the country".

The position of Vietnam Television within the political-regulatory framework of Vietnam gives a clear image on the role and importance of television in Vietnam. Vietnam Television is an institution under the direct administration of the Vietnamese government, meaning that they are equal in administrational rank as for example the General Department of Posts and Telecommunications.

However, due to the power of the television medium as a propaganda tool, in practice the political role of Vietnam Television might be even greater. A saying in the political scene is that "Vietnam Television is the Government, and the Government is Vietnam Television".

Television has become more and more important in the daily lives of the Vietnamese. Showing an incredible growth, Vietnam Television has managed to successfully build a television network in a few years. According to formal figures, the Vietnamese (terrestrial) television network reaches 65 million potential viewers (see table E-1 of appendix E). Television penetration is high at 10 million TV sets for a country with a per capita income of USD 400 per annum. Between 1991 and 1995, the number of TV

[13] At purchasing power parity

[14] UNDP, *Human Development Report 2001 – Making New Technologies Work for Human Development*, New York, 2001

[15] These forecasts are from before "September 11"

[16] Decree No. 52/CP dated August 16, 1993, issued by the Government

households quadrupled to an estimated 60 per cent penetration of the population. Except for some remote rural areas, this figure is rising to 90 per cent[17].

Emphasizing today's role of television in the lives of the Vietnamese, on the priority list of luxury goods to be purchased whenever one can afford them, the number one spot is occupied by the TV set, followed by the refrigerator and the motorcycle. Further, allover the country, in almost every family, the TV is always on (provided that there is one present). Television has become an inextricable part of Vietnamese culture[18].

Freedom of the Press and Media

Throughout the history of communist Vietnam, there has never been a shortage of newspapers. Currently, there are over 500 newspapers and magazines devoted to diverse subjects. The commonality is that the Vietnamese Communist party or one of its affiliate organizations publishes them all. All of the official publications in Vietnam practice a policy of self-censorship. The Ministry of Interior has a press wing devoted to monitoring and controlling media coverage. Close monitoring of the press is an ideological issue, which the Vietnamese government cannot toss aside without serious consideration. It is enshrined in their concept of communism and good government. Although change will not come quickly or easily, there were some developments in the provision of independent media that were very promising. As from July 1st, 2001, the television programs of CNN, TV5 and Deutsche Welle were broadcasted free-to-air[19] in the Hanoi area. This was done through digital terrestrial television broadcasts, the subject of this research. Although it is still a long way to complete freedom of press and media in Vietnam, the (free) provision of independent foreign media to Vietnamese citizens is a first and necessary step towards this goal.

Conclusions

With a per capita GDP of only USD 400 in the year 2000, Vietnam is among the world's poorest countries. However, with a population of 80 million people and a growing economy, Vietnam promises to be an important market for the future. Chapter 7 will elaborate on the market potential for digital terrestrial TV in Vietnam.

The present broadcast of digital terrestrial television services in Vietnam proves that besides economic considerations, there are other important considerations in Vietnam. **The political environment puts the medium of television in a peculiar position. On the one hand it is warmly welcomed by the political leaders as it can serve as a propaganda machine for party and state. On the other hand however, the government limits the possibilities of the television medium by strongly controlling and monitoring of the press and media.**

Digital terrestrial TV finds itself in the same position. **Technological progress is warmly welcomed but is resisted when it brings too much change in the political status-quo.** A typical example is the forced cancellation of the digital broadcast of CNN, TV5 and DW in Hanoi, a few weeks after the start of the trial. More on this subject will follow in the next chapters.

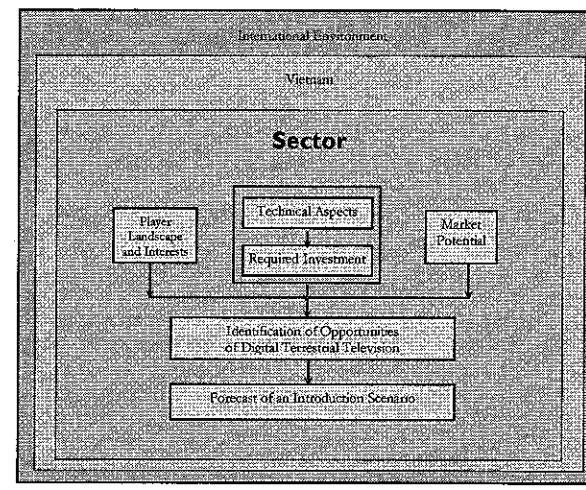
[17] Sources: DV Consultants, Philips Nederland B.V., Vietnam Television

[18] Source: DV Consultants

[19] Free-to-air means that no fee has to be paid for the reception of the broadcasted program

Chapter 4 Sector

Appendix E provides a profile of the Vietnamese television and broadcast sector[20]. This chapter provides a summary of this profile. Please refer to appendix E for more details.



Broadcasting is regulated and governed by Vietnam Television (VTV), which is an "organization under central government". As indicated in chapter 3, Vietnam Television has the role of "propaganda machine" for State and Party. In practice, Vietnam Television is the regulator, supervisor and executor of laws and regulations involving broadcasting and propaganda.

The model below is used to **allocate the activities of the players in the Vietnamese broadcast and television sector.**

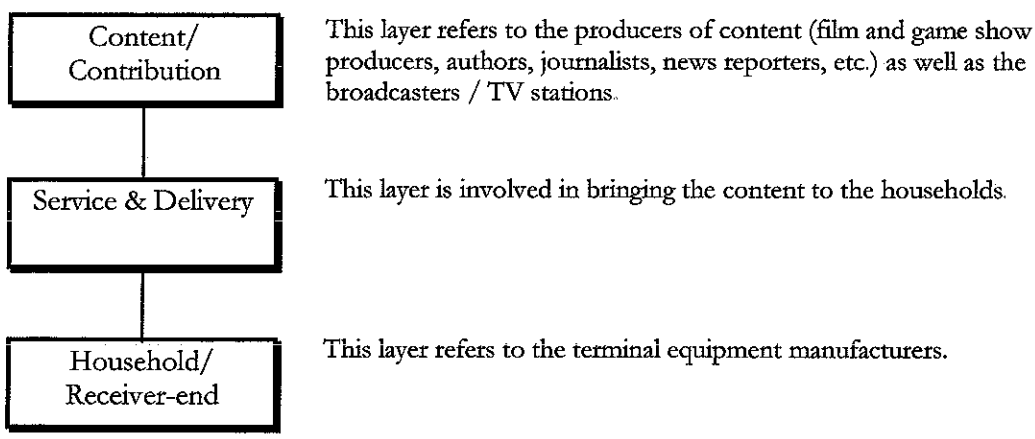


Figure 4-1 Activity Allocation Model: Value-added Television Chain

Content / Contribution

In Vietnam, the provision of content is largely taken care of by the TV stations. Although there are independent film-producers that contribute their part of content to the TV stations on contractual basis, most of the film producers belong to Vietnam Television. On a national level, there is Vietnam Television (VTV) broadcasting three terrestrial programs (VTV 1, 2 and 3) with a total of 36 hours per day.

[20] See section 1.2.2 for a definition

Besides national television, every province has a local TV station, placed under the supervision of the Provincial People's Committee and Vietnam Television. There are 61 local TV stations, but most of them have a rather poor local contribution, relying heavily on national programs. The most important and dynamic local stations are in Hanoi and Ho Chi Minh City. Hanoi TV is a local TV station that covers the Hanoi area and the surrounding provinces, and has 10 million potential viewers. It has one terrestrial program (Hanoi TV) and is on air 18½ hours per day. Ho Chi Minh TV covers the whole Mekong delta, and has 18 million potential viewers. It has two terrestrial programs (HTV 7 and 9) and broadcasts a total of 36 hours per day.

Figure below presents a diagram that shows the position of VTV and the Provincial TV stations.

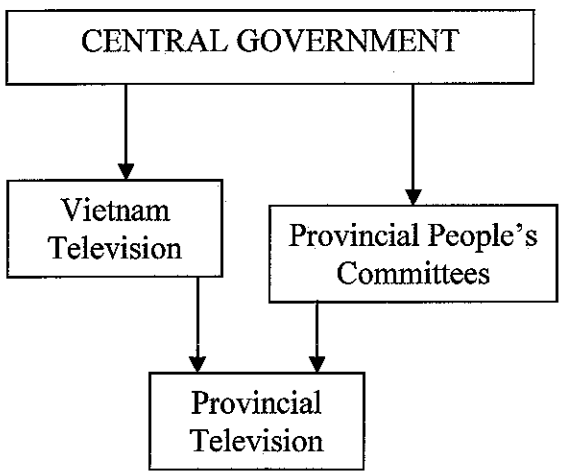


Figure 4-2 Position of Vietnam and Provincial Television

Service and Delivery

This part of the chain is taken care of by Vietnam Television and the local TV stations. Vietnam Television takes care of the service and delivery of its own programs, as well as the standardization and regulation of the broadcasts[21]. Vietnam Television's terrestrial network has a national coverage for VTV 1, its propaganda program. The other two terrestrial programs, VTV 2 and 3 are directly broadcasted by Vietnam Television in the Hanoi area only.

The national programs of VTV 1, 2 and 3 are also transmitted to satellites THAICOM and MEASAT. The main purpose of this is to distribute the programs to the local TV stations. In areas other than the Hanoi area, the programs of VTV 2 and 3 depend on the local TV stations to be re-transmitted. This applies partly to VTV 1, since the terrestrial network of Vietnam Television still has gaps. In practice, the most re-transmitted program is VTV 3.

Most local TV stations rely heavily on national programs provided by Vietnam Television. This is especially the case for provinces where the VTV programs are not re-transmitted through a separate channel; hence a selection of VTV 1, 2 and 3 is re-broadcasted through their local channel.

[21] One of its standardization efforts is for example the gradual change from SECAM to PAL color system in all of Vietnam in the 1980s and 90s.

The situation of terrestrial services is illustrated in table 4-1 below.

Table 4-1 Terrestrial Television Services

	Number of main programs	Main programs	No. of additional programs(i)
Hanoi area	4	VTV 1, VTV 2, VTV 3, Hanoi TV	0-1
HCM City area	4	VTV 1(ii), VTV 3, HTV 7, HTV 9	2-3
Larger cities	3	VTV 1(ii), VTV 3, local TV station	0-1
Smaller cities	2	VTV 1(ii), local TV station(iii)	0-1
Rural areas	1	Local TV station(iii)	0-1
Remote rural areas	0	n.a.	0

(i) Programs that are broadcasted in adjacent provinces that can be received when having the right conditions (location, antenna)
(ii) VTV 2 (picked up from satellite) is re-broadcasted on times VTV 1 is off air
(iii) In these situations, the local stations often re-broadcast a selection of the national programs (picked up from satellite).

Receiver-end

The receiver-end of the economic value-added television chain concerns the producers of the equipment for the individual households. For analog TV, this mainly concerns the TV manufacturers. The number of television sets in Vietnam is estimated at 10 million, while the annual sales are estimated at about 700,000 color TV sets. The majority of these TV sets is produced (assembled[22]) locally.

Digital Terrestrial TV – Developments

In 1998, the government, through the Ministry of Science, Technology and Environment, initiated a project team that would be responsible for investigating the possibilities of digital terrestrial television (DTT) in Vietnam. Presiding over this project team was the Hanoi People's Committee, through Hanoi Electronics (HANEL); Vietnam Television was appointed the "main contributor".

At the end of 1999, this project team held a seminar on the "first impressions". At that stage, the team had studied the three digital standards for terrestrial broadcasting, ATSC (United States), DVB-T (Europe) and ISDB-T (Japan). A strong preference was spoken out for the European standard, DVB-T. However, due to the slow decision making process of the Vietnamese bureaucracy, it lasted until April 2001 that Vietnam Television officially chose DVB-T as the standard for Digital Terrestrial Broadcasting.

[22] The majority of the local CTV production implies the assembly in CKD (complete knock-down), SKD (semi-complete knock-down), or IKD (incomplete knock-down) form.

Together with the seminar, the project team brought out a report[23] to the government on the advantages of DVB-T for Vietnam. The reported advantages were about the same as those identified in section 2.2 of this thesis.

In December 2000, a conference was organized, with one of the issues the recommendation of the following milestones:

- First DVB-T commercial trials in Hanoi and Ho Chi Minh City at the end of 2003;
- Digital broadcasting in larger cities from 2005;
- Digital broadcasting in the rest of the country and phasing out of analog broadcasting between 2015 and 2020.

As of now, these recommendations have not yet been translated into policy by the Vietnamese government. As a matter of fact, the milestones above are continuously changing. Further, from political scenes it is emphasized that the Vietnamese government is determined not to lag behind other countries in the region and encourages Vietnam Television to speed up the implementation schedule.

In the present situation, the Vietnamese government is examining proposals for the implementation of DTT in Vietnam. One important condition for the proposals is that they have to include the total infrastructure, containing the head-end (above described service and delivery) as well as the receiver-end. In practice this means that the project proposal needs to include a transmission system as well as a set-top-box production line.

The forced combination head-end and receiver-end, plus the political competition between various parties, has lead to a peculiar situation. The player landscape has changed compared with analog, which is elaborated in chapter 5. Initially, two parties have been submitting proposals for the trial broadcasting in the Hanoi area to the Vietnamese government. First objective was to get the government's approval as well as the attached loan for this trial.

However, there has been a change in the situation. One of the parties, VTC, has started a trial in the Hanoi area as from July 1, 2001. VTC is doing this without the approval of the government (VTV), but with a test license for UHF channel 26 for the Hanoi area. This license expires in March 2002.

The VTC trial consists of eight free-to-air programs in one single channel, covering greater Hanoi with one transmitting antenna. When the trial started, the broadcasted programs included VTV1, VTV2/HanoiTV, VTV3/VTV4[24], CNN, StarSports, MTV, TV5 and Deutsche Welle. However, because VTV had serious objections against the broadcast of DW, TV5, CNN (political issue) and MTV (cultural issue), VTV threatened to sue VTC. The two parties have reached a compromise: VTC will be allowed to continue the broadcast, but the content must be changed. The present content is now: VTV1/2, VTV3, VTV4, HanoiTV, Cartoon Network, StarSports, ESPN and "VTC" (a selection of international programs).

[23] Bo Khoa Hoc Cong Nghe va Moi Truong, *Tai Lieu KHCN-01-05B: Truyen hinh so mat dat, nhung quan niem ban dau*, Hanoi, December 1999.

[24] VTV4 is the program broadcasted on satellite for Overseas Vietnamese

VTC has already set up an SMT[25]-line for the production of digital set-top-boxes, in co-operation with Benjamin, a Taiwanese STB manufacturer. At the same time as the trial-start, VTC started to sell their STB at a price of USD 225. Six weeks after the start, sales had reached 3000 units[26]. Unit price has been relatively stable at about USD 215.

The other party, HANEL, is preparing a trial, but is still waiting for the government's final approval since it needs the government loan to finance the trial.

Available Spectrum for Digital Terrestrial Television Broadcasts

In order to "fit" new DTT broadcasts into the spectrum, in many countries the new DTT signals need to be "squeezed" into channels that were previously considered to be "taboo". The number of available DTT channels is then limited by the number of taboo channels that are available for use.

In Vietnam however, with an average of only one or two occupied channels throughout the country, no "squeezing" is necessary. Even in the largest cities, Hanoi and Ho Chi Minh City, there is no need to squeeze either.

In Vietnam, the following VHF and UHF channels are available for TV broadcasts:
VHF: channels 6-12
UHF: channels 21-51

Practically the whole UHF spectrum is available for digital broadcasting, since per site a maximum of two or three UHF channels are in use. This aspect is a relative advantage for Vietnam compared with other countries. A re-planning of the broadcast frequencies and a stronger regulation regarding the transmitting powers, especially in the south, can further boost the capacity for digital broadcasting and simulcasting with the existing analog programs.

Conclusions

The Vietnamese television broadcast sector is not a business, but a propaganda instrument for the central and provincial government. All TV stations belong to the government. Besides being the central broadcaster, Vietnam Television (VTV) is also the regulator, supervisor and executor of laws and regulations involving broadcasting and propaganda. Therefore, VTV can be identified as the most important party in this sector.

Although the infrastructure for analog terrestrial television is far from complete, there are already developments in digital terrestrial TV. This does not need to be a problem; chapter 2 has even identified it as a possible advantage, by skipping the investment in analog technologies and start digitizing terrestrial TV. This process has already started, and the question is now in which direction it will proceed.

Spectrum scarcity as in other countries is not the case in Vietnam. The amount of available content is small and the number of available channels is large. This implies that the potential capacity of digital terrestrial

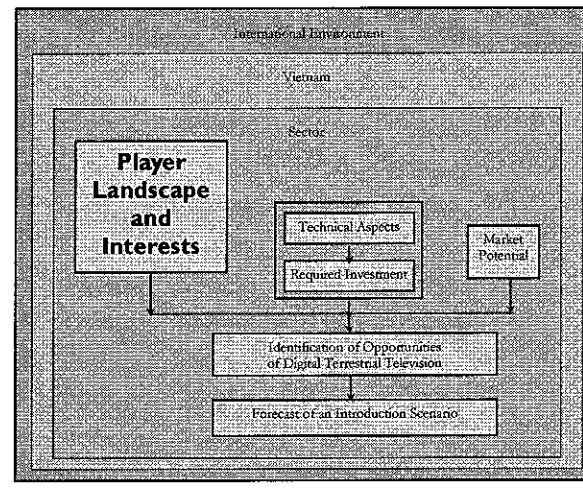
[25] Surface Mounting Technology
[26] Source: VTC

TV is huge, even with simulcast. It also implies that capacity, one of the four benefits mentioned in section 2.2, is not the decisive reason for Vietnam to digitize terrestrial television.

As this chapter gave a summary of the profile of the Vietnamese television and broadcast sector, the next chapters deal with variables in this sector that are considered important. These are:

- The DTT player landscape and the player's interests;
- The required investment for digitization of terrestrial TV; and
- The market potential of digital terrestrial TV.

Chapter 5 Player Landscape



This chapter describes the player landscape of digital terrestrial television in Vietnam. This player landscape is considered one of the three main variables in the Vietnamese television and broadcast sector for identification of opportunities of digital terrestrial TV in Vietnam. For a graphical presentation of these main variables, please refer to the theoretical framework presented in chapter 1 (figure 1-1).

Information for this chapter has been gathered mainly from personal interviews with senior officials of TV stations and engineers and project managers of electronics companies. Before actual enquiry on reasons and interests was possible, interviews with industry experts were done to identify the main parties interested in digital terrestrial TV. Please refer to subsection 1.3.2 for more details on the methods of data collection.

5.1 Identification

This section gives a helicopter view on the digital terrestrial TV chain in Vietnam. Purpose of this helicopter view is the identification of the main actors involved in the so-called actor network or player landscape. Identification of the market players is done through the value-added television chain of chapter 4. Besides that, there is a regulatory/political environment, in which one player is absolutely dominant: Vietnam Television.

In the following, we will fly briefly over the value-added chain, in order to determine the players and potentials players and draw up a landscape.

Content / Contribution

In Vietnam, the provision of content is largely taken care of by the TV stations. Digital terrestrial TV will not change the domestic part of this layer. However, since DTT offers the possibility of a larger capacity, it is plausible that additional content provision will be from foreign TV stations. At this moment, the trial broadcast of VTC includes Cartoon Network, StarSports, ESPN and a selection of other international programs. These programs are picked up from satellite, and re-broadcasted without permission of these respective TV stations. Although Vietnam is a country in which intellectual property rights are violated on a regular basis, it is obvious that for the development of the Vietnamese broadcast sector, the illegal re-broadcast of copyrighted programs can only last for the time of the trial.

Although the domestic part of the content provision will remain dominated by the TV stations, it is likely that in the near future (< 3 years) only the **national TV stations** and the **TV stations of Hanoi and Ho Chi Minh City** will act as a digital terrestrial player in this layer of the broadcast chain, since it will probably take years before other cities go digital. It is plausible that in the long term (>3 years), TV stations of other larger population centers will follow.

Service & Delivery

Traditionally, this part has been taken care of by the TV stations themselves. As can be seen from figure 5-1, the present players that are active in this layer are not the TV stations, but an electronics company (HANEL) and a trading company (VTC).

Since July 2001, VTC has been broadcasting digital terrestrial television on a free-to-air basis. With this they are the first digital terrestrial broadcaster in the Vietnamese market. At this moment, services are limited to the Hanoi area. HANEL is preparing a trial, also in the Hanoi area.

As mentioned in chapter 4, the present situation is bit peculiar. However, this situation will be **only temporary**, as the government will not likely allow other parties then the (state-owned) **TV-stations** to control the first two layers of the chain.

Household / Receiver-end

The receiver-end of the chain refers to the manufacturers of terminal equipment, in particular digital set-top-boxes. At present, there are two major parties that have (or are working towards) a production line of digital set-top-boxes for DVB-T. Also in this layer, **VTC** has been the first to enter the Vietnamese market. VTC has already set up an SMT-line for the production of digital STBs, in cooperation with Benjamin, a Taiwanese STB manufacturer. At the same time as the trial-start, VTC started to sell their STB at a price of USD 225.

HANEL was preparing a production line for STBs in cooperation with Zinwell, also from Taiwan. However, in September 2001 this cooperation was terminated. Presently HANEL is working towards cooperation with Humax (Korea).

Other potential players in this layer include the Vietnamese electronics companies. Besides HANEL, an exploration among these companies has resulted in the following potential STB manufacturers:

- Viettronics Binh Hoa
- Viettronics Tan Binh
- ST Electric

5.2 Visualizations

The next figures present the visualization of the present and future (short and long term) player landscape.

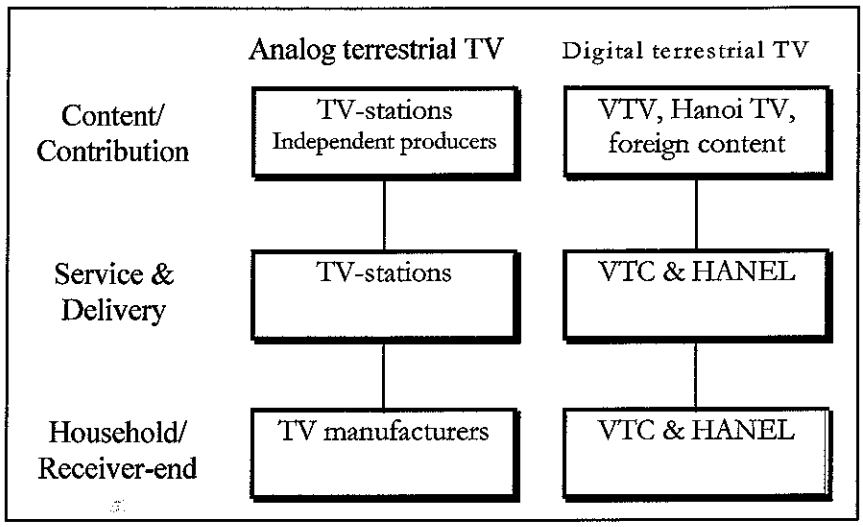


Figure 5-1 Present Player Landscape in Terrestrial TV

The figure above depicts the present situation as described in chapter 4. Figure below shows my view on the potential future player landscape, distinguished in a short and long term forecast. Elaboration of these forecasts is given in next sections.

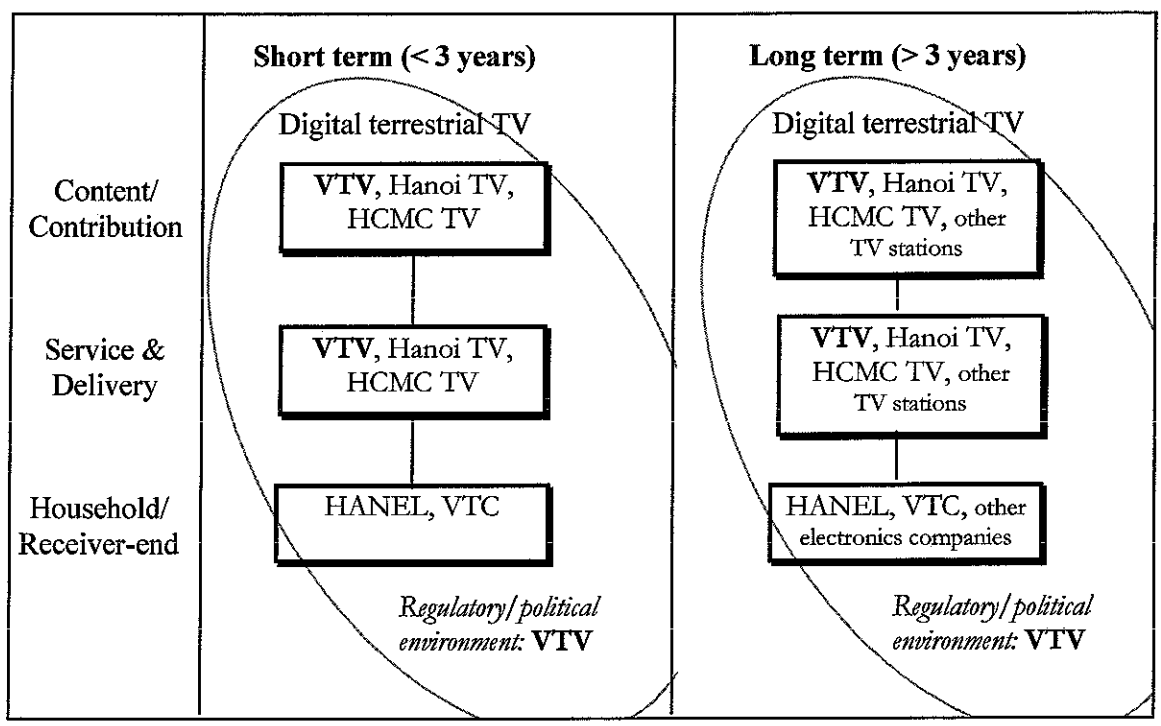


Figure 5-2 Future DTT Player Landscape

5.3 TV stations

Information for this section is obtained through the checklist, given in appendix B.

5.3.1 Vietnam Television

Place in Political/Regulatory Framework

As mentioned in chapter 2 and 3, Vietnam Television (VTV) has the role of "propaganda machine" for State and Party. Within the political-regulatory framework it has the status of "organization under central government", which means that the president of VTV reports directly to the Prime Minister. In the broadcasting sector, VTV is the absolute ruler by being the regulator, supervisor and executor of laws and regulations involving broadcasting and propaganda. Besides, all local TV stations are under VTV's authority.

Core Activities

Besides the above, VTV produces and broadcasts TV programs. Please refer to appendix E – section Analog Terrestrial TV – for an elaboration of VTV's core activities.

Present Relationship with DTT

With regard to digital terrestrial TV, VTV has cooperated with HANEL from 1998 to 2000 in a research project initiated and funded by the Ministry of Science, Technology and Environment. As a result of this research, in April of this year VTV was able to officially declare DVB-T as the standard for digital terrestrial television in Vietnam.

Plans/Prospects with regard to DTT

The policy and strategy of VTV regarding DTT is still in a developmental phase, and is dependent on political developments. Although the outcome of these political developments is very uncertain, a broad outline can be drawn for the basic issues. There is one main point in present policy making regarding DTT: digitizing of terrestrial broadcasts is considered an irreversible process.

At the end of 2000, VTV had set the following preliminary milestones for the implementation of DTT:

- First DVB-T commercial trials in Hanoi and Ho Chi Minh City at the end of 2003;
- Digital broadcasting in larger cities from 2005;
- Digital broadcasting in the rest of the country and phasing out of analog broadcasting between 2015 and 2020.

However, the early VTC-trial has somewhat surprised VTV, by being 2½ years earlier than was planned. Although VTV has the power to put a stop to the semi-legal trial, it is not in the (political) interest of VTV to do this[27]. The most serious objections of VTV against the VTC-trial were taken away by VTC almost immediately (see chapter 4).

[27] Although VTC is a subsidiary of VTV, the relationship between both is not good. However, it is not in the interest of VTV (nor the Communist Party) to have this known by the general public.

Although this unexpected surprise has disordered the planning of VTV, its effects are most likely to be limited to the time path of the DTT implementation. Below the most important issues of future DTT implementation will be presented. These issues (availability, affordability, accessibility and content) have come forward as key variables in other countries and have been well-documented elsewhere. See also section 2.3 of this thesis.

Availability

Ultimate goal of VTV is to make DTT available for all Vietnamese. However, even with analog TV there is no 100% national coverage, so this goal is considered to be a 'paper' goal. Under the current situation, with a GDP per capita of only USD 400 and still a considerable part of the population without TV, priorities are focused on the extension of analog TV provision to yet uncovered areas.

However, within the governmental policy of regional development of certain cities and provinces, VTV has set the following order of *regional availability* of DTT:

1. Hanoi and Ho Chi Minh City
2. Larger cities
3. Smaller cities
4. Rest of the country

Only certainty is point 1, since **only Hanoi and Ho Chi Minh City are presently considered to have a sufficient market for DTT**. Official digital broadcasting in these cities is expected to be within the next two or three years. **The markets outside these cities are considered too small, which is not expected to change within the next four or five years**. The larger cities that are thought to follow Hanoi and HCMC first are Danang, Cantho and Haiphong.

The milestones that have been set are based on two main assumptions. First is the assumption that the standard of living in some larger cities will be sufficient to have a market for DTT after 2005. The exact time of digitization will be assessed later. Second assumption is that all existing analog transmission equipment will be written off by 2020. These milestones are not backed up by thorough research, but are more or less derived from the five and ten year plans set by Party and State.

The *variety of services*, which is especially important when there are many conditional access (CA) programs, is not considered an important issue by VTV. With regard to the choice between free-to-air and CA, **VTV prefers free-to-air**. Several reasons have been given for this. First, VTV is a state broadcaster responsible for "disseminating Party and State's policies". Broadcasting through conditional access would go against the fundamentals of VTV. Second, VTV believes there is not yet a market for conditional access programs. The figures of MMDS subscribers in Hanoi and Ho Chi Minh City seem to validate this. In both cities an analog MMDS system providing up to 12 channels for USD 3-36 (depending on the program package) has only 2000 subscribers in Hanoi and 3000 in HCMC[28].

Another issue of availability is the *way of reception*, as DVB-T offers the possibility to receive the signal with an **indoor/portable** antenna as well as **mobile reception**. However, in the Vietnamese situation **VTV**

[28] Sources: VCTV and SCTV

finds it no priority to offer such service. Most important is considered the delivery to the existing outdoor antennas[29].

Affordability

Affordability of reception *equipment* (digital set-top-box) is a large concern for VTV. However, this concern is limited to the question of viewing public size. VTV will only broadcast DTT when there is a large enough viewing public. **Subsidizing digital STBs** like for example in the UK is **out of the question**.

Affordability of possibly offered *CA services* in the future will be left to the market. In fact there is no policy or strategy regarding CA since it is considered 'too far away'.

Accessibility

Accessibility of TV services for the general pubic is very important to VTV considering its functions. However, **ensuring accessibility will first be done through analog TV**. *Accessibility to the poorest communities* will still be done through the free provision of black and white TVs and so-called community centers where a TV set is available for the people.

Ensuring accessibility of digital TV to the general public is limited to the provision of *free-to-air programs*. The **simulcast period and therewith the timing of analog switch off will be assessed on situational basis** (per region). Latest switch off is believed to be around 2020.

Content

With regard to content, standpoint of VTV is that **at first only the existing Vietnamese programs** will be **digitally broadcasted**. New programs will only be made when there is a public for those programs. Regarding the broadcast of foreign programs, the attitude of VTV is ambivalent. On the one hand, conservative powers within VTV and in political scenes are strongly opposed to distribute foreign (i.e. capitalist) programs through a Vietnamese terrestrial network. Most important objection is that these foreign programs have not been censored by the Party.

On the other hand, more opportunist powers see the attractive content of some foreign programs as a way to offer these through conditional access and therewith collecting subscription fees. However, as the VTC trial broadcast has proved, this foreign content will be limited to relatively 'harmless' programs such as sports and cartoons.

Regarding **other issues** relating to content, such as the number of programs per channel, the number of channels, the choice of *content quality* (i.e. SDTV or HDTV) and *extra features* (e.g. enhanced audio, multiple audio, subtitling, widescreen, EPG, teletext, interactivity, NVOD, et cetera), VTV's standpoint is **undecided**. Unofficially it is stated that Vietnam's future DTT will be one or two channels (multiplexes) with four to five SDTV programs each. Extra features of DVB-T will not be used, except for perhaps limited interactivity features to provide some way of near video on demand (NVOD).

[29] Major part of the TV households receives their TV signal through an outdoor antenna.

5.3.2 Hanoi TV

Place in Political/Regulatory Framework

Hanoi TV is a provincial TV station that belongs to the Hanoi People's Committee. As shown in chapter 4, as a provincial TV station it is subordinate to VTV. Because Hanoi TV is the capital's TV station it has a considerable power. For example, it has the right to broadcast with a 70 to 80 km radius, which means it has a coverage of Greater Hanoi plus surrounding provinces (10 million potential viewers).

Core Activities

Hanoi TV produces and broadcasts TV programs. Please refer to appendix E – section Analog Terrestrial TV – for an elaboration of Hanoi TV's core activities.

Present Relationship with DTT

With regard to digital terrestrial TV, Hanoi TV has cooperated 'on paper' with HANEL since the beginning of this year. In fact, this 'cooperation' has been led by HANEL to obtain the approval of the Hanoi People's Committee (to which they both belong) for a trial broadcast project. Within this project, Hanoi TV would supply the content to HANEL which would take care of the service and delivery. Hanoi TV will also send out their engineers to HANEL when necessary. The latter seems unrealistic since the expertise of digital TV at HANEL is much higher than at Hanoi TV. In fact, **the expertise knowledge of digital TV at Hanoi TV is minimal**.

Plans/Prospects with regard to DTT

In the ten-year-plan of 2001-2010, Hanoi TV has set the target for the start of a DVB-T trial at the end of 2003, in concordance with VTV recommendations given at the end of 2000. This target will perhaps be met earlier than planned. In the same ten-year-plan, Hanoi TV has set the target to start broadcasting a second television program (Hanoi TV 2 or something similar) in 2005.

Standpoints on Important Issues

The standpoint of Hanoi TV on the issues of **availability**, **affordability**, **accessibility** and **content** are **about the same as VTV**. In fact they have no choice since they are subordinate to VTV. In addition to the content issue, in the present project with HANEL, they are only licensed to broadcast Vietnamese (i.e. censored) programs.

5.3.3 Ho Chi Minh City TV

Place in Political/Regulatory Framework

Ho Chi Minh City TV (HCMC TV) is a provincial TV station belonging to the Ho Chi Minh City People's Committee. The HCMC People's Committee is a political 'bulwark' comparable to that of Hanoi. Its TV

station broadcasts two programs to the whole Mekong Delta (18 million potential viewers) which is considered the economic center of Vietnam.

Core Activities

HCMC TV produces and broadcasts TV programs. Please refer to appendix E – section Analog Terrestrial TV – for an elaboration of HCMC TV's core activities.

Present Relationship/Plans/Prospects with regard to DTT

HCMC TV is not yet involved in any DTT project. However, they expect to start a trial broadcast at the end of 2002. The situation of HCMC TV is somewhat different from Hanoi TV. In Hanoi, Hanoi TV only broadcasts its own program. In HCMC however, HCMC TV broadcasts its own two programs as well as the VTV programs. **When this situation remains in the digital era, HCMC TV will be the sole digital broadcaster in a market perhaps twice as large as Hanoi.**

Standpoints on Important Issues

Just like Hanoi TV, their standpoint on the issues of **availability**, **affordability**, **accessibility** and **content** are **about the same as VTV**. As far as the timing of DTT implementation is concerned, HCMC TV is fully dependent on VTV to give the green light.

5.3.4 Other TV Stations

Other TV stations are not involved in this research. There are two reasons for this:

- First, according to the plans of VTV, other cities as Danang, Cantho and Haiphong (which will be the first to follow) will not digitize their terrestrial TV broadcasts earlier than 2005. It is likely that the knowledge of DTT at these TV stations is inadequate to conduct useful interviews.
- Second, the available time and money for this research was inadequate for the involvement of more TV stations than VTV, Hanoi TV and HCMC TV.

5.3.5 Conclusions

In the present player landscape for analog terrestrial television, the TV stations control the first two layers of the activity allocation model[30] used for this research. Although the present digital terrestrial TV landscape shows a somewhat different picture, it is likely that **in the short and long term the TV stations will be in control of the content/contribution layer as well as the service & delivery layer** in the DTT player landscape. The potential **main parties** in these layers will be **VTV**, **Hanoi TV** and **Ho Chi Minh City TV**. In the long term it is possible that other TV stations will join the DTT player landscape, although a large extent of uncertainty is accompanied with the digitization of the TV broadcasts outside Hanoi and Ho Chi Minh City.

[30] See chapter 4 and appendix E for an elaboration.

The most important player is Vietnam Television. In the political/regulatory environment, it represents the government and with that also the Communist Party of Vietnam. All provincial TV stations are subordinate to VTV and are in fact subsidiaries of the national TV station.

With regard to the official planning of digitizing of terrestrial TV, VTV is the only party that can make legitimate decisions. However, in practice, political powers are not as centralized as by law. Especially the cities of Hanoi and Ho Chi Minh are strong and have obtained a relative higher autonomy. In television broadcast this is expressed in the position of the TV stations of these cities. They are for example allowed to broadcast in a large area, covering 10 million potential viewers in the Hanoi area and 18 million in the Ho Chi Minh City area.

Still, with regard to digital terrestrial TV, it is likely that **Hanoi TV and HCMC TV will be dependent on VTV's policy on DTT**. Not surprisingly, the standpoints of the two provincial TV stations on implementation issues are in accordance with the VTV policy line.

Because of the limited prospects of conditional access in Vietnam, there are **no business incentives for the TV stations to start digitizing their terrestrial broadcasts**. The **reasons for digitization** of the TV stations are by no means stemming from business interests but from **political interests**. Five and ten year plans make up the guidelines for implementation plans of TV stations. In present policy making regarding DTT there is one main point: digitizing of terrestrial broadcasts is considered an irreversible process. This policy making process is a slow and difficult process.

In the meanwhile, politics cannot keep up with the pace of developments in the Vietnamese electronics business. Next section discusses the electronics companies that have an interest in digital terrestrial television.

5.4 Electronic Companies

Information for this section is obtained through the checklist, given in appendix B.

5.4.1 VTC

Place in Political/Regulatory Framework

VTC – full English name Vietnam Television Technology Investment and Development Company – is a state-owned company founded in 1996 on the basis of the merger of three companies (INTEDICO, TELEXIM and RATIMEX) and placed under the supervision of Vietnam Television[31]. VTC is in fact a subsidiary of VTV, but acts as a totally independent entity. According to industry experts, the relationship between both is not good. Some have even used the term bastard to refer to this relationship. Its origin lays in the compulsory way VTC is founded.

[31] Decision No. 918 QD/TC – THVN dated December 10, 1996, issued by Vietnam Television

Core Activities

Despite all formal objectives[32], VTC is above all a trading company in broadcast equipment. Major activity of VTC has been the supply of all kinds of equipment – from production to transmission – to the provincial TV stations. They often buy cheap secondhand equipment that is written off abroad and sell it to the provincial TV stations (that lack the expertise to buy at the international market).

Present Relationship/Plans/Prospects with regard to DTT

With regard to digital terrestrial TV, **VTC is presently the only active player in service & delivery as well as receiver-end**. From July 2001, VTC started a trial broadcast in the Hanoi area. Their broadcast license expires in March 2002. Their transmission and broadcast equipment has been purchased from ITIS, Tiernan and Hirschman.

An SMT line for the assembly of digital STB has been purchased from Samsung. Benjamin, a Taiwanese STB manufacturer, is cooperating with VTC and presently delivering 3,000 CKD kits per month. Production capacity of VTC is about 500 STB per day so if necessary they can boost their production considerably. However, sales have been only 3,000 in the first six weeks. Present unit price at the Hanoi market is about USD 215.

Interests

VTC's early broadcast trial has its basis in its many interests. Firstly, the **broadcast** functions as a **catalyst for the production and sales of digital STB**. VTC expects the market for STBs to grow fast in the next few years and has a comparative advantage because of its ability to test its products. Further, the advantage consists of being the first to sell STB on the Vietnamese market.

Finally, according to VTC the DVB-T trial will have positive effects on its core business, namely the trading of television equipment. VTC especially aims at the provincial TV stations, and considers this DVB-project as part of the 'image building'.

5.4.2 HANEL

Place in Political/Regulatory Framework and Core Activities

Hanoi Electronics (HANEL) is a state-owned company under the authority of the Hanoi People's Committee. Besides its core business – electronics – it has a broad business scope, varying from construction, housing and hotels to telecom, logistics and insurances.

HANEL seems to be just another state-owned company like any other one in Vietnam, but it is not. The political powers of HANEL are unheard-of. To give an illustration of HANEL's political position, Hoang Van Nghien, former general director of HANEL is presently Chairman of the Hanoi People's Committee. This is comparable to the function of mayor in the west. Besides that, he is member of the Communist Party Central Committee as well as Deputy Secretary of the Hanoi Party Committee.

[32] Refer to legal document of previous note

Present Relationship with DTT

Also illustrative for the political powers of HANEL is the appointment of HANEL as DVB-T research project leader by the Ministry of Science, Technology and Environment in 1998 (see chapter 4). HANEL is often referred to as Hanoi's 'favorite child'.

This is worth mentioning since lobbying is an important activity in doing business in Vietnam with which political powers can come to hand. In this respect, HANEL has managed to receive a loan of almost USD 7 million of the city of Hanoi (and approved by the central government) for a project containing (among others) the production of digital set-top-boxes. The project plan includes the building of a new factory as well as the import of an SMT line for the assembly of personal computers and digital STB. For the assembly of the latter, HANEL is working towards cooperation with Humax, a Korean STB manufacturer.

Plans/Prospects with regard to DTT

HANEL has stated to target an initial production of 1,000-1,500 units per month. Target quality is medium-end and target market price is about USD 300. However, these are very preliminary targets and will be adjusted as the situation requires.

HANEL is presently lobbying at various levels (from city to central government) in order to get the approval for a city loan for a DVB-T trial broadcast in the Hanoi area. In the project proposal, Hanoi TV will be HANEL's partner, wherein Hanoi TV will take care of the content and HANEL will be a 'platform operator'. HANEL has already obtained a broadcast license[33] for the Hanoi area.

Interests

Like VTC, HANEL's business interests in **DVB-T broadcasting** are mainly in the **catalyst function for the production and sales of digital STBs**. The ability to test STBs is mentioned as an advantage of an own broadcast. Further, the possibility to influence the quality, quantity and nature of the content is seen as a strategic instrument for the sales of STBs.

Besides the fact that HANEL believes the market for STBs has the potential to grow in the next years, HANEL's interests in the production of digital set-top-boxes are a part of a wider business strategy. The company – with a core business in electronics in general and color TV sets in particular – is planning to build a new factory including an upgrade in production technology. This plan is said to be a **shift** in **production technology** (from old-fashioned assembly methods as pin-hole insertion to surface mounting technology) as well as in **focus** (from products as analog color TV sets to personal computers and digital STBs).

So the production of digital STBs fits in the whole strategic picture. This especially because the expected volumes of both personal computers and STBs require the production of both to justify the purchase of one SMT line. Further, HANEL considers production of STBs for digital television a logical step from its

[33] UHF channel 47, 1 year valid from first broadcast

TV production. The possibility of integrating both in integrated digital television sets (iDTV) is seen as a promising possibility for the future.

5.4.3 Other

Other potential players are among the Vietnamese electronics companies that have stated to be interested in the STB market. These companies are **Viettronics Binh Hoa, Viettronics Tan Binh** and **ST Electric**. None of these companies have done any preparations for the production of STBs. Moreover, the knowledge of digital terrestrial TV is rather limited. All of the above companies are interested in STB production, provided a foreign company supports them.

According to the representatives of these companies, **the largest hindrance is the uncertainty caused by the lack of clarity from the government**. Without knowledge of the DTT roll out, they cannot make business plans for STB. In this regard, they have a large disadvantage compared with HANEL and VTC that have inside information on the DTT broadcast developments. Besides this, the technological capabilities of VT Binh Hoa, Tan Binh and ST Electric to produce STB are questionable.

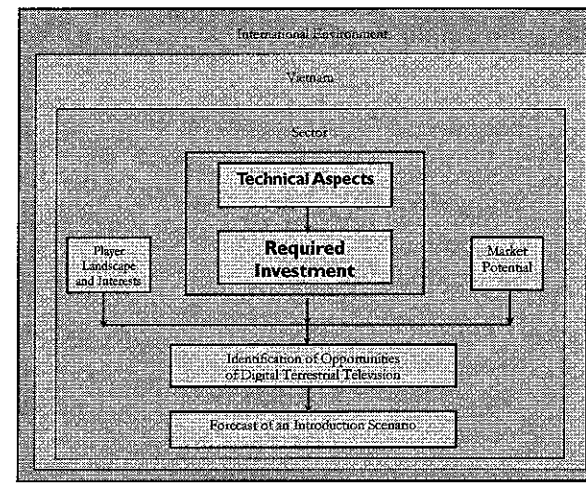
5.4.4 Conclusions

As mentioned in the conclusions of previous section, there are no business incentives for the TV stations to start digitizing their terrestrial broadcasts. **The policy making regarding DTT occurs very slowly, being out of pace with the developments in the Vietnamese electronics business.** Two electronics companies in particular are eager to jump in the market for digital set-top-boxes. Lacking an infrastructure of DTT, one company, VTC, has started a trial broadcast in the Hanoi area. Another company, HANEL is preparing one in the same area.

Apparently, the **business incentives** are to be found in **production and sales of digital set-top-boxes. VTC** and **HANEL** are presently the only (potential) players in the **receiver-end of the DTT chain.** Both companies have interests in **DVB-T broadcasting** because of the **catalyst function** for their business. Both expect the market for STBs to grow fast in the next few years. It is likely that when this is indeed the case, **other companies** will follow rapidly, **provided there is a proper infrastructure present.**

Chapter 6 Required Investment

This chapter describes the required investment for digitization of terrestrial television in Vietnam. The required investment is considered one of the three main variables in the Vietnamese television and broadcast sector for identification of opportunities of digital terrestrial TV in Vietnam. For a graphical presentation of these main variables, please refer to the theoretical framework presented in chapter 1 (figure 1-1).



The main question for the required investment for digital television is the question of the required infrastructure. This chapter first discusses the technical/infrastructural aspects of digitization of terrestrial television transmission. In this discussion, a distinction is made between transmission and reception. Then, a number of assumptions are made with regard to the infrastructure requirements in Vietnam. Finally, indicative figures are given on the required investment in terms of equipment, technical support and training.

6.1 Technical Aspects

This section gives a brief overview of what is roughly needed to go from analog terrestrial TV to digital terrestrial TV. In order to get a good picture of what is needed to get a TV signal into the household, a digital video distribution chain is presented below.

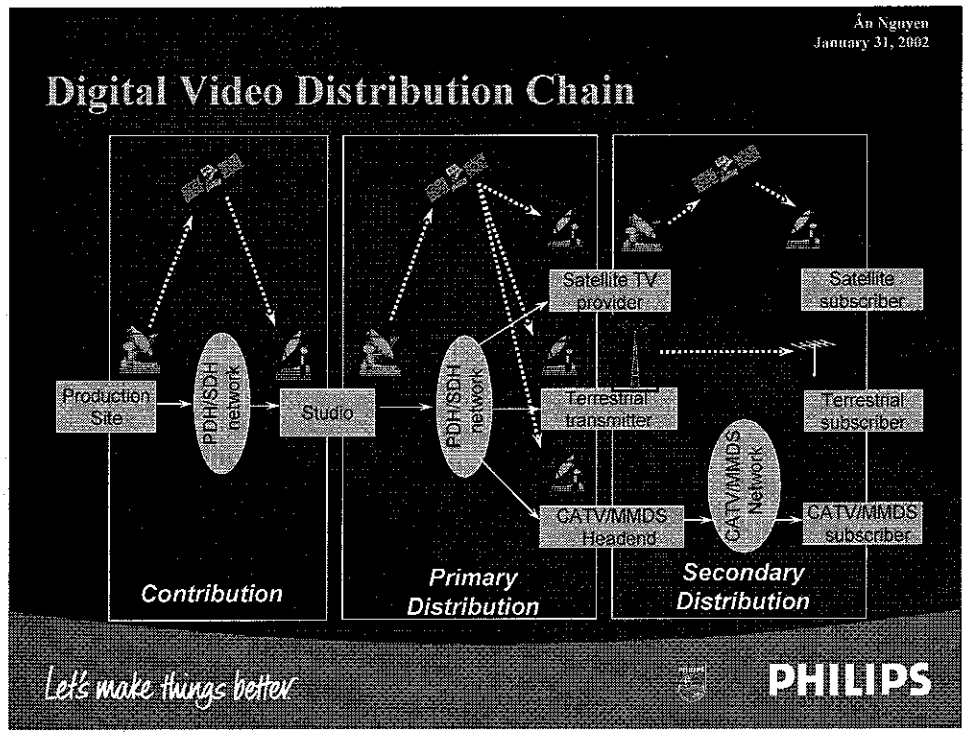


Figure 6-1 Digital Video Distribution Chain

Focus in this research is on the terrestrial distribution of the video signal. In this context, the assumption is that the signal provided to the terrestrial transmitter is digital[34].

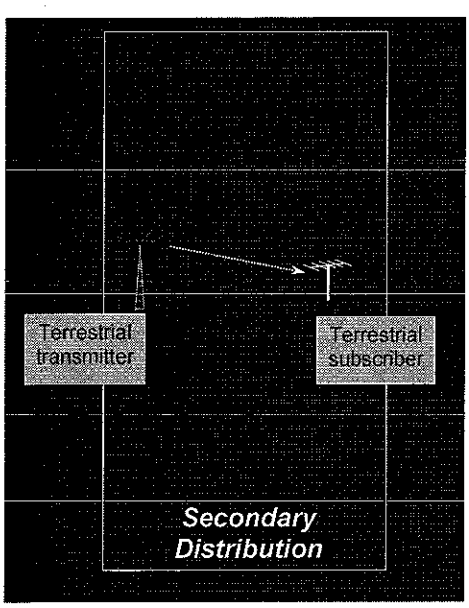


Figure 6-2 Terrestrial Distribution

[34] If this is not the case, it can be easily converted with an AD-converter

6.1.1 Transmission

What needs to be done to get the digital TV signal, consisting of digital video and audio signals, into the viewer's home? The answer to this question is graphically presented in the figure below. Please note that the solution presented below is only an example, based on the Philips DVB-T solutions.

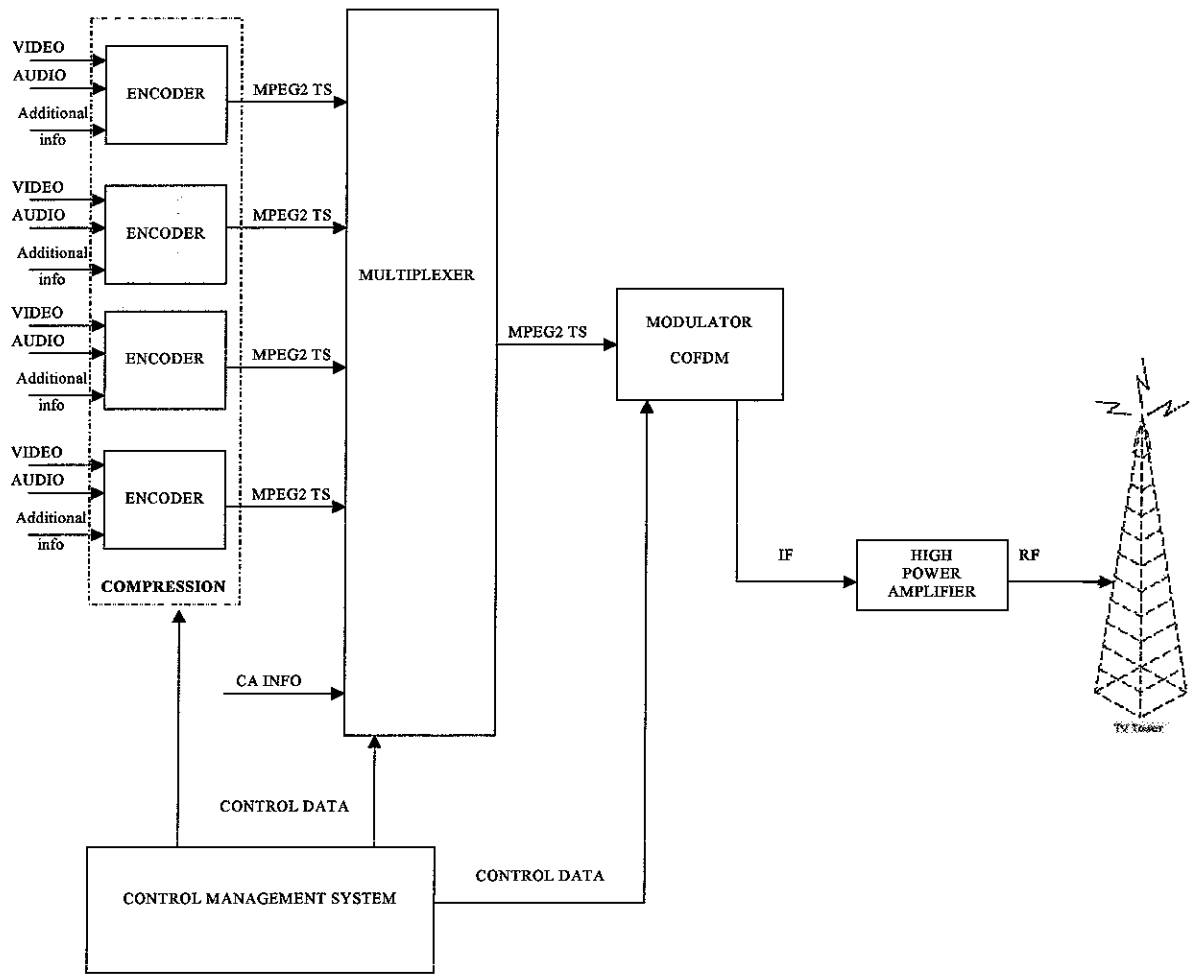


Figure 6-3 Example of DVB-T Transmission System

As can be seen in figure 6-3, the digital TV signal (video and audio) plus additional info is fed to the **encoders**. These encoders will basically compress the signal into an MPEG-2 Transport Stream (TS). There are 2 ways to encode the signal, one is using a CBR (constant bit rate) and the other one is using VBR (variable bit rate) encoding method. In the VBR method, frequency of assigning bit rate to a particular picture or frame is the key: the more frequent the better it is.

The output from the encoders (MPEG2 TS) is fed to the **multiplexer**. The multiplexer multiplexes the incoming inputs and generates one transport stream. It also multiplexes the control data together with the conditional access (CA) info and the video and audio information. The control data is generated from the **Control Management System**.

The output from the multiplexer is fed to the **modulator** before going to the **high power amplifier**, where an RF signal is generated to be transmitted by an antenna on a TV tower.

6.1.2 Reception

The RF signal is picked up by the receiving antenna and fed to the DVB-T set-top-box, which demodulates, demultiplexes and decompresses the signal before converting it into an analog TV signal that is suitable for the viewing on a normal analog TV set.

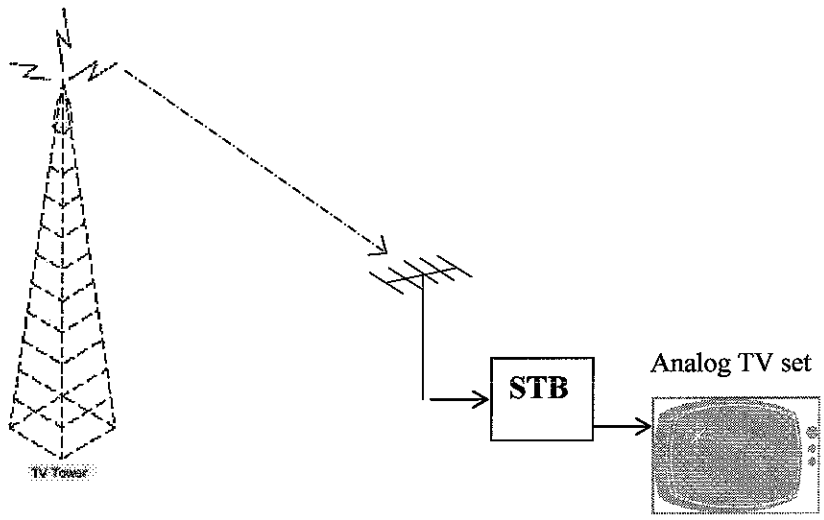


Figure 6-4 Reception of DVB-T Signal

6.2 Infrastructure Requirements

The infrastructure requirements for DVB-T depend to a large extend on the choices of the TV stations. These choices include, among others, the desired geographic coverage, the number of channels/multiplexes, the number of programs/services per channel, the type of services, the desired quality of service and the desired extra DVB features.

Because the introduction of digital terrestrial TV in Vietnam is still in a very preliminary stage, the certainty of the choices that will be made, and therewith the infrastructure requirements, is relatively low. However, in order to be able to make a rough estimate on the required investment, a number of assumptions are made. These assumptions are a translation of policy into choices, based on the information of previous chapter. Because of the preliminary status of DTT in Vietnam, the following will be a prediction on the short term (< 3 years, conform the short term forecasts of chapter 5) only.

Table 6-1 Short Term Assumptions

Policy with regard to	Choices
Availability	
• Regional availability: Hanoi and Ho Chi Minh City are the only cities to implement DTT.	• A single-transmitter network in each city is sufficient
• Variety of services: only free-to-air broadcast.	• No investment in CA systems needed
• Way of reception: rooftop antenna.	• Large radius possible
Affordability	
• Equipment: no subsidy.	• Basic STB, to keep the consumer threshold low
• Services: not applicable because only free-to-air.	• No CA means that STB can be without CA-decoding, smartcard reader etc.
Accessibility	
• Simulcast period: to be assessed later.	
• Free-to-air: all.	
Content	
• Which programs: only the existing Vietnamese programs.	• Possible content: VTV 1, 2, 3 and 4 plus one or two local programs.
• Service quality: SDTV.	• In SDTV, each service/program takes up an average bit rate of 4 Mbps. This means at least 20 Mbps have to be available per channel (assuming 5 programs, no teletext/subtitle or other extra features).
• Desired extra DVB features: none.	

From the above, it can be derived that the infrastructure for DTT will be very basic, for the head-end as well as the receiver-end. In the following, a distinction will be made for the infrastructure requirements for transmission and reception.

6.2.1 Transmission

From subsection 6.1.1, we learned that a TV station needs a compression system (encoders), multiplexer, modulator, control management system, high power amplifier and TV tower and antenna to broadcast a DVB-T signal. In case of geographic coverage of more regions in Vietnam, a network of transmitters would be necessary. In that case, a complicated network – using technologies such as ATM, SDH or PDH, plus many other equipment such as a modulator, re-multiplexer and high power amplifier for each transmitter, and a GPS system and SFN adapter in case of an SFN network – would be necessary. However, since only Hanoi and HCMC will broadcast DTT, a single transmitter network in each city will be sufficient.

Assuming further that each city will broadcast five digital programs (all free-to-air), a broadcaster will need the following equipment for the digital broadcast in one city:

Table 6-2 Estimated Costs (USD)

Equipment	Low-end	High-end
Compression system with five encoders (CBR[i])	100,000	150,000
Multiplexer	20,000	30,000
Modulator	15,000	25,000
High power amplifier (5 kW[ii])	300,000	400,000
Control management system	15,000	25,000
TV tower and antenna (optional[iii])	450,000	600,000
Monitoring system (optional[iv])	25,000	40,000
Redundancy configuration (optional[v])	80,000	130,000
Total	**1,005,000**	**1,400,000**

i) Constant bit rate encoding is enough to put 5 programs into one channel.
ii) 5 kW is enough to provide a coverage area of 1200 sq km.
iii) An existing TV tower and antenna used for analog TV can be used so it is not necessary to invest.
iv) A monitoring system can be used to monitor and analyze the output stream from the multiplexer.
v) A redundancy configuration – containing a digital router (for redundancy switching), 2 extra encoders, an extra multiplexer, an extra modulator and accessories – can be used as a backup system.
Note: All prices above are estimates, excluding shipping costs, import duties or any taxes applicable.

Total equipment costs are thus estimated at about USD 1.0 to 1.4 million, depending on the choice of equipment quality. Some costs can be avoided or reduced, such as the costs of a TV tower and antenna, which can be existing or secondhand. Other equipment, such as a monitoring system or a redundancy configuration, is not crucial for operation but highly recommendable. It is conceivable that a redundancy configuration is not used for trial operation but will be indispensable for full (commercial) operation.

Besides equipment costs, additional investment costs are mainly costs for technical support (for installation, approximately 6-10% of total equipment cost) and training[35] (approximately USD 15,000). Costs of preparation of the broadcast site can be considerable when the building does not satisfy certain necessary requirements[36].

Upgrading of the system can be easily done by simply acquiring additional equipment. For example, for extension of the number of services from five to six, the purchase of one extra encoder (USD 20,000 – 30,000) will suffice. A conditional access system for five scrambled services would cost an additional USD 30,000 – 40,000 (including extra equipment for multiplexer).

[35] Assumption: on-site training of 4 days at rate of USD 3,000 per day per trainer, training manuals plus travel and accommodation costs

[36] These requirements concern (among others) the dimensions of the rooms and traffic ways, shielding, acoustics, dust level, room climate (temperature, humidity), fresh air supply, power supply, earth system, cabling, et cetera.

6.2.2 Reception

In a broadcast infrastructure, the largest part of the investment costs is at the receiver-end. If for example 100,000 households in Hanoi and Ho Chi Minh City will switch to DTT in the next three years, this means that they will invest a total of USD 20 to 30 million in digital set-top-boxes. Compared to this figure, the necessary investment in transmission-end infrastructure is only a fraction of total required investment.

At the beginning of this section it is mentioned that the set-top-box for the Vietnamese market will be very basic. At this moment, VTC is selling its low-end STB for USD 215 (see subsection 5.4.1). Although it is still unclear how many households will eventually purchase a digital set-top-box, the two companies discussed in section 5.4 of previous chapter are evidently convinced of the market potential of DTT. Next chapter will take a closer look at this belief.

VTC has already invested in production technology for the assembly of STBs. The largest investment was the purchase of an SMT[37]-line. Industry experts estimate the costs of this SMT-line (second-hand, from Samsung, Korea) at USD 500,000. HANEL has stated to reserve an amount of USD 1.2 million for the purchase of an SMT-line. However, in contrary to VTC, this SMT-line is also for the assembly of PCs.

Estimated costs for a (new) SMT-line for the assembly of STBs are USD 1 to 2 million. These lines can have a production capacity of up to 20,000 STBs per month. As with the transmission part of the infrastructure, additional investment costs are mainly costs for technical support (approximately USD 50,000 – 100,000) and training (approximately USD 15,000). Costs of preparation of the production site can be considerable when the building does not satisfy certain necessary requirements.

Besides the above costs of production technology, investments need to be made for the purchase of CKD[38] kits and licenses for set-top-boxes. These costs can be considerable and depend upon contract. Estimates vary from around USD 150 per unit for the low-end to around USD 250 for the mid-end.

6.3 Conclusions

For each of the two cities of Hanoi and Ho Chi Minh, the initial investment costs would be considerable for both transmission and reception. For **transmission**, each city would have to invest **USD 1.1 to 1.5 million** for a digital terrestrial broadcast of five programs covering their city and surroundings areas (1200 sq km). The estimated amount includes the costs for all **equipment** (excluding shipping costs, import duties or any taxes applicable), **technical support** and **training**. The equipment costs can be reduced with about USD 500,000 when an existing TV tower and antenna is used, which is very likely. **Required initial investment is then USD 0.6 to 1.0 million.**

[37] Surface mounting technology

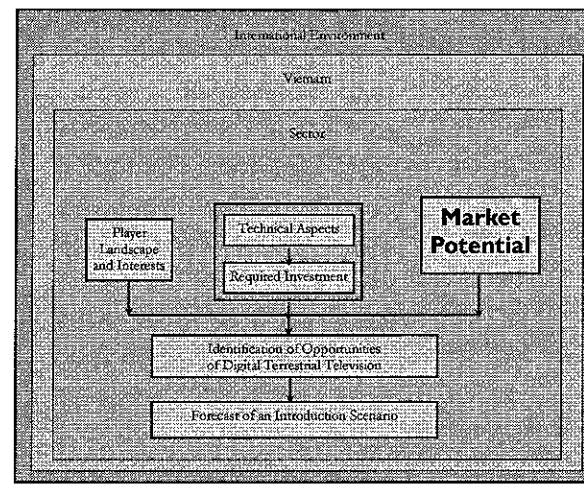
[38] Complete knock-down; the interests of the (potential) players in the receiver-end of the DTT chain (see section 5.4), as well as the capability of these players point out that assembly of STBs, especially in CKD-form, is the most likely way of production. This means that foreign companies need to supply the CKD kits, the design, the development kits and the technical support to the Vietnamese electronics companies.

Initial investment costs (for equipment, technical support and training) for each electronics company that wants to produce (assemble) **STBs** depend on the choice of SMT-line. If one chooses a second-hand, like VTC did, costs can be as low as USD 500,000. If one chooses a new, higher-quality SMT-line that can be used for multiple purposes, costs would be **USD 1 to 2 million**.

Besides these initial investment costs, **additional investment in working capital** is necessary to purchase kits and licenses for STBs. Assuming a working capital for 10,000 units at USD 200 per unit, this would be USD 2 million.

The main question is whether these investments can be earned back in the future. Because the transmission part belongs to the TV stations – and these are not particularly focused on profit – this question especially concerns the reception part, which concerns the viewers/consumers. Next chapter gives a view on the market potential of digital terrestrial TV in general and digital set-top-boxes in particular in the two main cities of Vietnam.

Chapter 7 Market Potential



This chapter describes the market potential of digital terrestrial television in Vietnam. The market potential is considered one of the three main variables in the Vietnamese television and broadcast sector for identification of opportunities of digital terrestrial TV in Vietnam. For a graphical presentation of these main variables, please refer to the theoretical framework presented in chapter 1 (figure 1-1).

The potential Vietnamese market for digital terrestrial TV will be – at least in the short term (< 3 years) – concentrated in Hanoi and Ho Chi Minh City. The main reason for this is the living standard in these cities, which is significantly higher than in the rest of the country. This chapter will present an analysis of the market potential for digital terrestrial television in general and digital set-top-boxes in particular. First, this is done through an analysis of the living standard in the two cities. Purpose is to introduce these markets to the reader as well as to provide a justification for the demarcation of the research. Next, the potential market size for digital STB is determined, using the segmentation approach. Finally, the behavior of the citizens of Hanoi and Ho Chi Minh City – as consumers and as viewers – is analyzed.

7.1 Living Standard

As demonstrated in previous chapter, the costs of the DTT infrastructure will for a large part be in the receiver-end. In practice this means that the viewer, the consumer, has to be able to buy a set-top-box in order to view digital terrestrial broadcasts. Without a sufficient purchasing power of the viewer, digital broadcasting cannot be a success.

The first step in determining the living standard in the relevant regions is to take an overview of a number of macro economic indicators.

Table 7-1 Market Overview

Macro Economic Indicators (2000)	Data
Population	80 million
Households	15.6 million
GDP per capita (USD)	400
GDP growth	6.70%

Source: Philips Vietnam

From table 7-1 only, one could describe Vietnam as a potential market of 80 million people with the highest economic growth rate in Southeast Asia in recent years, but presently with a very low income per capita. Indeed, taking the prices of a digital STB that vary from USD 200 for the low-end to about USD 400 for the high-end, it seems an impossibility for digital terrestrial TV to become a market success.

However, there are reasons to be much more optimistic on the chances for DTT market success in Vietnam. The first is the **distribution of income in the country**. The **largest part of the country's GDP is generated in the two largest cities Hanoi and Ho Chi Minh City** (HCMC or Saigon). Result is that income per capita in these cities is significantly higher than the country's average.

Table 7-2 Market Overview

Income per capita (2000)	USD
Vietnam	400
Hanoi	725
Ho Chi Minh City	1350

Source: DV Consultants

Let's take a look at some indicators of Hanoi and HCMC. Table below shows the figures for the population in Hanoi and HCMC. Remarkable is the large difference between the official governmental census and the unofficial estimates. An explanation for this discrepancy is the residential registration of Vietnamese citizens. Many originally rural citizens who live in the two cities are not allowed to officially register in the city. Massive urbanization in recent years has therefore not been fully accounted for in official figures.

Table 7-3 Market Overview

Population	Official(i)	Unofficial(ii)
Vietnam	76.3 m	80 m
Hanoi	2.7 m	3.2 m
Ho Chi Minh City	5.0 m	7.0 m

(i) April 1999 census
(ii) Estimates for 2000
Sources: General Statistical Office, DV Consultants

Although the population figures between Hanoi and HCMC show large differences, the difference in household number is somewhat smaller. The consequence of the **large extended-family households** is that the **disposable income per household** is much higher than the figure of income per capita suggests. This is especially the case in Ho Chi Minh City, where the average number of persons per household is more than seven.

Table 7-4 Market Overview

Household Number (2000)	Average # per household	Million Households
Vietnam	5.1	15.6
Hanoi	4.6	0.7
Ho Chi Minh City	7.2	1.0

Source: GfK

Table 7-5 Market Overview

Income per household (2000)	USD	per month (USD)
Vietnam	2040	170
Hanoi	3335	278
Ho Chi Minh City	9720	810

Besides the above, there are reasons to believe that the income difference might be even much larger. First of all, above figures are based on official GDP figures. The **real expendable income is likely to be higher**, as much of the income is generated at the 'informal market' and often not accounted for in GDP figures. Another point of thought is the incomes at state-owned enterprises or governmental agencies. The real income of a 'state' employee in HCMC is estimated to be an average of three times higher than the official income. In Hanoi, it is estimated that the official income takes up an average of about two thirds of the real income[39]. The unofficial part becomes more important as one climbs higher in the organizational hierarchy. Whether generated at the informal market or as an 'extra'[40] for state employees, most of these take place in the larger cities, especially Hanoi and HCMC.

A third point of thought is the money inflow from 2 million overseas Vietnamese that reach an average of USD 200 million per month, mainly to HCMC[41]. If all of these would indeed go to HCMC, it would mean an additional average USD 200 per month per household.

All the above illustrates that the average real incomes in Hanoi and HCMC are much higher than the official average of USD 400 per year for the total country suggests. Of course, it is the question how these incomes are distributed among the citizens of these two cities. Taylor Nelson Sofres Vietnam, a marketing and research consultancy bureau, has indicated that **about 1 million urban households in Vietnam can be classified as belonging to the "upper socio-economic classes"**. These classes are defined as **households with incomes above USD 350 per month**. It is these classes in the Vietnamese society on which the development of digital terrestrial television must build on at first. About **half of the Hanoian and Saigonese households belong to these classes**. An estimated **15 per cent of the households in these cities have an income of more than USD 500 per month**[42].

[39] Source: DV Consultants

[40] These so-called unaccounted "extras" can consist of bonuses, free housing, free motorcycles, gifts, etc.

[41] Source: Philips Vietnam

[42] Source: Taylor Nelson Sofres

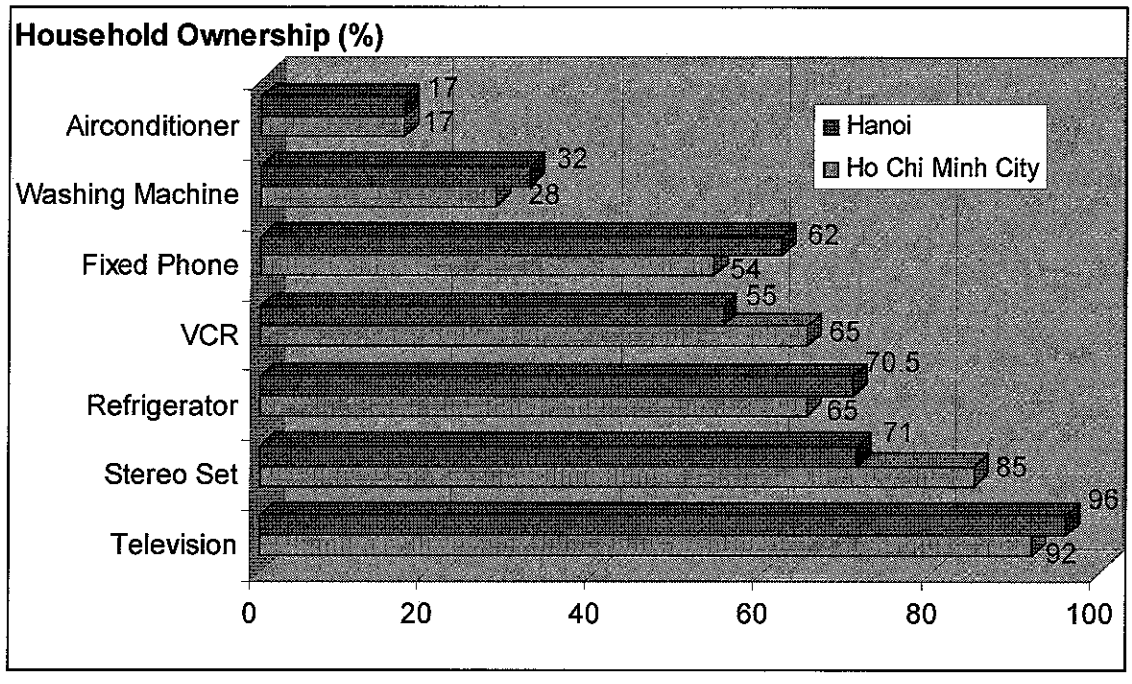


Figure 7-1 Household Ownership of Electrical Appliances (%) in Hanoi and HCMC

(Sources: Philips Vietnam, Taylor Nelson Sofres)

Illustrative for the fact that the living standard in these two cities is much higher than what is suggested in official figures, is perhaps the household ownership of some electronic appliances in Hanoi and HCMC. From these figures and figures before, one could gather that there is a considerable potential market for a "luxury product" such as a digital set-top-box in these two cities.

A more aimed analysis of the market size and market potential of DTT in general and digital set-top-boxes in particular follows in the next section.

7.2 Market Size

The determination of the potential market size for digital set-top-boxes depends on the definition of the target market. Most marketers in Vietnam target their products and services to the upper socio-economic classes in urban areas. Previous section has shown that, when defined at households with declared incomes of above USD 350, this group constitutes an estimated 1 million urban households nationwide, dominated by the citizens of Hanoi and HCMC. To be able to target a specific product as a digital STB and a service as digital TV, a more detailed approach is necessary.

7.2.1 Segmentation

It is obvious that the **market for digital TV will take up only the higher segments of the total TV market**. The determination of the size of these segments will follow a two-way track.

- The first one is the **segmentation per screen size**, based on the assumption that households that have a 29-inch screen TV will be more likely to purchase a digital STB than households with a 14-inch. The value added of digital TV, especially the higher image quality, is better expressed in a large-screen TV than in a small one.
- Second track of analysis is the **price segmentation for TV sets**, based on the value-for-money principle. Households that own or purchase a USD 100 TV set are less likely to purchase a USD 200-400 digital STB than households that are willing to pay USD 1000 for a TV set.

Besides the above mentioned assumptions, the following assumptions have been made:

- **Representativeness**

  Segmentation in TV sales in Hanoi and HCMC are more or less representative for purchasing behavior of the households in these two cities. This assumption is based on the TV ownership rates of almost 100 per cent in these cities (see figure 7-1) that suggest a large replacement's market. This in turn suggests that the TV buyers are a cross-section of all households in Hanoi and HCMC, since every household has to replace its TV set sometime.

  To get a view on the representativeness of this 'cross-section', table below shows the volume of TV sales in Hanoi and Ho Chi Minh City. Considering the estimated number of households in these cities, the TV buyers take up about 1/5 to 1/4 of the city households.

Table 7-6 Color TV Sales in Hanoi and Ho Chi Minh City

CTV sales ('000 units)	1998	1999	2000
Hanoi	121	139	158
Ho Chi Minh City	269	277	254

Sources: GfK, Philips Vietnam

- **Points of Reference**

  Niche market:
  - Households owning or planning to buy a TV set with a screen size of 25 inch and above.
  - Households owning or planning to buy a TV set of more than VND 6.5 million (USD 450).

  This refers to the crème de la crème of the market, which will most likely be the first target group for digital TV.

  Upper market:
  - Households owning or planning to buy a TV set with a screen size of 21 inch and above.
  - Households owning or planning to buy a TV set of more than VND 4.5 million (USD 315).

  This refers to the upper socio-economic classes of the market, which can be considered a potential market for the long term (> 3 years).

Screen size and price are more or less linked, as the larger the screen size, the more expensive is the TV set. See table below for the average prices in 2000.

Table 7-7 Average Prices for Color TV (2000)

	Screen Size	VND (million)	USD
Conventional TV	14"	2.2	155
	16"	2.9	205
	20"	3.4	240
	21"	3.7	260
	25"	5.9	415
	29"	9.8	685
Flat Screen TV	21"	5.5	385
	25"	8.5	595
	29"	13.0	910

USD prices are rounded off and using exchange rate end of 2000: USD 1 = VND 14,280
Source: GfK

Reference points for screen size are chosen for practical reasons: households with a larger TV screen will benefit more from the value-added of digital TV than ones with a smaller TV screen.

On the other hand, reference points for prices are based on the prices for digital STBs. Presently there is only one brand and type of STB in the Vietnamese market: VTC DT T5-2001, sold for VND 3.2m (USD 215). This product has demonstrated to be low quality. Future STBs of higher quality are estimated to come at about USD 300+. Assuming that the digital set-top-box will be regarded by the Vietnamese consumers the same as the VCR or the VCD-player: **an electronic device supplemental to the television set**[43] – it is unlikely that Vietnamese consumers are willing to pay more for an STB than what they pay or have paid for their TV set.

Therefore, the upper market reference point is chosen at about USD 300 and the niche market reference point 50 per cent higher at USD 450.

- **Similarity**

The determined **niche market** for color TVs is the **potential niche market** for digital STBs, while the determined **upper market** for color TVs is the **potential upper market** for digital STBs.

Ratio of Screen Sizes

Figure 7-2 shows that more than half of the sold TV sets in Vietnam have a screen size of 20 inch and lower. The figures of Hanoi and HCMC show about the same picture for these segments, although in 2000 these segments take up slightly less than half of the total TV market in these cities (48 per cent, see figure

[43] This because it is likely that analog terrestrial broadcasts will continue, which means that a digital STB is not necessary to watch TV

7-3 and 7-4). 21 inch is the most sold screen size, for Vietnam in general as well as for its two most important cities.

The markets of Hanoi and HCMC show a gradual shift from small screen (in 1997: 50 per cent taken up by 14" and 16" TV sets) to medium screen TV sets. Taking the definition of 25" inch screen and above as a point of reference, the niche market in Hanoi and Ho Chi Minh City has grown considerably in recent years. Where in 1997 sales of 25" screen and above took only 4 per cent and 2 per cent in Hanoi and HCMC respectively, segment of these sales increased to 9 per cent for both cities in 2000. Same applies for the upper market: sales of 21" and above grew from 27 per cent and 30 per cent in 1997 to 51 per cent and 52 per cent in 2000.

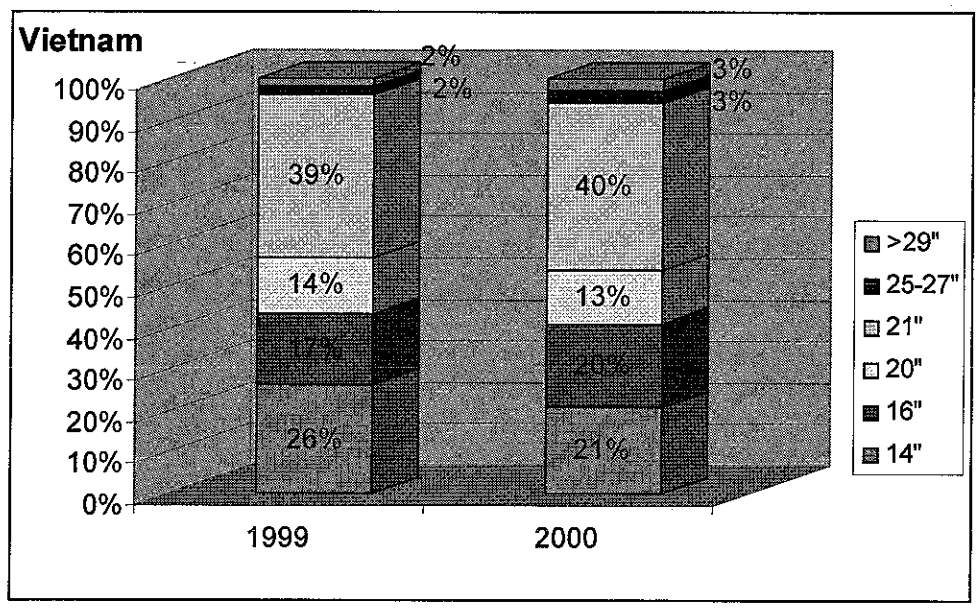


Figure 7-2 Ratio of Screen Sizes

(Source: GfK)

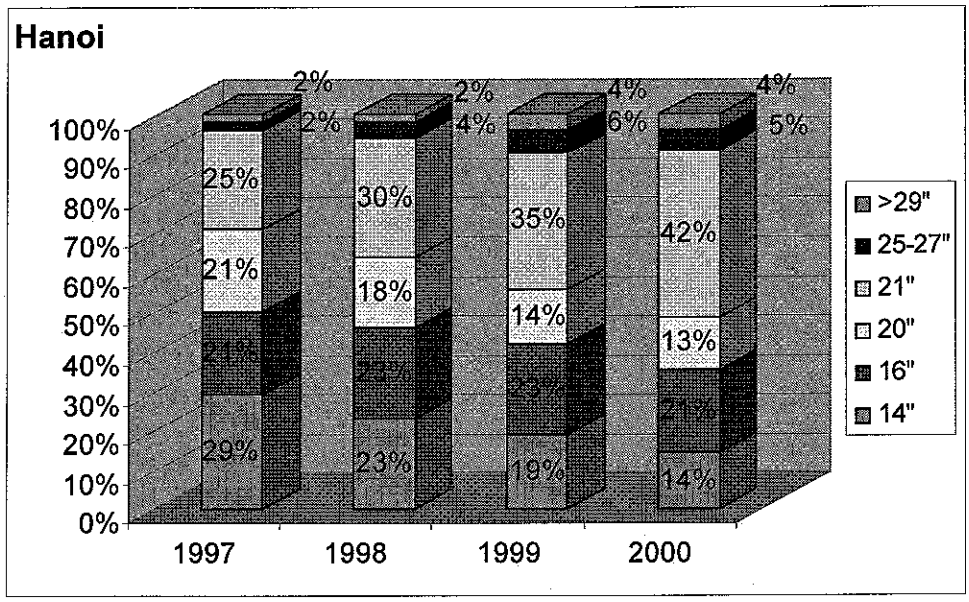


Figure 7-3 Ratio of Screen Sizes

(Source: GfK)

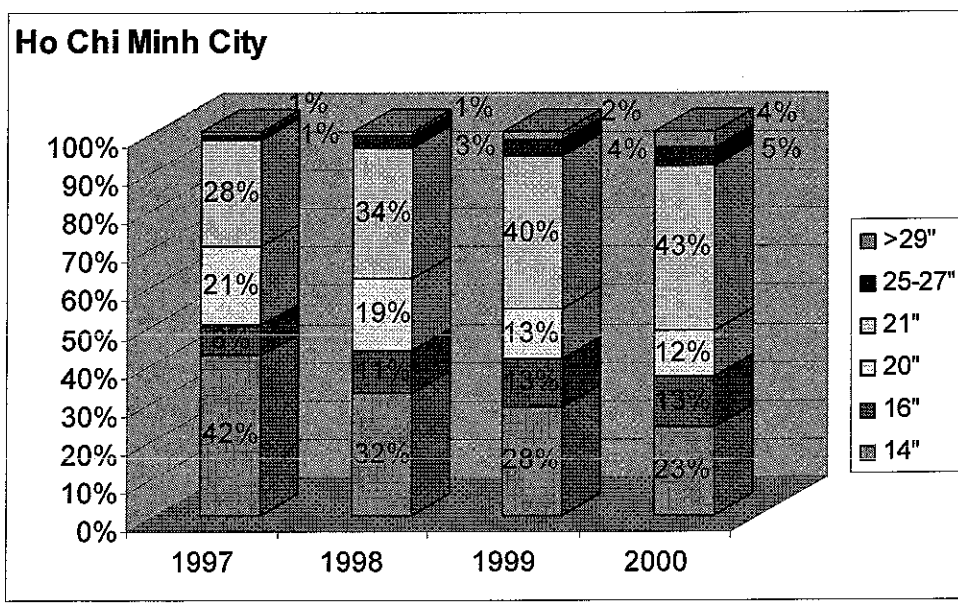


Figure 7-4 Ratio of Screen Sizes

(Source: GfK)

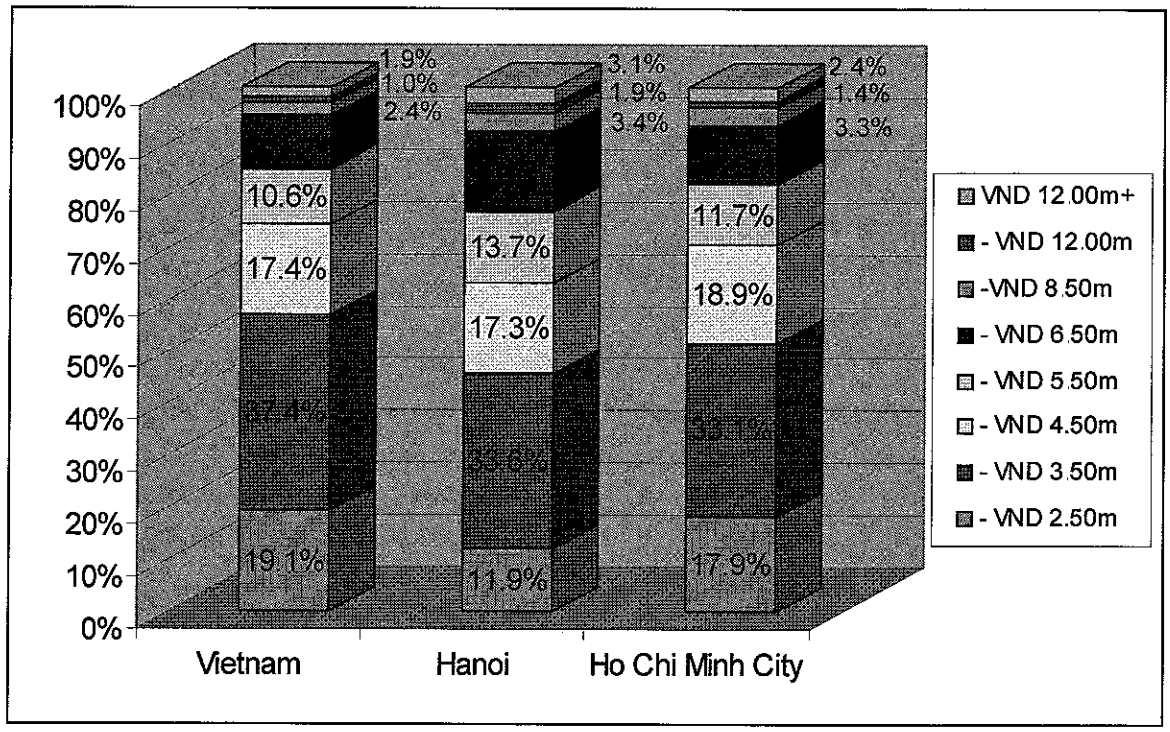


Figure 7-5 Price Segment for 2000

(Source: GfK)

Price Segments

Segmentation through price shows about the same picture as the segmentation through screen size. Sales of the low-end TV sets are high, while high-end sales are marginal. If TV sales of VND 6.5 million per set would be point of reference, the niche market in Hanoi and HCMC takes up about 8 per cent and 7 per cent respectively of the total TV market. TV sales of VND 4.5 million and above per set take up 37 per cent in Hanoi and 30 per cent in Ho Chi Minh City.

7.2.2 Figures

Both reference points for the niche market (25"+, VND 6.5m+) come to about the same figures:

- 8-9 per cent in Hanoi; and
- 7-9 per cent in Ho Chi Minh City

for the year 2000.

In **absolute figures** this means that the **niche market** consists of about **60,000 households in Hanoi** (8.5%), and about **80,000 households in HCMC** (8.0%).

Reference points used to determine the upper market (21"+, VND 4.5m+) have resulted in different figures:

- 51 per cent based on screen size and 37 per cent based on price in Hanoi; and
- 52 per cent based on screen size and 30 per cent based on price in Ho Chi Minh City

for the year 2000.

In **absolute figures** this means that the **upper market** consists of about **300,000 households in Hanoi** (44%), and about **400,000 households in HCMC** (41%).

7.3 Consumer Behavior

Vietnamese consumer behavior is an interesting thing. Although per capita income figures show an average of about USD 60 and USD 110 per month in Hanoi and Ho Chi Minh City respectively, over 90 per cent of the households own a TV (see figure 7-1). In Hanoi the TV penetration is even higher than in HCMC, although the average income is much lower and the households smaller.

The high TV penetration suggests that television has conquered an important place in the daily lives of the Hanoians and Saigonese. Although TV is still the most important propaganda tool for the Vietnamese government and the Party, it is also a form of entertainment. Therefore, it is sensible to look at how the average Hanoian and Saigonese spend their spare time.

Leisure Activities

Before the early 90's, leisure time was spent largely 'filling in time'. Whether watching the crops grow, drinking tea, or just hanging out pondering about the future, the general urban population was incredibly limited in terms of the variety of available entertainment. This was mainly a question of economics: entertaining oneself is considered a non-necessity in times of limited economic resources. This has changed substantially in the last ten years, as the Vietnamese economy grew fast, concentrated in the two main cities.

According to a survey conducted by Taylor Nelson Sofres in 1999, eating out, watching TV and cruising around town on motorcycles dominated all social activities. Over three quarters of the Hanoian and Saigonese respondents noted that they eat out at least once a week. Consistent with one of Vietnam's favorite pastimes, eating and drinking are part of almost all social activities. Cruising around town was noted as second most popular leisure activity. Over half of the respondents 'cruise' on a weekly basis. This activity is largely dominated by younger Vietnamese aged 15 to 29.

TV Transfixion [44]

Not surprisingly, with TV ownership at over 90 per cent, watching TV is the third most popular form of entertainment in Vietnam. In **Hanoi, where TV transfixion is much stronger**, almost **two thirds** of all respondents are watching TV when at home, in comparison to **45 per cent** of the **Saigonese**. However, Saigonese actually have a stronger tendency for TV, if one includes the fact that two fifths of the Saigonese are watching videos.

As the household ownership figures (see figure 7-1) may have suggested, consumers in Hanoi and HCMC behave very differently. This dichotomy is not surprising, given the differences between Northern and Southern culture and the fact that the North and the South have only been reunited for 27 years. Another

[44] "TV transfixion" is used in marketing and advertisement as the extent of TV watching.

Taylor Nelson Sofres research revealed that VCRs, VCD-players, karaoke machines and motorcycles all have a much higher penetration in HCMC. Although partially due to Hanoians' lower incomes, another reason explaining this difference is that **Hanoians still look at entertainment in a more traditional way than Saigonese, who are more on the lookout for external stimuli since they are exposed to more foreign entertainment media.**

Purchasing Mentality

On the other hand, **Hanoians appear to buy and own more household conveniences than Saigonese.** Refrigerators, washing machines, air conditioners all have higher or equal penetration in Hanoi. Simply put, **Hanoians spend more time at home**, go out less and hence **give more priority to these in-home convenience items.** This is further validated by the fact that fixed line phone penetration is higher in Hanoi than in HCMC (see figure 7-1).

The stronger TV transfixion and the larger home-spending time of Hanoians explain only a part of the figures. Watching the segmentation figures of previous section, Hanoi shows a tendency towards higher-end products. The niche market was determined at around 8 per cent in both cities, although the purchasing power in Ho Chi Minh City is much larger. Based on price segmentation, the share of the upper market in Hanoi (37%) is even larger than in HCMC (30%).

The **tendency of the Hanoian towards higher-end products** is believed to be a result of the so-called "only the best is good enough" mentality, and is not limited to the TV market only. An excellent example of this mentality can be found in the motorcycle market. In Hanoi, most motorcycles carry Japanese brands such as Honda, Suzuki and Yamaha. These brands are considered the best quality and cost around USD 1,800 for the common models such as Honda Dream. In Ho Chi Minh City however, the consumer mentality is more practical – Saigonese are said to want "value for money". For example, most Saigonese motorcycles carry Chinese or Taiwanese brands. These motorcycles have exactly the same look and appearance as their Japanese counterparts, but are only about a quarter to a third in price[45].

Also in the TV market, lower end brands have a larger share in HCMC then in Hanoi. The Saigonese TV buyer can be typified as someone who wants the largest screen and the most features his money can buy. The Hanoian TV buyer on the other hand, can be typified as someone who wants the best his money can buy. Although these are just some typifications, the figures seem to validate these.

Table 7-8 Color TV Market – Brand Share of Low-End Brands

Brand share by unit (2000)	Hanoi	Ho Chi Minh City
Belco	3.7%	2.7%
Hanel	1.6%	5.0%
TCL	0.5%	1.2%
Other low-end	2.7%	7.2%

Source: GfK

[45] Source: DV Consultants

Besides the differences mentioned above, Hanoians and Saigonese have one important thing in common. Just like all other Vietnamese people, they tend to have a desire to be on the forefront of technology, which has resulted in considerable household ownership figures of electronic appliances, considering their income level. People do not only buy what they really need, and that gives opportunities for a product as a digital set-top-box.

With regard to digital STB, the different purchasing mentality in the two cities has to be taken into consideration. A digital STB is on itself through its advanced and high-tech features already a "niche product". In this respect, **Hanoians are likely to take up this new product earlier and faster than their Southern kin. The Saigonese market will likely take up slowly**, but when the digital STB has demonstrated its value to the early users, **the market will mature faster than in Hanoi, due to the larger purchasing power of Saigonese households**.

As any new product, the market success of the digital STB depends for a large part on its value-added. This value-added should not only be the higher quality of image and sound, but also the content of the received signal. In this regard, it is sensible to take a look at the viewing behavior of the Vietnamese.

7.4 Viewing Behavior

With regard to the supply of TV programs, both Hanoi and Ho Chi Minh City have about the same. Both cities provide four terrestrial TV programs, as well as an MMDS system with 9 to 12 channels. However, the latter has a very low penetration of about 2,000 subscribers in Hanoi and 3,000 in HCMC[46]. The analysis of the TV audience will therefore be limited to terrestrial TV.

In Hanoi, broadcasted terrestrial programs are VTV 1, 2, 3 and Hanoi TV, and are good for 54 hours per day. In HCMC, 66 hours are broadcasted per day via VTV 1 (VTV 2 when VTV 1 is off air), VTV 3, HTV 7 and HTV9. In both cities there is a possibility to receive programs from adjacent provinces, but the audience for these programs is minimal.

Although in HCMC the supply of TV programs is larger and more entertaining[47], TV transfixion is stronger in Hanoi. Reasons have been elaborated in previous section. Besides this difference, the TV audiences in both cities have about the same preferences. Most popular TV programs seem to be Chinese series. Table below shows the most viewed TV programs in 2000.

[46] Sources: VCTV and SCTV

[47] In Hanoi the content is more political oriented and the censorship stronger.

Table 7-9 Top TV Programs in 2000

Hanoi		*Ho Chi Minh City*	
Program	**Genre**	**Program**	**Genre**
Cong chua Hoan Chau	Series/Chinese	Cong chua Hoan Chau	Series/Chinese
Vi than suc manh	Series/American	Tan Bao Thanh Thien	Series/Chinese
Khang hy vi hanh	Series/Chinese	Giao thoi	Series/Vietnamese
Song o day song	Series/Vietnamese	Khang hy vi hanh	Series/Chinese
Cuoc doi o co be Sabelita	Series/Mexican	Dien dan van hoa nghe thuat	Entertainment/Art&Culture

Source: Taylor Nelson Sofres

Although series are the most popular, they take up only 23% of the broadcasted programs. Movies are very popular too, but most people rent videos (tape or VCD) to watch them since the supply of movies on TV is minimal (see figure 7-6 below). Television in Vietnam is not a question of supply and demand as any other business. In fact, it is not considered a business at all. This seems to be the major issue for success of digital TV. **For digital terrestrial TV to be a market success, viewers' desires should be taken more into account than is the case now.**

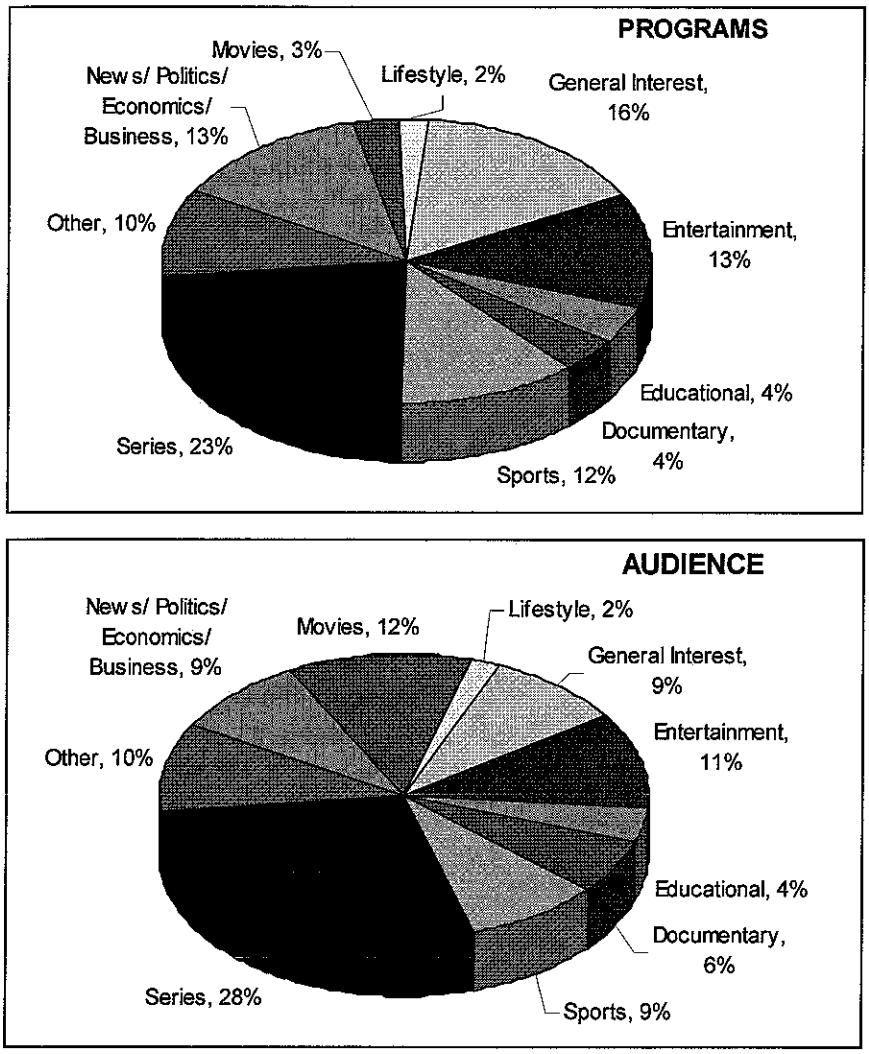


Figure 7-6 TV Programs and Viewing Audience in Hanoi and HCMC (2000)

(Source: Taylor Nelson Sofres)

7.5 Conclusions

On first sight, Vietnam, as one of the poorest countries in the world, seems to be a place with no commercial opportunities for digital terrestrial TV. With a price of USD 200-400 per digital set-top-box and a GDP per capita of USD 400, digital TV seems to be far-fetched.

The first section of this chapter has illustrated that the average real incomes in Hanoi and HCMC are much higher than the official average of USD 400 per year for the total country suggests. Taylor Nelson Sofres has indicated that about half of the Hanoian and Saigonese households belong to the so-called "upper socio-economic classes", defined as households with incomes above USD 350 per month. An estimated 15 per cent of the households in Hanoi and HCMC have an income of more than USD 500 per month.

The potential markets for STB of these cities have been estimated as follows:

Hanoi
Niche market: 60,000 households (8.5%)
Upper market: 300,000 households (44%)

Ho Chi Minh City
Niche market: 80,000 households (8.0%)
Upper market: 400,000 households (41%)

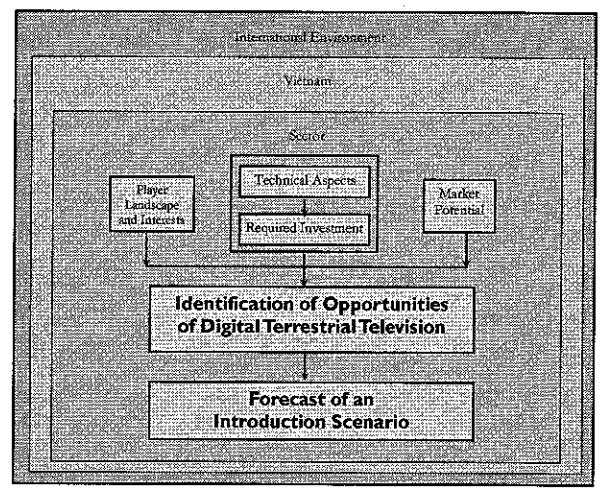
The so-called niche market could be viewed as a target for the short term (< 3 years), while the upper market could be viewed as a target for the long term (> 3 years).

The question is of course whether digital terrestrial TV will actually be able to reach these potential markets. Consumer and viewing behavior of the citizens of Hanoi and HCMC is no hindrance for the success of digital terrestrial TV in Vietnam. TV has conquered its place in daily life and has become the third most popular form of entertainment. Series and movies enjoy an unprecedented popularity. As long as the offer is good, the potential is there. This means that when digital terrestrial TV, or – to speak in terms of a consumer – a digital STB, can demonstrate its value-added, the Hanoians and Saigonese will buy it.

This value-added could for example be (besides the higher picture and audio quality) the ability to receive an extra program, containing movies and series. However, this is still a political issue as discussed in chapter 5. Next chapter will identify the opportunities of digital terrestrial TV in Vietnam, based on the analyses of this and previous chapters.

Chapter 8 Opportunities of DTT in Vietnam

As mentioned in chapter 1, the goal of this research is *to inform Philips Digital Networks about the opportunities of digital terrestrial television in Vietnam.* In order to achieve this goal, a research problem, seven research questions and a research framework were formulated and designed. The latter has been displayed repeatedly at the beginning of each chapter. The chapters 2 to 7 each discussed a concept of the framework, while each part of the framework was derived from the research questions. This chapter is the conclusional chapter of this thesis. Based on the chapters 2 to 7, this chapter identifies the opportunities of digital terrestrial television in Vietnam and provides a summary of conclusions of the previous chapters.



Based on the identification of opportunities, the research problem is answered and three introduction scenarios are forecasted. As mentioned in chapter 1, as a result of this research Philips Digital Networks can decide which role it wants to play in the introduction of DTT in Vietnam. Assisting this decision, recommendations are formulated in the last section of this chapter.

8.1 Summary of Conclusions

Seven research questions were posed in chapter 1. These questions were answered elaborately in the previous chapters. Brief answers to these questions form a summary of conclusions and display the opportunities of DTT in Vietnam step by step.

1) What are the options for the digitization of television transmission?

There are four main broadcast transmission systems: terrestrial, cable, satellite and microwave. All systems have analog as well as digital versions. Important issue is whether the delivery system is suitable for the Vietnamese situation. While in other countries cable, satellite and microwave (MMDS) are important modes of delivery, in Vietnam these are **not available** (cable), **forbidden** for common citizens (satellite), **difficult to access** (MMDS) or **too expensive** (MMDS).

On the other hand, **terrestrial TV** is widely **available** (over 80% coverage in Vietnam), easy to **access** (a TV set and antenna are sufficient), and more **affordable** (all services are free-to-air). Considering the Vietnamese situation which is not expected to change in the near future, terrestrial TV is the only suitable television transmission system.

In certain perspective, Vietnam is starting from an almost clean sheet, with only terrestrial television developed to a certain stage. The country is yet to invest in new infrastructures, which gives it a "backward advantage" compared with the more industrialized countries in Europe and North America. **The key issue is that Vietnam could skip the investment in analog technologies and start digitizing right away. It is clear that in Vietnam, the digitizing effort should be in terrestrial television.**

2) What are the advantages of digital terrestrial television for Vietnam?

DVB-T, the most important standard for digital terrestrial TV, offers many advantages above analog terrestrial TV. The advantages include:

Capacity – DVB-T allows the transmission up to 10 television channels in a single VHF or UHF channel (instead of one with analog), thus increasing the content on terrestrial networks.

Quality – DVB-T offers interference-free reception and DVD-quality video and audio (including wide-screen picture and multi-channel surround sound)

Flexibility –DVB-T allows broadcasters a huge amount of flexibility in striking a balance between three variables: technical quality, signal robustness and number of services.

Extra – Other possibilities of DVB-T include:

- Multi-lingual audio and subtitling
- Conditional Access (CA)
- Electronic Program Guide (EPG)
- Interactive and data services

These advantages do not all apply to the Vietnamese situation in the same extent. Capacity for example is not a decisive reason for digitization of terrestrial TV in Vietnam, as the amount of available content is small and the number of available channels is large. Although the DTT project team under the direction of HANEL has recognized the advantages above in its report to the Vietnamese government, **none of the advantages above are decisive reasons for the choice to implement digital terrestrial TV in Vietnam.** From political scenes it is emphasized that the Vietnamese government is determined not to lag behind other countries in the region and encourages Vietnam Television to speed up the implementation schedule. More strongly, interviews with the TV stations have shown that the reasons for digitization of the TV stations are by no means stemming from business interests but from **political interests** (see question 5).

3) What is the role of television in Vietnam?

With a per capita GDP of only USD 400 in the year 2000, Vietnam is among the world's poorest countries. However, with a population of 80 million people and a growing economy, Vietnam promises to be an important market for the future.

Television has become more and more important in the daily lives of the Vietnamese. Showing an incredible growth, Vietnam Television (VTV) has managed to successfully build a television network in a few years. According to formal figures, the Vietnamese (terrestrial) television network reaches 65 million potential viewers. Television penetration is relatively high at 10 million TV sets considering Vietnam's average income level.

Television in Vietnam has always had the primary purpose to educate and inform the people. The attitude of the Vietnamese government with regard to television is amply expressed in governmental decree no. 52/CP:

"Vietnam Television is a central Television, an organization under the administration of the Government. It has the functions of an agency for disseminating Party and State's policies"

Besides this, the decree also states that Vietnam Television is "responsible for state management of television technical development throughout the country".

The position of Vietnam Television within the political-regulatory framework of Vietnam gives a clear image on the role and importance of television in Vietnam. Vietnam Television is an institution under the direct administration of the Vietnamese government, meaning that they are equal in administrational rank as for example the General Department of Posts and Telecommunications.

However, due to the power of the television medium as a propaganda tool, in practice the political role of Vietnam Television might be even greater. A saying in the political scene is that "Vietnam Television is the Government, and the Government is Vietnam Television". **The political environment puts the medium of television in a peculiar position. On the one hand it is warmly welcomed by the political leaders as it can serve as a propaganda machine for party and state. On the other hand however, the government limits the possibilities of the television medium by strongly controlling and monitoring of the press and media.**

Digital terrestrial TV finds itself in the same position. **Technological progress is warmly welcomed but is resisted when it brings too much change in the political status-quo.** A typical example is the forced cancellation of the digital broadcast of CNN, TV5 and DW in Hanoi, a few weeks after VTC started a DVB-T trial broadcast.

4) How is the present situation in the television and broadcast sector?

The Vietnamese television broadcast sector is not a business, but a **propaganda instrument for the central and provincial government**. All TV stations belong to the government. Besides being the central broadcaster, Vietnam Television (VTV) is also the regulator, supervisor and executor of laws and regulations involving broadcasting and propaganda. Therefore, VTV can be identified as the most important party in this sector.

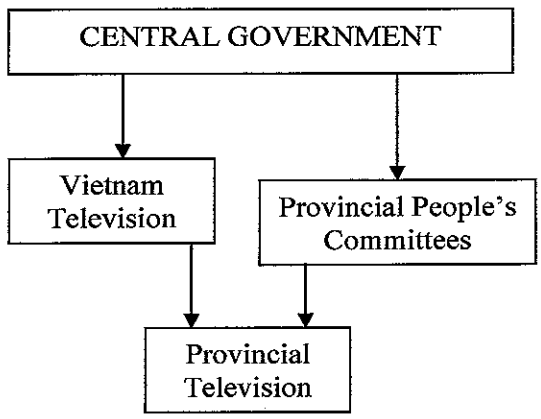


Figure 8-1 Position of Vietnam and Provincial Television

Although the infrastructure for analog terrestrial television is far from complete, there are already developments in digital terrestrial TV. This does not need to be a problem; it could even be a "backward" advantage, by skipping the investment in analog technologies and start digitizing terrestrial TV. This process has already started, and the question is now in which direction it will proceed.

Spectrum scarcity as in other countries is **not the case in Vietnam.** The amount of available content is small and the number of available channels is large. This implies that the potential capacity of digital terrestrial TV is huge, even with simulcast.

5) Who are the main parties involved in the introduction of digital terrestrial television, and what are their interests?

The main parties involved in the introduction of digital terrestrial television are Vietnam TV, Hanoi TV, Ho Chi Minh City TV, VTC and HANEL. These parties can be divided into two groups: TV stations and electronics companies.

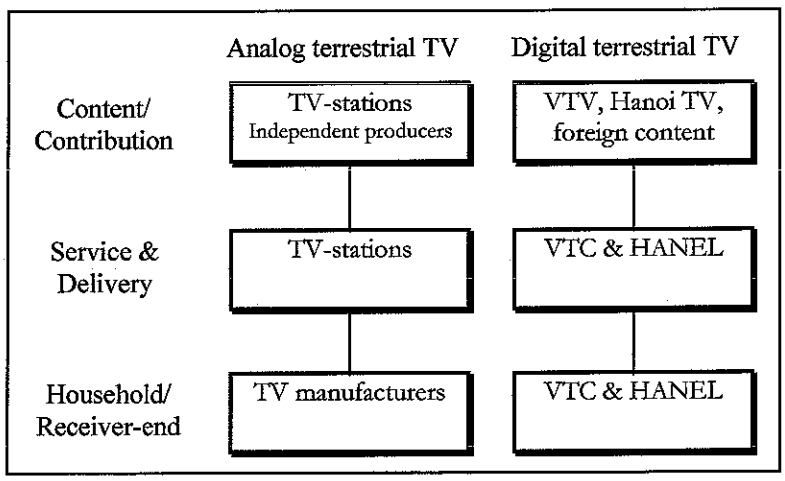


Figure 8-2 Present Player Landscape in Terrestrial TV

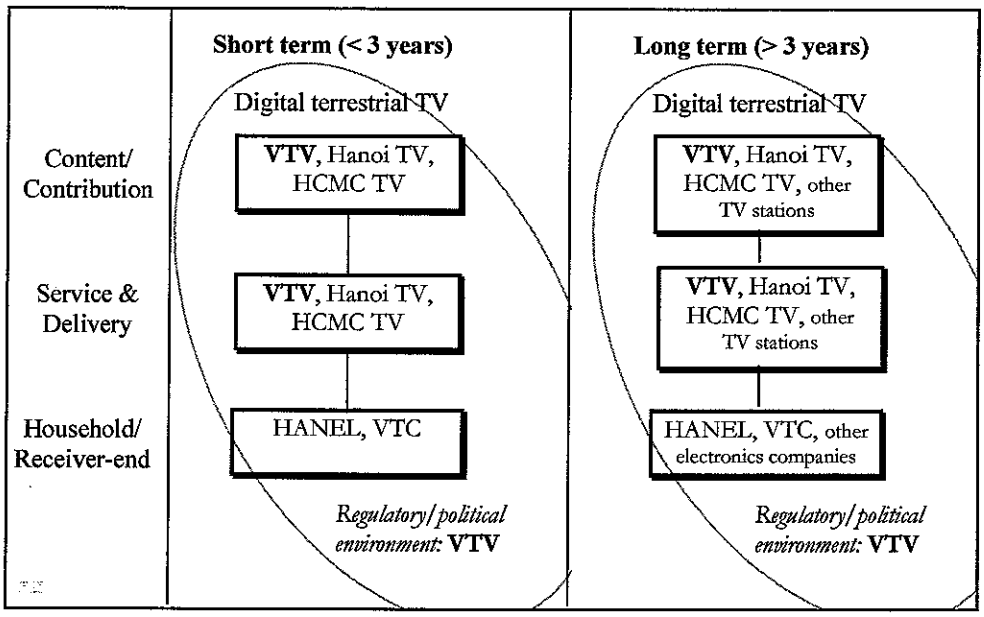


Figure 8-3 Future DTT Player Landscape

In the present player landscape for analog terrestrial television, the TV stations control the first two layers of the activity allocation model used for this research. Although the present digital terrestrial TV landscape shows a somewhat different picture, it is likely that **in the short and long term the TV stations will be in control of the content/contribution layer as well as the service & delivery layer** in the DTT player landscape. The potential **main parties** in these layers will be **VTV, Hanoi TV** and **Ho Chi Minh City TV.** In the long term it is possible that other TV stations will join the DTT player landscape, although a large extent of uncertainty is accompanied with the digitization of the TV broadcasts outside Hanoi and Ho Chi Minh City.

The most important player is Vietnam Television. In the political/regulatory environment, it represents the government and with that also the Communist Party of Vietnam. All provincial TV stations are subordinate to VTV and are in fact subsidiaries of the national TV station (see figure 8.1).

With regard to the official planning of digitizing of terrestrial TV, VTV is the only party that can make legitimate decisions. Not surprisingly, the standpoints of **Hanoi TV** and **HCMC TV** on implementation issues are **in accordance with the VTV policy line.**

In short, this policy line on DTT is as follows:

- First implementation of DTT in Hanoi and Ho Chi Minh City.
  The urban population in these two areas (about 10 million people) has a significant higher purchasing power than the rest of the country, which is of importance for successful introduction of DTT.

- Free-to-air broadcast.
  Business models in other countries are for a large part based on conditional access. In Vietnam, the prospects of a successful business model based on conditional access are limited. VCTV in Hanoi and

SCTV in Ho Chi Minh City that are presently offering CA services through analog MMDS are having very meager numbers of subscribers. However, CA is not ruled out by the TV stations.

- Mobile and portable (indoor) reception is no priority.
  Reception through rooftop antenna will be the main way of receiving digital terrestrial TV.

- No subsidy of digital set-top-boxes.
  Unlike ONdigital in the UK, the Vietnamese TV stations cannot and will not subsidize STBs in any way.

- Simulcast period will be assessed per region.
  Simulcast is a way to ensure that TV services are accessible to a large public. This is considered very important because television has a public and political function. Conditions for analog switch off are not made up yet. VTV has stated that it will review this issue on a situational basis as the status of digitization of each region will be different. According to preliminary plans the latest switch off will be around 2020.

- At first only simulcast of existing Vietnamese programs.
  There will be no new programs for digital terrestrial TV unless there is a large enough public for those programs. Foreign content is a sensitive issue since foreign programs have not been censored and therefore considered potentially dangerous for society.

- Many issues still undecided.
  Many issues such as the number of programs per channel, the number of channels, the choice of content quality and the use of extra features of DVB-T are considered 'too far away' and are still undecided.

Because of the limited prospects of conditional access in Vietnam, there are **no business incentives for the TV stations to start digitizing their terrestrial broadcasts.** The **reasons for digitization** of the TV stations are by no means stemming from business interests but from **political interests.** Five and ten year plans make up the guidelines for implementation plans of TV stations. In present policy making regarding DTT there is one main point: digitizing of terrestrial broadcasts is considered an irreversible process.

This policy making process is a slow and difficult process. In the meanwhile, **politics cannot keep up with the pace of developments in the Vietnamese electronics business.** Two electronics companies in particular are eager to jump in the market for digital set-top-boxes. Lacking an infrastructure of DTT, one company, VTC, has started a trial broadcast in the Hanoi area. Another company, HANEL is preparing one in the same area.

Apparently, the **business incentives** are to be found in **production and sales of digital set-top-boxes. VTC** and **HANEL** are presently the only (potential) players in the **receiver-end of the DTT chain.** Both companies have interests in **DVB-T broadcasting** because of the **catalyst function** for their business. Both expect the market for STBs to grow fast in the next few years. It is likely that when this is indeed the case, **other companies** will follow rapidly, **provided there is a proper infrastructure present.**

6) What are the basic investment requirements for digital terrestrial television?

For each of the two cities of Hanoi and Ho Chi Minh, the initial investment costs would be considerable for both transmission and reception. For **transmission**, each city would have to invest **USD 1.1 to 1.5 million** for a digital terrestrial broadcast of five programs covering their city and surroundings areas (1200 sq km). The estimated amount includes the costs for all **equipment** (excluding shipping costs, import duties or any taxes applicable), **technical support** and **training**. The equipment costs can be reduced with about USD 500,000 when an existing TV tower and antenna is used, which is very likely. **Required initial investment is then USD 0.6 to 1.0 million.**

Initial investment costs (for equipment, technical support and training) for each electronics company that wants to produce (assemble) **STBs** depend on the choice of SMT-line. If one chooses a second-hand, like VTC did, costs can be as low as USD 500,000. If one chooses a new, higher-quality SMT-line that can be used for multiple purposes, costs would be **USD 1 to 2 million.**

Besides these initial investment costs, **additional investment in working capital** is necessary to purchase kits and licenses for STBs. Assuming a working capital for 10,000 units at USD 200 per unit, this would be USD 2 million.

7) What is the market potential of digital terrestrial television in Vietnam?

On first sight, Vietnam, as one of the poorest countries in the world, seems to be a place with no commercial opportunities for digital terrestrial TV. With a price of USD 200-400 per digital set-top-box and a GDP per capita of USD 400, digital TV seems to be far-fetched.

However, there are reasons to be much more optimistic on the chances for DTT market success in Vietnam. The average real incomes in Hanoi and HCMC are much higher than the official average of USD 400 per year for the total country suggests. About half of the households in these cities belong to the so-called "upper socio-economic classes", defined as households with incomes above USD 350 per month. An estimated 15 per cent of the households in Hanoi and HCMC have an income of more than USD 500 per month.

The potential markets for STB of these cities have been estimated as follows:

Hanoi
Niche market: 60,000 households (8.5%)
Upper market: 300,000 households (44%)

Ho Chi Minh City
Niche market: 80,000 households (8.0%)
Upper market: 400,000 households (41%)

The so-called niche market could be viewed as a target for the short term (< 3 years), while the upper market could be viewed as a target for the long term (> 3 years).

The question is of course whether digital terrestrial TV will actually be able to reach these potential markets. Consumer and viewing behavior of the citizens of Hanoi and HCMC is no hindrance for the success of digital terrestrial TV in Vietnam. TV has conquered its place in daily life and has become the third most popular form of entertainment. Series and movies enjoy an unprecedented popularity. As long as the offer is good, the potential is there. This means that when digital terrestrial TV, or – to speak in terms of a consumer – a digital STB, can demonstrate its value-added, the Hanoians and Saigonese will buy it.

This value-added could for example be (besides the higher picture and audio quality) the ability to receive an extra program, containing movies and series. However, at first there will be only simulcast of existing Vietnamese programs; new programs will only be made when there is a public for those programs.

8.2 Final Conclusions

The research problem formulated in chapter 1 was as follows:

Under which technical, regulatory and market conditions can digital terrestrial television become a success in Vietnam?

Based on the conditions for success, three scenarios can be drawn up: a pessimistic scenario, assuming none of the conditions are satisfied, an optimistic scenario, assuming all conditions are satisfied, and a most realistic scenario, assuming some of the conditions are satisfied.

The conditions under which digital terrestrial TV can become a success are interrelated, and based on the answers to the research questions. The conditions are presented below.

Technical conditions

- The transmission systems have to fit the needs of the TV stations.
  - The systems should be **basic** (no EPG, Dolby 5.1, AC3, subtitling, teletext, interactive and data services, etc.), with the possibility to upgrade. All (unnecessary) extras lead to waste of resources, since it is likely that these cannot be earned back.
  - The first and, for the time being, only cities to broadcast digital terrestrial TV are Hanoi and Ho Chi Minh City. Therefore, a **single-transmitter network** in each city is sufficient.
  - Since conditional access is believed to have very limited prospects in the near future, **no investment in CA systems** should be made. As the TV stations plan to broadcast only the existing terrestrial programs.
  - **The use of an existing TV tower and antenna** can save about USD 500,000 (per city).

- The reception equipment for digital terrestrial TV should have a low threshold for the consumer and fit with the broadcasts.
  - The set-top-box should be **basic** (no EPG, Dolby 5.1, AC3, subtitling, teletext, interactive and data services, etc.), in order to keep the costs low.
  - The set-top-box can be **without CA-decoding, smartcard reader** etc.
  - The **existing rooftop antenna** should be used for reception.

- The potential manufacturers of set-top-boxes **need to have a foreign partner** that is able and, more important, **willing to assist them in setting up a production line for STBs** (by supplying them kits for the assembly of STBs and the necessary expertise).

- The production technology for assembly of digital set-top-boxes has to fit in the business strategy of the electronics companies. This is particularly important because the potential market for STB in the short-term is not very big (estimated 60,000 in Hanoi and 80,000 in Ho Chi Minh City).
  - The SMT line should be **second-hand** (for example from Japanese, Korean, or Western companies that are modernizing their factories, possibly with development aid) when STB is the only assembled product with this SMT line.
  - If one purchases a new SMT line, it should be **suitable for the assembly of other products** (such as PCs), because it is likely that the production capacity will be multiple times larger than the actual production volume of STBs.

Regulatory conditions

- The government (through Vietnam Television) should provide clarity regarding the DTT roll out in Vietnam as soon as possible, in order to take away the uncertainty that is hindering the parties in the DTT player landscape. This **clarity** can be provided by:
  - taking a **definitive decision** with regard to the implementation of DTT in **Hanoi** and **Ho Chi Minh City**; and by
  - initiating a **thorough research of the possibilities for implementation in the rest of the country.**

  This should be done **as soon as possible.**

- The government should guarantee the continuity of the digital terrestrial broadcasts.
  - Present **trial broadcast of VTC** in Hanoi **should be followed immediately by full operation of a TV station** (VTV or Hanoi TV). Any 'silence period' can lead to consumer skepticism in DTT.

- The government should allow the broadcast of new terrestrial programs, in order to promote the creation of a value-added to digital terrestrial TV. These programs could be:
  - **New Vietnamese programs**, for example an entertainment channel with movies, series, sports et cetera; or
  - **certain foreign programs** that are considered 'harmless'.

Market conditions

- **Hanoi** and **Ho Chi Minh City** should be the only cities that introduce digital terrestrial TV in the short term (< 3 years).

- The TV stations should use an **advertising-based business model**[48], because of the limited prospects of conditional access.
  - In case of simulcast, **different advertising** can be used for the **analog** and **digital** broadcasts. Whereas the analog broadcasts can be used to reach the **general public**, the digital broadcasts can be used to advertise specific products and services for certain **niche groups**. The latter also applies to the new (digitally broadcasted) programs.

- The first **set-top-boxes** for DTT should be **moderately priced** in order to **enhance affordability** and therewith **lower the threshold** for consumers (this has technical implications, see "technical conditions").

8.3 Introduction Scenarios

Television in Vietnam is slowly shifting from complete propaganda to a blend of subtle propaganda and entertainment. The view of the relevant players in the broadcast sector is also a blend of conservative and progressive opinions. It is the progressive vision that has led the way for Vietnam towards digital television.

Vietnam is one of the first countries in the region to have a DVB-T broadcast trial. However, this trial is not part of a well-coordinated policy of the government. National policy and strategy for digital terrestrial television has yet to be developed. On the other hand, digital terrestrial TV in the country's two main cities, Hanoi and Ho Chi Minh City, is not far away. If there is one thing that becomes clear from the present trial broadcast of VTC, it is that in Vietnam development does not need policy or strategy to take place.

The exact DTT roll out will be dependent on a political and economical dance, of which the outcome is still uncertain. However, it is possible to draw up a pessimistic and optimistic scenario in broad outlines, based on the directions of the various players, the required investment and the market potential of Hanoi and Ho Chi Minh City. These two scenarios are so-called worst and best case scenarios, indicating the range of possible realistic outcomes. A third scenario that lies between the worst and best case is drawn up to serve as a handle for recommendations.

Pessimistic Scenario

In the case of the pessimistic scenario it is assumed that the **conditions for success are not satisfied**.

In the field of technology, the desire of the TV stations (VTV, Hanoi TV and HCMC TV) to be on the forefront of technology leads to high-flown technical proposals for a DVB-T trial (for example expensive systems with conditional access, interactive features and NVOD). Because of the high price tag of these systems, the government turns down the requests for the financing of these proposals. The TV stations are forced to revise their proposals, causing a delay in their implementation schedules. Only VTV manages to receive the necessary 'approval of funding' together with a broadcast license for DTT from the government in the second half of 2002. Further, HANEL and other potential manufacturers are not able to find (and

[48] Of course this should be done within the regulatory framework. Decree No. 52/CP (dated August 16, 1993, issued by the Government) for example states that advertising time on TV must be limited to 5% of the airtime. Because this limitation is not further specified, it leaves the TV stations a lot of room for interpretation (Source: VTV).

contract) foreign partners that are willing to assist them in setting up an STB production line. Therefore, VTC is the only STB manufacturer in Vietnam.

In the political scenes, conservative powers at government levels prevail. The government does not issue (content) licenses for new programs, implying that only existing programs can be broadcasted.

Present VTC's trial broadcast that ends in March 2002 is only allowed to continue till May 2002. As mentioned above, HANEL's lobby for the finance of a DVB-T trial broadcast (of HANEL and Hanoi TV) is not successful either. A period of 'DTT silence' follows until VTV starts an official trial[49] in Hanoi in the second half of 2003. For this trial, VTV invests USD 1.5 million dollars in brand-new equipment, including a head-end system, high power amplifier and a TV tower and antenna. These investments are made within the framework of the propaganda for new high-tech infrastructure.

Because of the silence period of more than a year, consumer confidence in the continuity of the broadcasts drops dramatically. Further, consumers do not see any value added in digital terrestrial TV, since the content of VTV's trial contains only the existing Vietnamese programs (VTV 1, 2, 3, 4 and Hanoi TV). As a result, the only Vietnamese STB-manufacturer, VTC, has a huge problem selling its product.

VTV broadcasts digital TV free-to-air, so is dependent on advertising to have additional income (besides government funding). However, due to the very low DTT penetration, advertising for niche groups is not feasible. Instead, the advertising in the analog and digital broadcasts is the same and hence VTV fails to generate extra income. All in all, the DVB-T trial becomes a financial and political debacle for VTV.

Meanwhile in Ho Chi Minh City, initial plans to start a DVB-T trial at the end of 2002 are put on the back burner because officials want to await the developments in Hanoi first. After the debacle of VTV in Hanoi, HCMC TV decides to postpone the trial indefinitely.

As a result of all this, the implementation schedule as recommended by VTV in 2000 is delayed. The government fails to provide clarity and governmental policies needed to support the development of digital broadcasting are postponed, awaiting the formulation of the next five-year plan of the Communist Party (2005). In this scenario, the early failure of the introduction of DTT has closed the so-called 'window of opportunity'. The politicians have become very skeptical about digital terrestrial TV and decisions with regard to DTT implementation outside Hanoi are likely to wait for years. The only rescue of DTT success in the long term would be a dramatic change of course of the Vietnamese government at the next planning period (2005-2010). This however seems far-fetched, even in the most optimistic view.

Optimistic Scenario

In the case of the optimistic scenario it is assumed that all **conditions for success are satisfied.**

In the field of technology, the technical proposals of the TV stations are appropriate for the Vietnamese situation and VTV and HCMC TV receive the necessary 'approval of funding' together with a broadcast license for DTT from the government in the first half of 2002. Further, HANEL is able to find a foreign

[49] The VTC trial is in fact unofficial (see chapter 4).

partner that is willing to assist HANEL in setting up an STB production line. First HANEL set-top-boxes start to enter the market at the beginning of 2003, a year and a half after VTC's set-top-box introduction.

In the political scenes, progressive powers at government levels prevail. The government allows VTV and HCMC TV to make an additional program for digital terrestrial TV.

VTC's trial broadcast that would end in March 2002 is allowed to continue till the end of the year. Because of this decision, the government sees no reason to grant its approval to HANEL's request for finance. The government is of opinion that only one digital broadcast in Hanoi is feasible.

In this prolonged trial, VTC is summoned to cooperate with VTV. Additional equipment[50] is purchased and installed in preparation for full operation. At the end of this second trial period, VTC is summoned to hand over the trial equipment to VTV, which continues the digital broadcast with a slight change. Offered services are the simulcast of the analog terrestrial programs (VTV1, VTV2, VTV3 and Hanoi TV), the international Vietnamese program VTV4 (presently broadcasted via satellite for overseas Vietnamese) and an extra entertainment program 'VTVdigital'[51].

Viewers of VTC's digital terrestrial broadcast trial (that have bought the VTC set-top-box) who have more or less enjoyed the extra content (VTV4, StarSports, ESPN, Cartoon Network) during the trial can harmonize with the new VTV program offer. They are all the more satisfied because the quality of the broadcasts has improved since the reduction of services from 9 to 6. Consumers, especially the upper class consumers, become step by step aware of the benefits of digital terrestrial TV. STB sales of VTC, already substantial at the end of 2002 because of the VTV announcement that DTT broadcasts would continue, take up considerably in 2003. HANEL 'hitchhikes' on that take up with the introduction of its own STB.

VTV broadcasts digital TV free-to-air, and uses an advertising-based business model for its additional income. The government even encourages this by encouraging self-sufficiency of TV stations[52]. The 'segmented' way of advertising on digital broadcasts becomes a commercial success because of the specific social-economic characteristics of digital TV viewers and a considerable penetration of 10 per cent (70,000) of the Hanoi households in 2005.

Meanwhile in Ho Chi Minh City, HCMC TV starts a trial at the end of 2002 as planned, financed by the city (and approved by the central government). During the trial, the commercial success of the introduction of DTT in Hanoi does not go without notice. At the end 2003, HCMC TV decides to run commercial

[50] At the moment VTC offers 9 services using 9 encoders. In this optimistic scenario VTV will use 6 encoders for 6 services, while using the other three for redundancy A redundancy configuration is purchased and installed in order to guarantee continuity of the broadcasts Investment cost for this upgrade operation is USD 200,000, while VTV pays VTC a compensation of USD 600,000 (for the trial equipment, including TV tower and antenna).

[51] In this optimistic scenario, the extra entertainment program 'VTVdigital' contains premiere (foreign) movies and series (bought by VTV for both analog and digital TV, but first broadcasted on VTVdigital to create the value added), and reruns of the most popular analog programs.

[52] This is a realistic assumption. A Party official stated that "there are plans to let the executive part of the VTV institution (i.e. the TV station) be financially independent of governmental budgets". This means that the regulative and supervising tasks will remain dependent of government funding, but the broadcast tasks will have to be funded by the advertising income.

operation[53] (approved by VTV). Using a slightly different business approach[54] as VTV in Hanoi, HCMC TV manages to outdo Hanoi in commercial DTT success: despite starting a year later with commercial operation, DTT has a penetration of 90,000 households (9%) in Ho Chi Minh City in 2005. Because of the relatively larger households and higher purchasing power in HCMC, advertising incomes are much higher than in Hanoi.

The introduction of digital terrestrial TV in Hanoi and HCMC is already considered a political and commercial success in 2004. As a result, the government initiates a thorough research of the possibilities for implementation in the rest of the country in the second half of 2004.

Realistic Scenario

In the case of the realistic scenario, it is assumed that **only some of the conditions for success are satisfied.**

In the field of technology, the initially high-flown technical proposals of the TV stations are turned down by the government. Revised proposals follow soon, and VTV and HCMC TV receive the necessary 'approval of funding' together with a broadcast license for DTT from the government in the second half of 2002. Further, HANEL and other potential manufacturers are not able to find (and contract) foreign partners that are willing to assist them in setting up an STB production line. Therefore, VTC is the only STB manufacturer in Vietnam.

In the political scenes, conservative and progressive powers at government levels reach a compromise. The government allows VTV and HCMC TV to make an additional program for digital terrestrial TV, but limits the amount of entertainment to 50%. The other content must be 'education and information'.

VTC's trial broadcast that ends in March 2002 is allowed to continue till the end of the year. Because of this decision, the government sees no reason to grant its approval to HANEL's request for finance. The government is of opinion that only one digital broadcast in Hanoi is feasible.

As a condition to the prolongation of the trial broadcast, the government summons VTC to cooperate with VTV and hand over the trial equipment to VTV at the end of the trial period. However, traditional tensions[55] between VTV and VTC prevail and VTC refuses to cooperate with VTV during the trial. VTV purchases additional equipment for full operation[56] and installs it after the hand over of the VTC trial equipment. VTV continues the digital broadcast three months later (April 2003) with a slight change. Offered services are the simulcast of the analog terrestrial programs (VTV1, VTV2, VTV3 and Hanoi TV),

[53] HCMC TV uses an existing TV tower and antenna and purchased and installs a transmission system as suggested in subsection 6.1.1. Total investment cost for this operation is USD 800,000.

[54] Offered services: the simulcast of the analog terrestrial programs (VTV1 (VTV2 when VTV1 is off-air), VTV3, HTV7 and HTV9), and an extra entertainment program 'HTVdigital'

[55] See subsection 5.4.1

[56] See optimistic scenario for details.

the international Vietnamese program VTV4 (presently broadcasted via satellite for overseas Vietnamese) and an extra dedicated program 'VTVdigital'[57].

Because of the three months silence period, consumer confidence in the continuity of the broadcasts has dropped. Further, consumers do not see much value added in digital terrestrial TV, since the content of VTV's extra program is not that attractive. As a result, the only Vietnamese STB-manufacturer, VTC, has problems selling its product.

VTV broadcasts digital TV free-to-air, so is dependent on advertising to have additional income (besides government funding). However, due to the modest penetration of DTT (25,000 households, 3.5%, by the end of 2005), advertising for niche groups is limited to the VTVdigital program. Advertising for the simulcasted programs is the same in the analog and digital broadcasts and hence VTV only succeeds to generate extra income for one program. While the introduction is considered politically successful, it cannot be called a commercial success.

Meanwhile in Ho Chi Minh City, HCMC TV starts a trial at the end of 2002 as planned, financed by the city (and approved by the central government). At the end 2003, HCMC TV decides to run commercial operation[58] (approved by VTV). Using a slightly different business approach[59] as VTV in Hanoi, HCMC TV achieves a DTT penetration of 2 per cent (20,000 households) by the end of 2005.

Reason for the lower penetration in Ho Chi Minh City is the later start of commercial operation as well as the consumer behavior in HCMC. Consumers in HCMC are even more skeptical about the value added of DTT than in Hanoi. Further, the 1½ year lasting trial of VTC in Hanoi containing international content caused a considerable advantage in comparison with the HCMC TV trial that only contained existing Vietnamese programs. Nevertheless, because of the relatively larger households and higher purchasing power in HCMC, advertising incomes are slightly higher than in Hanoi.

The introduction of digital terrestrial TV in Hanoi and HCMC is considered a political success for the factions at government levels supporting technological innovation. As a result, the government initiates a thorough research of the possibilities for implementation in the rest of the country at the beginning of 2006.

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A forecast on the rest of the country can not be given, because the results of this research are mainly based on information of Hanoi and Ho Chi Minh City. In the realistic scenario, 45,000 households in the two cities are converted to digital terrestrial TV by the end of 2005. For VTC, the only STB manufacturer in this scenario, this would mean a turnover of about USD 11 million (assuming USD 250 per STB). In the optimistic scenario, 160,000 households in the two cities are converted to digital terrestrial TV by the end of 2005. For the STB manufacturers this would mean a turnover of about USD 40 million.

[57] Unlike in the optimistic scenario, the extra dedicated program 'VTVdigital' is not only entertainment. Besides the entertainment content mentioned in the optimistic scenario, 50 per cent of the air time is dedicated to educational and informational programs (repeated later on analog TV) and 'Text TV' containing news and information in text form.

[58] See optimistic scenario for details

[59] See optimistic scenario for details

The advertising incomes can not be estimated because there is not enough information on the advertising business. However, to give an indication, in 2000, USD 72 million was spent on television advertisement, of which major part was spent in the two largest cities[60].

8.4 Recommendations

The scenarios above, especially the optimistic scenario, can be viewed as indirect recommendations for the Vietnamese government. As mentioned in chapter 1, this research is conducted as a consequence of HANEL's approach of Philips Digital Networks at the beginning of 2001. Besides a request for the supply of a digital transmission system for digital broadcasting, HANEL requested the assistance of Philips Digital Networks in setting up an STB production line. The following **recommendations** for Digital Networks are **based on the realistic scenario.** Table 8-1 shows the consequences of the realistic scenario and the resulting recommendations.

HANEL – Recommendations for short term (< 3 years) purposes

Commercial opportunities toward HANEL in the short term are limited. In digital broadcasting, HANEL fails to obtain financing, and hence will not be able to purchase Digital Networks' solutions. As for assistance of HANEL in the production of digital set-top-boxes, the indicated figures in the realistic scenario (45,000 units by the end of 2005) are too small to justify any commitment of Digital Networks. *With regard to the request of HANEL in 2001 the recommendation is therefore* ***negative.***

HANEL – Recommendations for long term (>3 years) purposes

However, **in the interest of future business opportunities,** it is recommended to **find a way to get out of this double 'dead-lock' and** ***save face.*** Concretely, this means that with regard to **digital broadcasting,** Digital Networks should not expect a concrete order, but should still **be helpful by submitting offers when requested by HANEL.** With regard to the **assistance of the production of STB,** a **detour via Philips Semiconductors** is an option. Philips Semiconductors is already supplier to HANEL in the field of color TV solutions. The business opportunity for Semiconductors is two-fold: on the one hand assistance of HANEL in STB can strengthen the relationship between the two. On the other hand, assisting HANEL can push the market for Semiconductors' DTV solutions.

Semiconductors can first assist HANEL in finding a foreign STB partner. Of course this partner should use Semiconductors' solutions for STB. In the optimistic case that HANEL succeeds in setting up a production of STBs and becomes more technically self-sufficient, Semiconductors can become a direct supplier of HANEL in a later stadium.

[60] Source: Taylor Nelson Sofres

Table 8-1 Consequences of Realistic Scenario

Condition	Extent of satisfaction[i]		Consequences		Recommendations	
	ST	LT	ST	LT	ST	LT
Technical						
Transmission systems fit needs TV stations	3	3	Turnover for DN ≤ $0.5m	If in the long term all of Vietnam implements DTT, total value of possible orders for DN can be at least $10m	Commercial interest for DN is small, but **demonstration effect** of successful technical implementation of a DN solution can be great	**Strengthen relationship with VTV** for advantage in future tenders
Low threshold for reception equipment	3	3	No opportunities for Philips STB	Philips STBs can get cheaper, while purchase thresholds are subjective and change with time	**No Philips STB on Vietnamese market** (through import or partnership)	Market can change in long term **=> monitor Vietnamese market**
Foreign partner for potential STB manufacturers	1[ii]	?[iii]	VTC is only player in STB => little competition in case of entry in the market			
SMT line fits business strategy	n.a.[iv]		-			
Regulatory						
Clarity from government	2	3	License and financing for VTV and HCMC TV in Q.3/4 2002;	Initiation of research for rest of VN in Q.1 2006	HANEL fails to get proper financing for broadcast => **negative advice for HANEL's request**	**Strengthen relationship with VTV** for advantage in future tenders
Continuity of digital broadcast	1	n.a.	Low consumer confidence in DTT => limits the potential for commercial success			
Content	2	2/3	Low value added of DTT => limits the potential for commercial success	**Possible** ease in restrictions on content		**Strengthen relationship with VTV** in order to get inside information on this issue

(Table 8-1 continued)

Condition	Extent of satisfaction[i]		Consequences		Recommendations	
	ST	LT	ST	LT	ST	LT
Market						
Hanoi and HCMC in short term	3	n.a.	Opportunity in HCMC only		**Pursue HCMC TV account to get an opening to Vietnamese market**	
Effective use of advertising	2	2/3	Income for TV stations is disappointing	This is strongly related to content issue (see above)		
Low price STB in short term	3	n.a.	No opportunities for Philips STB in short term		**No Philips STB on Vietnamese market** (through import or partnership)	
Result			***Comment***	***Comment***		
Political result	*3*	*3*	*Positive political sentiment for implementation in the rest of the country*	*Initiation of research for rest of VN in Q.1 2006*		Opportunity of DTT implementation in rest of Vietnam is present in the long term => **strengthen relationship with VTV**
Commercial result	*2*	*2/3*	*Penetration of 45,000 in 2005*	*Vietnam is promising market for the long term*	Short term market is too small => **negative advice for HANEL's request**	Market can grow in the long term => **monitor Vietnamese market**

i) Extent of satisfaction of conditions: 1 – not satisfied, 2 – partly satisfied, 3 – satisfied.
ii) Only VTC, the incumbent STB manufacturer, has a foreign partner; others fail in finding one (short term).
iii) The willingness of foreign players to assist Vietnamese manufacturers depends on the market and is therefore unpredictable for the long term.
iv) Not applicable since there are no new players. The existing SMT line of VTC is second-hand (see section 5.4.1).

TV Stations – Recommendations for short term (< 3 years) purposes

Besides HANEL, there are other important players for Philips Digital Networks. The most important are the TV stations. The commercial opportunity here is the **supply of head-end systems for digital transmission to the TV stations**. In the near future, only the two main cities will broadcast digital terrestrial TV. The concerning TV stations are VTV and HCMC TV. According to the realistic scenario, VTV will take over the equipment of VTC and upgrade it. Digital Networks will not likely be involved in this upgrading process because VTC purchased its equipment from Tiernan. Therefore, **focus should be on HCMC TV**. If HCMC TV uses only the basic requirements of the broadcasts (as suggested in section 8.2), turnover for Digital Networks will likely be no more than USD 500,000. Although this means that the short term commercial interest is not so high, the demonstration effect of successful implementation of a Digital Networks head-end system can be great.

Therefore, *it is recommended to* ***pursue the 'HCMC TV account'*** *in order to get an* ***opening to the Vietnamese market.*** In this context it wise to 'create a good relationship' with HCMC TV. This can be done through the Vietnam Representative Office of Philips Singapore Pte. Ltd. in Ho Chi Minh City, where there are already contacts with senior officials of HCMC TV.

TV Stations – Recommendations for long term (> 3 years) purposes

The realistic scenario forecasts a positive political sentiment towards the implementation of digital terrestrial TV in the rest of the country after the recognition of the political success of DTT introduction in 2005. Because of this presence of opportunity of implementation of DTT in the rest of Vietnam, *it is wise to 'strengthen the relationship' with VTV.* VTV is likely to become the coordinating and perhaps even executing party in the implementation of DTT in the rest of the country. The strengthening of the existing relationship of the Representative Branch Office of Philips Singapore Pte. Ltd. in Hanoi with VTV can be of huge value when it comes to public tenders.

Besides the above, there is another reason to have a strong relationship with VTV. As implied by the forecasted scenarios of previous section, the attractiveness of the content is the most important factor for success. If this factor is changed (for example if the government lowers the restrictions on the content), it can have a large impact on the consumer interest for DTT. This factor is totally dependent on the political decision-making process. Although it is not likely that Philips can exert any influence on this process, **a strong relationship with VTV can result in valuable inside information on this issue.**

STB Manufacturers – Recommendations for long term (> 3 years) purposes

The (potential) players in the digital STB business need a different approach. While HANEL is discussed earlier, **VTC** seems to be **out of reach for Digital Networks,** because it already has a partner. Other electronic companies that might get in to the STB business have a questionable technological capability. If any of the Vietnamese electronics companies would be approached by Philips for the assembly of STB, this should be done through Semiconductors (see recommendations for HANEL).

Market for Philips STB and iDTV – Recommendations for long term (> 3 years) purposes

The final recommendation concerns Philips' own set-top-boxes and integrated digital TVs (iDTV). The indicated figures in the realistic scenario (45,000 units by the end of 2005) shows that the market potential for the short term is too small. Moreover, this forecast was based on the assumption of low-priced STBs (USD 250). The time to introduce Philips' high-end STB (USD 400+) or iDTV (USD 1000+) has not come yet. However, considering Philips' future commercial interests, *it is wise to monitor the Vietnamese market* that has shown an incredible growth in recent years. This can be done through the representative offices of Philips Singapore Pte. Ltd. in Hanoi and Ho Chi Minh City.

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Internet and multimedia

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http://www.ero.dk/

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http://www.tue.nl

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Director
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Technical Department
Viettronics Tan Binh

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ST Electric Corporation Ltd.

Nguyen Tri Nang
Product Engineer
ST Electric Corporation Ltd.

Appendix A: Company Profile

This appendix is provided merely with the intention to inform the reader on the organizational structure of the commissioner, its activities, as well as the place and role of Digital Networks in the company. All information provided in this appendix is sourced from Philips Digital Networks and is proprietary to Philips.

Philips

Philips is a Dutch multinational company with a wide range of products, including consumer electronics, professional electronic equipment, medical systems, lighting, domestic appliances and semiconductors and components.

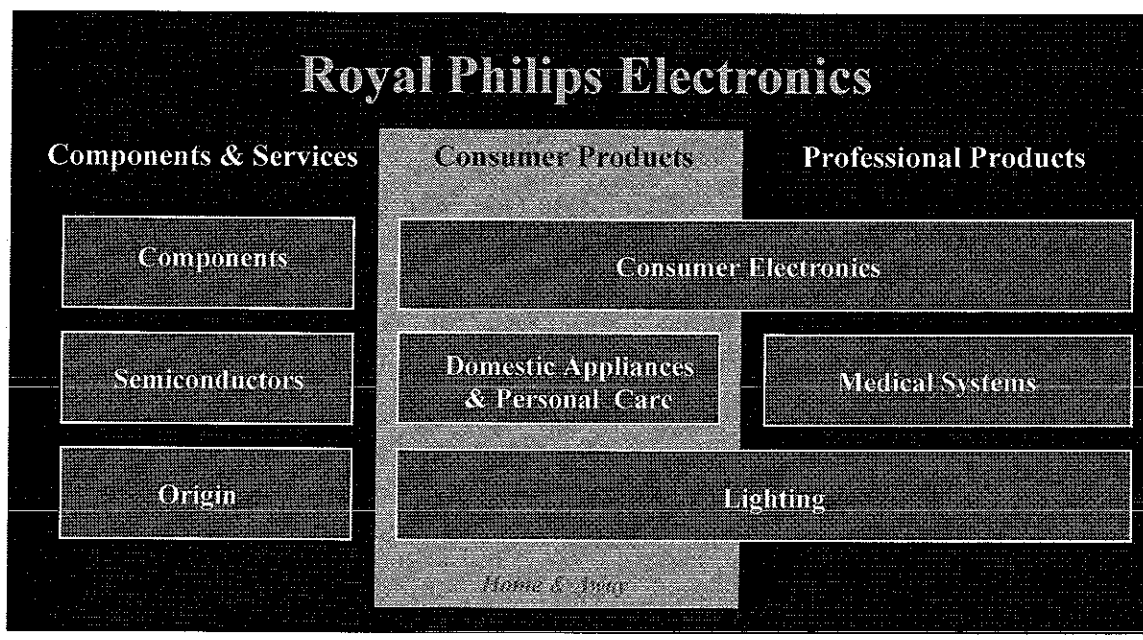

Figure A-1 Philips Divisional Structure

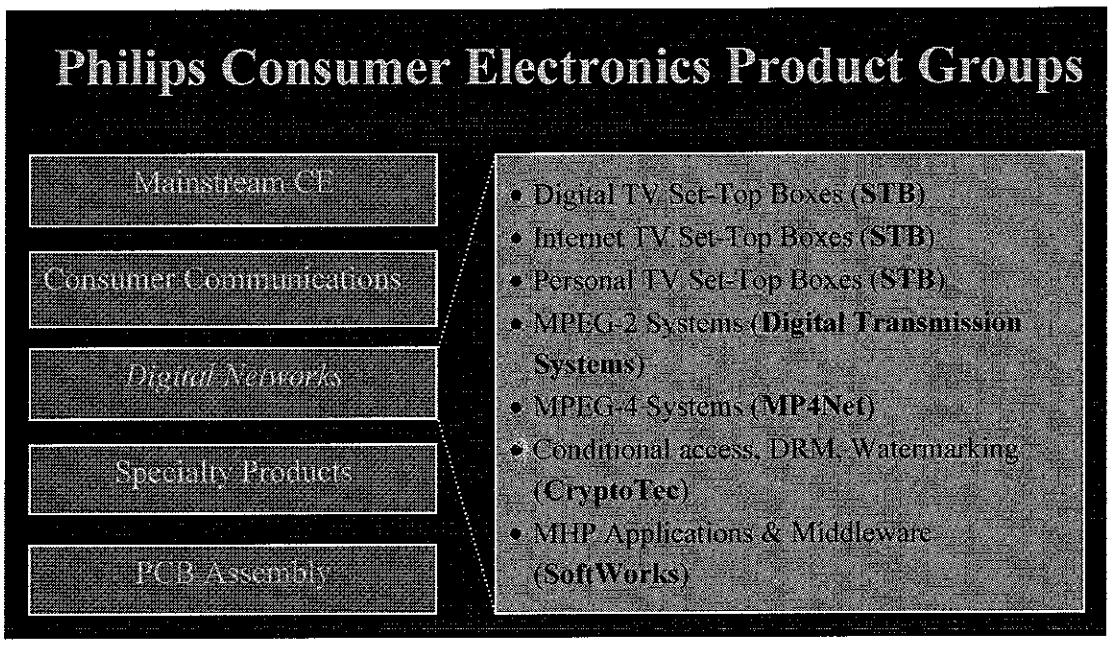

Figure A-2 Consumer Electronics Product Groups

Digital Networks

The Consumer Electronics division comprises the product groups Mainstream CE, Consumer Communications, *Digital Networks,* Specialty Products and PCB Assemly. Digital Networks on its turn comprises the business units Set-Top-Box Group, Digital Transmission Systems, MP4Net, CryptoTec and Softworks. The activities of these business units are shown below.

Set-Top Box Group:

- Digital TV
- Internet TV
- Personal TV

Digital Transmission Systems:

- MPEG- 2 Compression
- MPEG-2 Multiplexing
- Professional Decoders
- System Integration & Servicing

MP4Net:

- MPEG-4 Compression
- MPEG-4 Server
- MPEG-4 Decoders

CryptoTec:

- (Fine grain) Conditional Access
- Digital Rights Management
- Secure Communication
- Watermarking

SoftWorks:

- MHP applications (resident & broadcast)
- MHP middleware

Philips Digital Networks is a leading supplier of digital broadcasting equipment, broadcast television equipment, and broadband networking equipment. Its products provide customers with end to end solutions based on open standards. These products have brought Philips worldwide industry recognition and success due to their superior quality and innovative features. Philips has been able to achieve this and will continue to build on its reputation because of an unparalleled research and development program that has a long history for inventing breakthroughs in the digital audio and video technology.

Philips' digital broadcasting equipment includes MPEG 2 / DVB compression systems and related head-end equipment as well as digital receivers for cable, satellite, terrestrial, telecommunications, and other networks. Broadcast television equipment includes digital broadcast cameras and a wide range of studio equipment. Broadband networking equipment includes analog and fiber cable TV and data networking components, including cable modems.

The beginning

Digital Networks was established in 1994, when video distribution systems started to migrate towards digital technology as a result of emerging MPEG-2 and DVB standards. Due to active participation to these standardization bodies and also due to many years of research and development, Philips had all the technical capabilities in-house to address the new market.

The first customer was MTV (a Viacom company), who wished to transmit their content in digital format to cable head-ends. Key reasons for MTV to choose for Philips were the picture quality of the Philips video encoder and the ability of Philips to offer an End-to-End solution.

The next step was taken together with Canal+ Technologies, where Philips was first to provide a digital receiver, or set top box, for reception of the Canal Satellite services. This was and is a close co-operation, challenging the possibilities of state-of-the-art digital technology at the lowest possible price. In this co-operation Philips offers compression equipment, set top hardware and low level drivers; Canal+ provides the Mediahighway software application platform and the Mediaguard Conditional Access system. Today, Philips is still the largest supplier of set top boxes for the Canal+ group, the foremost DBS operator in most European countries. Philips sells the set tops to the local service providers as well as to consumers directly through retail.

Philips also offers set top boxes based on their own software application platform, called e-4TV. This platform targets open market solutions, standardized by bodies like DVB and ATSC, and supports multiple

Conditional Access systems. Amongst others, this set top box is deployed by Astro (Measat), the leading digital DTH operator in Asia, and by @Entertainment (also known as Wizja) in Poland. Both Measat and @Entertainment use the Philips CryptoWorks Conditional Access system as well as the Philips compression and multiplexing equipment.

Open Standards

Philips is in favor of open, standardized platforms such as MHP, and therefore very active in several standardization bodies. Philips is a founding member of the DVB Group (which it is currently chairing), a major contributor to ISO MPEG and DAVIC, an active participant in the OpenCable process and a member of the SCTE DVS subcommittee. Because of Philips' commitment to open standards, Philips End-to-End solutions are truly open.

Quality

High quality has always been very important to Philips, and indeed the company is known for the reliability of its products. Most of the factories of Philips Digital Networks are ISO 9001 compliant, which in itself goes to show that Philips is very committed to quality. An additional process has been put in place to control product creation. Besides timely release to the factory, this process again ensures that the product has the right quality. The essence of the process is the standardized way in which a project is divided into distinct phases. Several formal milestones are passed during each phase, and the phase is also ended with a milestone. Each milestone involves extensive checklists to make sure that all activities are fully under control.

The phases that are used are the Concept, the Creation and the Realization Phase, with the following milestones:

- Concept Phase: Kick Off (KO), Concept Start (CS) and Architecture Choice (AC)
- Creation Phase: Specification Release (SR), Commitment Date (CD), End of Integration (EI) and Design Release (DR)
- Realization Phase: Industrial Release (IR) and Commercial Release (CR)

In short

- Philips Digital Networks has an excellent track record when it comes to development and deployment of digital video distribution systems. Philips has customers all over the world, in the satellite, terrestrial as well as in the cable market segment. Many world-renowned service and network operators have chosen for Philips.

- Philips has no 'exclusive' agreement with any third party, supplier or customer.

- Philips is in strong favor of open standards. For this reason Philips plays an active role is various standardization bodies.

- Philips always has been and still is a forerunner in the area of digital video systems.

- Its newest developments include fine-grained Conditional Access, MPEG bit-rate transcoding and splicing, high-throughput data broadcast products, network management systems, sophisticated interfaces to studio automation / traffic control, an MHP set-top box and personalization of TV content through the use of a hard disk, a breakthrough in television.

For more information, please see http://www.philips.com and http://www.digitalnetworks.philips.com

Appendix B: Checklists

This appendix provides the research instruments for this research: checklists for the gathering of data.

Information to be obtained for concept **"International Environment: Digitization of Television Transmission"**

- Broadcast Transmission Systems
  - i. Main types
    - Terrestrial
    - Cable
    - Satellite
    - Microwave
  - ii. General information on each type
    - Basic principles
    - Costs
    - Capacity
  - iii. Country-specific information on each type
    - Availability
    - Costs
  - iv. Comparison of the types
    - General
    - Country specific
- Analog Terrestrial Television
  - i. Technical issues
    - Capacity
    - Propagation
- Digital Terrestrial Television
  - i. History of Digital TV
    - 1980s and early 1990s
    - "European Launching Group for Digital Video Broadcasting"
  - ii. Benefits of DVB-T
    - Capacity
    - Propagation
    - Additional benefits
- Experiences with DTT
  - i. Selection of countries
    - UK
    - Sweden
    - Spain
    - Singapore
  - ii. Background information
    - Licensing

- Content
- Other (competing) platforms
- Coverage
- Penetration figures

Information to be obtained for concept **"Vietnam"**

- General/Geography
  i. Area
  ii. Population
  iii. Administrative Division of the Country
  iv. Topography
  v. Infrastructure
  vi. Communication
- Political System
  i. Representation of the people
  ii. Head of state
  iii. Government
    - Administrative Structure
  iv. Communist Party
- Economic Situation
  i. GDP per capita
  ii. GDP growth rates
    - Past
    - Forecasts
  iii. Developments
- Currency and Exchange Rate
  i. Changes due to Asian crisis
  ii. Present situation
- The Role of Television in Vietnam
  i. Political
    - Role of VTV
  ii. Coverage
  iii. TV penetration
  iv. Role in social life
- Freedom of the Press and Media
  i. Censorship
  ii. Developments

Information to be obtained for concept **"Sector"**

- Regulatory Framework
  i. Position of VTV
- Activity allocation model
  i. De Bruin and Smits (1999)
  ii. Derivation of activity allocation model for Vietnamese situation
- Analog Terrestrial Television in Vietnam
  i. Content/contribution

        - VTV
        - Provincial TV
    ii. Service and Delivery
        - Administrative structure
        - Infrastructure
        - Coverage
        - Service level in Hanoi and Ho Chi Minh City
    iii. Receiver-end
        - Market size
        - Market shares
- Status-quo of DTT in Vietnam
    i. Background information
        - Developments
        - Planning
    ii. Trial
        - Time
        - Place
        - Infrastructure
        - Content
        - STB production
        - Parties
    iii. Available spectrum
        - VHF
        - UHF

Information to be obtained for concept **"Player Landscape"**

- Identification of main parties according to activity allocation model
    i. Content/contribution
    ii. Service and Delivery
    iii. Receiver-end
- Backgrounds and profiles
    i. Place in political/regulatory framework
    ii. Core activities
    iii. Present relationship with DTT
    iv. Plans/prospects with respect to DTT
- TV stations: standpoints on important issues
    i. Physical availability (of DTT services)
        - Regional availability
        - Variety of services
        - Way of reception
    ii. Affordability
        - Equipment
        - Services (in case of CA)
    iii. Accessibility
        - Simulcast period
        - Free-to-air programs

        - Accessibility to the poor
    iv. Content
        - Which programs
        - Service quality
        - Desired features
- Interests of electronics companies
    i. Motive for involvement in DVB-T broadcast
    ii. Motive for interest in STB production
    iii. Motive for not having any concrete plans/preparations

Information to be obtained for concept **"Required Investment"**

- Technical aspects
    i. Place of terrestrial distribution in digital video distribution chain
    ii. Required elements for terrestrial delivery of digital TV signal into viewer's home
        - Transmission
        - Reception
- Infrastructure requirements
    i. Choices (assumptions)
    ii. Costs (equipment, technical support, training)
        - Transmission
        - Reception

Information to be obtained for concept **"Market Potential"**

- Living standard
    i. Macro economic indicators
        - Population
        - Number of households
        - GDP/cap
        - GDP growth
    ii. Population in Hanoi and HCMC (official and unofficial)
    iii. Number of households in Hanoi and HCMC
    iv. Income in Hanoi and HCMC (official and unofficial)
    v. Distribution of income in Hanoi and HCMC
    vi. Household ownership of selected electronic appliances
- Potential market size
    i. Segmentation based on ratio of screen sizes of color TVs
        - Upper market
        - Niche market
    ii. Segmentation based on price segments of color TVs
        - Upper market
        - Niche market
- Consumer behavior
    i. Leisure activities
    ii. Differences between Hanoi and HCMC
        - TV transfixion
        - Purchasing mentality

- Viewing behavior
    i. Supplied programs
    ii. Best viewed TV programs
    iii. Connection between supply and demand

Appendix C1: Benefits of Digital Terrestrial TV

This appendix describes the problems of terrestrial television and how digitization could solve those problems.

Analog Terrestrial Television

As mentioned in subsection 2.1.1, major advantage of terrestrial television is its high receiving range: in Europe, more than 95% of the households can receive terrestrial television signals. In Vietnam, the receiving range is over 80%. To achieve this high coverage, a dense network of main and relay transmitters is built throughout each country. The two tables below give an impression on the density of a terrestrial network in Europe and Vietnam.

Table C1-1 Number of Analog Transmitters in Selected European Countries

Country	Main analog transmitters	Analog relay transmitters	Area (sq km)
France	109	2661	551,500
Germany	100	2638	356,910
Sweden	53	614	449,964
United Kingdom	51	887	244,101
Italy	48	1507	301,268
Spain	39	359	504,782
Netherlands	7	8	41,526

Source: CDG Consultants Ltd., Digital Terrestrial Television in Europe – The Dynamics of Transition, London, 1998, p. 32

Table C1-2 Number of Analog Transmitters in Vietnam

Year	Main analog transmitters	Analog relay transmitters	Coverage (% of population)
1998	128	531	77.75%
1999	156	596	78.75%
2000	172	666	80.75%

Sources:
Dai Truyen Hinh Vietnam, *Cong Tac Thi Dua va Phat Trien Su Nghiep Truyen Hinh Nam 2000-2001*, Hanoi, 2001, p. 5
Dai Truyen Hinh Vietnam, *Cong Tac Thi Dua Nam 1999*, Hanoi, 2000, p. 5

The size of Vietnam is 329,556 sq km, comparable to Germany and Italy. It is very difficult to make a just comparison between countries, since the state and structure of a terrestrial network depend on the different

characteristics of each country. These differences include geography, politics and economics. Therefore, above values should be taken as illustration only.

The following subsection explains some key technical issues of terrestrial television.

Technical Issues of Terrestrial Television[61]

Terrestrial television has inherent features irrespective of whether the underlying technology is analog or digital. Digitization may modify some features, but the fundamental physics remain the same. Terrestrial television uses radio frequency (RF) waves to deliver television services to the households. RF waves propagate outward from their transmitter in ever-expanding circles, similar to waves on a still pond when a small rock is tossed into the water.

Transmitting antennas, mounted on broadcast towers (or on a high building) are situated at strategic sites (such as the top of the highest hill nearby a population center) in order to reach the maximum number of potential viewers. The frequency used for terrestrial television broadcasts is known as the VHF/UHF spectrum (VHF: 30-300 MHz; UHF: 300-3000 MHz; usually a much smaller part of this spectrum is used for television broadcast). This spectrum is divided into 'channels'. Please note that 'channel' in this context has a different meaning than 'TV-channel' in the sense of a TV-station.

Analog terrestrial transmission requires that each receiver 'tunes-in' to only one channel from only one transmitter at any time otherwise severe interference will occur. Adjacent transmitters must therefore operate on different channels, even when transmitting the same program. This restricts the total number of programs that can be broadcasted, as each TV-station requires many channels to deliver their programs in a wide geographic area.

There is a compensating benefit to this problem. With transmitters in different locations using different channels they can actually broadcast different programs. This capability is used in Vietnam to provide local programming: there are 61 provinces, all with an own local TV station providing local variation in the programming.

Another restriction of the total number of programs that can be broadcasted originates from the restrictions of reception technology. This especially concerns the TV-tuner. Although tuner technology has improved over the years, still, in order to avoid TV channels from 'stepping' on each other's signals, most channel assignments are left at least one channel of empty, unused, spectrum between TV channels that are broadcasting in the same area. These empty channels are called 'taboo' channels.

The limited capacity of the terrestrial VHF and UHF spectrum can usually accommodate only three to six analog programs/services depending on local circumstances. Besides this, there are a number of propagation aspects of terrestrial television that affect the quality of analog terrestrial television, which will be discussed in the following.

[61] Information for this subsection is partly derived from Cahners In-Stat Group, *Digital Broadcast Infrastructure Overview*, January 2001

Signal Reach

The first physical restriction for reception of a TV signal is the so-called optical horizon, caused by the bend of the earth. The distance of the optical horizon can be calculated with the following formula:

$$d_{km} = 2.6\left(\sqrt{2h_T} + \sqrt{2h_R}\right),$$

where: d_{km} = distance of the optical horizon (km);
h_T = transmitter antenna height (m); and
h_R = receiver antenna height (m).

To give a numeric example, if the transmitting antenna height is 40 m and the receiving antenna height is 10 m, the optical horizon would be 35 km.

Within the area that is covered by the optical horizon, signal strength becomes an issue. The most important aspect that affects the signal strength at the receiver is the distance from the transmitter. The amplitude of radio frequency waves goes down as the distance between the receiving and transmitting antenna goes up. With analog terrestrial television, the quality of the image and sound gradually deteriorate as the signal becomes weaker.

Shadows

Radio frequency waves can be blocked by features of the terrain. Hills, mountains, buildings can block the propagation of transmitted signals, causing areas to be "in the shadow", resulting in an inability to properly receive the signal. With analog TV, viewers in the shadow of a large building or mountain see a very vague image on their TV screen. Viewers in the edge of the shadow can see a better image then those in the core. This aspect of gradually fading away is typical to analog TV.

Multipath

Besides shadows, another problem for analog terrestrial television are echoes. In this case, multiple versions of the TV signal are picked up by the receiver, with the result that each object on the TV screen appears to have a "ghost" that moves around behind it. The technical term for this effect is "multipath". There are two kinds of multipath that can affect the quality of the received signal: static multipath and dynamic multipath.

Static Multipath

TV signals originally travel directly outward away from their transmitting antenna and out into their coverage area. However, any large impediment in its path can reflect the signal in such a way that two (or more) signals arrive at the receiving antenna: the direct signal and a secondary reflected signal. With analog TV, the secondary signal produces "ghosts" that consistently follow major objects on the TV screen. Static multipath is a particular problem in urban areas where tall buildings can produce strong reflections.

Dynamic Multipath

For large objects that are moving, such as large trucks, airplanes flying over the city, helicopters or clouds, the echo-effects are dynamic. These effects change rapidly with time, and are unpredictable. However, since the object that is causing the echo is moving, the effects of dynamic multipath are usually temporary.

Dynamic multipath effects can be quite bizarre with analog TV. The "ghosts" on-screen may appear to move from "behind" the main image, to "in front of" the main image, or they may oscillate, moving from "behind" to "in front" resulting in a very irritating visual effect. Fortunately, these effects are usually temporary and are gone quickly.

Impulse Noise

When the TV signal is picked up by the receiver, electrical motors, passing cars and atmospheric conditions (lightning, etc.) can impart electrical "shot" noise that can affect the receiver. With analog TV, impulse noise exhibits flashing little white spots on the TV screen. These white spots are randomly distributed across the screen image, and are unaffected by the image on the screen. Most viewers refer to impulse noise on their TV as "a noisy picture" or simply "snow".

Summary of Technical Issues

Terrestrial TV has five major features that need to be considered, irrespective of whether the underlying technology is analog or digital. These features are:

- Capacity of the terrestrial VHF/UHF spectrum
- Signal reach
- Shadows
- Multipath (static and dynamic)
- Impulse noise

The next section will show that these features have different effects for digital TV.

Digital Terrestrial Television

From the previous section, one can derive that terrestrial television needs an improvement in spectrum efficiency (capacity) and quality. This section will describe how these improvements can be reached through digitization. Before getting into detail on the five mentioned technical issues of the previous section, the next subsection will provide a historical background of digital TV. The developments of TV in Europe, especially the efforts of the DVB-consortium will be discussed. This because firstly, the Vietnamese broadcast sector has always been dependent on European technology. Second, the Vietnamese government – in the capacity of Vietnam Television – has officially chosen for the European standard for digital terrestrial television broadcasting.

History of Digital Television[62]

Digital technology entered the television industry in the late 1970s, but the high cost and complex implementation confined its use to high quality studio equipment. Digital processing was used internally in specialist equipment which was used within a conventional analog studio environment.

Throughout the 1980s the cost of digital processing technology came down and the awareness of its benefits spread until it was widely used in all aspects of television production. The first development was to connect digital equipment using digital signal paths to create small digital 'islands', within which the quality and consistency of digital processing could be exploited to create complex, high quality, special effects. Later, new standards were developed allowing low cost interconnection of many types of digital equipment. With more widespread use came a realization that digital is not an expensive technology, as it allows better results to be obtained faster and more consistently. This dramatically reduces the ongoing costs associated with operation, maintenance and training.

By the beginning of the 1990s the digitization of the production process was complete with the introduction of affordable professional digital videotape recorders. From this point onwards analog technology was rapidly squeezed out of the professional television production environment.

Outside the television industry other new developments were taking place which would soon have a major impact. Through the late 1980s and early 1990s digital compression techniques were being developed to allow digital video and audio to be stored and manipulated using low cost, domestic, computer based technologies which lacked the processing speed and storage capacity of professional production equipment. These developments were primarily focused on the home entertainment industry (particularly video games and film viewing) and telecommunications (videoconferencing).

The widespread application of digital compression to professional TV production began with the introduction of off-line editing systems (used for making rough cuts or guide copies of programs), built around desktop computers and using normal computer hard-disc drives, albeit large ones, to store the pictures and sound. These devices rapidly gained widespread acceptance, without offering the high quality previously associated with digital technology. The appeal of these systems was speed, convenience and low cost.

It was soon realized that developed, professional versions of this digital compression technology, when combined with new, highly efficient modulation techniques, could be used to reduce the cost of transporting high quality, television pictures and sound from place to place. By utilizing digital compression, two, three or even more digitally compressed channels could be sent in the same space as a single analog television channel. Such digital links, using satellites, land-lines or microwave distribution, were widely adopted for delivering television signals from one studio to another, from a single studio to many cable head ends and even to analog terrestrial transmitters. The high capital costs of the compression equipment being offset by the reduced ongoing cost of the links.

To extend these advantages to the consumer marketplace, however, required an enormous reduction in equipment costs as complex demodulation and digital decompression technology would have to find its

[62] CDG Consultants Ltd., *Digital Terrestrial Television in Europe – Full Report*, London, 1998, pp. 47-49

way into every television household. Such reductions in costs were thought to be possible but required very expensive development and the assurance of large production volumes. To achieve this it was obvious that some common standards were required.

In Europe, in the 1980s, technologist-led new standards for better quality analog television production, transmission and home reception were developed and introduced but failed to gain widespread acceptance in the marketplace. This process has been well documented elsewhere[63]. By contrast, in the professional environment, the adoption of digital technology was based on incremental development and the adoption of systems and standards which deliver a large range of real benefits. The long time scale and haphazard nature of this process would not work in consumer markets so a new process was required.

In the early 1990s a group called **'The European Launching Group for Digital Video Broadcasting'** (ELG-DVB and later just DVB) was set up to explore the expectations of a wide range of commercial players across the industry in respect of digital broadcasting. The aim was to establish a set of standards which could and would be supported in the marketplace. The group included broadcasters from the private and public sectors, transmission platform operators, manufacturers of both professional and domestic television products and ancillary service providers.

The work of DVB was split between a 'commercial module' where the market requirements of a digital broadcasting system were debated and defined and a 'technical module' where technologies were adopted and standards were developed to best serve those needs. The keenest early interest came from those involved in satellite and cable broadcasting who were looking for means to introduce more services and new service types at lower cost than was possible with analog technology. In general these groups wanted to see the earliest possible deployment of digital broadcasting technology, hoping to gain significant pay-TV revenues (via subscription and pay-per-view). As a result, standards for satellite broadcasting (DVB-S), cable distribution (DVB-C) and microwave (DVB-MC/DVB-MS) were quickly developed.

By contrast, the incumbent terrestrial broadcasters, often carrying a public service ethos or protective of their commercial position, were lacking a dynamic for change. The danger of being left behind and a developing interest on the part of governments in the value of the radio spectrum soon changed this and standards for terrestrial broadcasting (DVB-T) soon followed. Digital terrestrial television is now in the long term plans of terrestrial broadcasters across Europe.

Over 200 of the main players in the broadcasting supply chain co-operated as part of the DVB project. The DVB has the strong support of the European Commission and the standards developed have been widely adopted, not just in Europe but around the world.

Although the DVB has developed new standards where necessary it has also been prepared to adopt existing standards where appropriate. In particular, the widely adopted international standard for moving image compression, known as MPEG-2 (Motion Picture Expert Group) is used. This allows the widest possible compatibility with other domestic entertainment technologies and lower costs through the use of common mass produced components.

[63] For example in: De Bruin, R. and J. Smits, *Digital Video Broadcasting: Technology, Standards and Regulations*, Boston: Artech House, 1999

Consumers will require a new receiver to access any of the digital delivery systems. In the initial stages of the digital transition, a separate dedicated unit (or set-top-box) may be attached to existing analog television sets, to convert digital broadcast signals back to analog. Some boxes may be compatible with a single delivery system only, but eventually most are likely to be dual or multi-platform compatible.

In time, the electronics for digital reception will become incorporated into TV sets to produce an integrated digital TV set which connects directly to the delivery system. It is likely that these sets will retain the ability to receive conventional analog transmissions, as this will have little impact on the overall cost.

Benefits of DVB-T[64]

In previous section, two main problems of analog terrestrial television were identified: the limited capacity of the spectrum and the quality of the received signal due to propagation aspects. This subsection will give a quick look on how digital TV in general and DVB-T in particular handles these problems.

Capacity

Digital broadcasting offers large increases in channel capacity over analog. This improvement is primarily due to the use of digital compression techniques. As mentioned above, DVB has chosen to adopt the MPEG-2 standard for moving image compression. This standard is capable of compressing audio and video signals and additional data into one single transport stream (TS).

As can be derived from the text above, MPEG-2 is optimized for moving images. Only differences between successive images are transmitted, so unchanging information does not unnecessarily take up channel capacity. This means that the load of a program is variable. For example, for a sports program (e.g. a soccer match) the load is higher then for a news program.

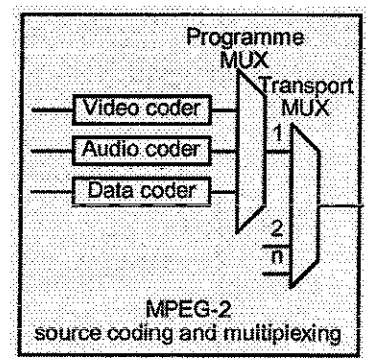

Figure C1-1 Functional Diagram of MPEG- 2 decoder

A DVB-T transmitter can transmit one transport stream per channel, which takes up as much bandwidth (8 MHz) as one single analog TV-channel. The capacity of a transport stream varies from 5 to 31 Mbps, depending on the modulation technique.

Taking into account the overhead and overcapacity (necessary due to the variable character of the TS) up to six programs/services can be transmitted in one single transport stream. Techniques such as statistical multiplexing[65] offer further incremental improvements in channel capacity

[64] Information for this subsection is partly derived from Cahners In-Stat Group, *Digital Broadcast Infrastructure Overview*, January 2001 and CDG Consultants Ltd., *Digital Terrestrial Television in Europe – Full Report*, London, 1998

[65] Image sequences with fast motion and a lot of detail require a higher bit rate than sequences with still images that lack detail. This means that in principle, the required bit rate depends on the instantaneous video content. When using a fixed bit rate, for part of the time a higher bit rate will be used then would normally be needed. Statistical multiplexing makes use of a various bit rate per program/service, therewith reducing the bit rate requirement for a certain service.

(up to ten programs/services in one single channel). This means implies huge cost reductions for broadcaster, being able to offer several services whilst using only one transmitter.

Propagation Aspects

Four propagation aspects of terrestrial TV were mentioned in previous section that could have serious quality implications for analog TV:

- Signal reach
- Shadows
- Multipath (static and dynamic)
- Impulse noise

For digital TV, these aspects have different effects.

Signal reach

The signal strength at the receiver goes down as the distance between the receiving and transmitting antenna goes up. With analog terrestrial television, the quality of the image and sound gradually deteriorate as the signal becomes weaker. With digital terrestrial TV, the ability of the digital receiver to perform error correction on the signal permits the on-screen image to appear nearly perfect, even with low signal strengths. However, at some point, the strength of the received signal can become so low that the demodulator cannot decode it adequately. When this occurs, the receiver blanks the image on the TV screen, and displays an error message. This binary 'on' or 'off' condition is known as the digital 'cliff effect'. Either one gets a perfect image on the TV screen, or none at all.

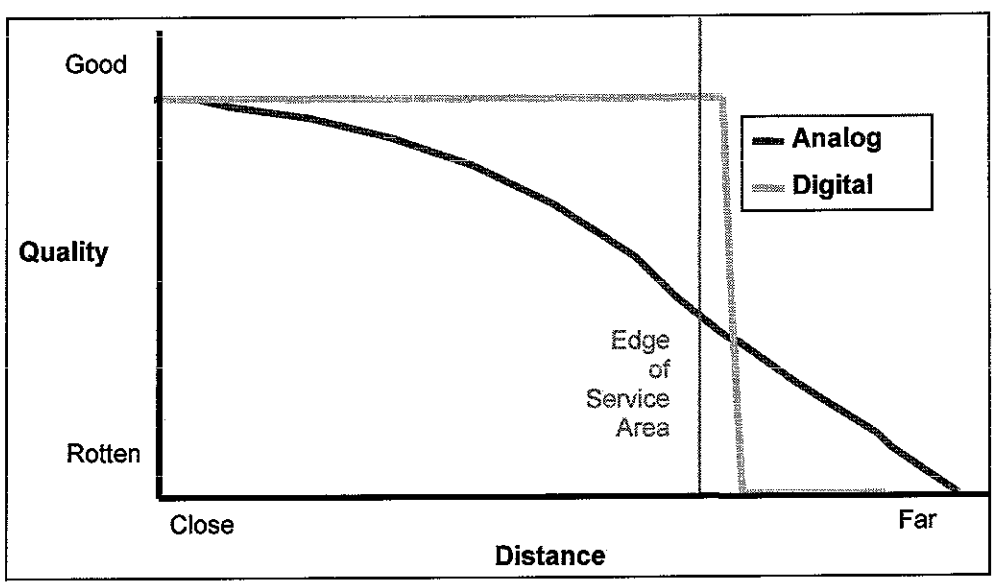

Figure C1-2 Distance Dependency of the Analog and Digital TV Signal

Shadows

With analog TV, impediments to the signal path can cause faint images on the TV screen. With digital TV, as long as a bare minimum of signal strength can be picked up, the image quality will be perfect. However, once the signal strength goes below this minimum, the digital receiver will blank the image on the TV screen, and displays an error message. This is a second instance of the digital 'cliff effect'.

Multipath

In the case of multipath, multiple versions of the TV signal are picked up by the receiver. With analog TV, this can result in 'ghosts', moving around behind each object on the TV screen.

Static Multipath

With digital TV, static multi path interference can be eliminated by the error correction mechanism of the digital receiver, permitting a perfect image on the TV screen. However, if the static multipath signal is too strong, it 'confuses' the receiver, causing the receiver to blank the screen and put up an error message. This is a third instance of the 'cliff effect'.

Dynamic Multipath

Dynamic multipath interference can also be eliminated by the error correction mechanism of the digital receiver. Again, when the interference signal is too strong, the error correction mechanism will not work properly, causing another instance of the 'cliff effect'. Although this is only temporarily – the blank screen will become a perfect image again when the dynamic multipath problems goes away – it can be very irritating to the viewer, when the screen goes 'on-and-off' frequently.

Impulse Noise

With digital TV, impulse noise can be corrected through the error correction mechanism. However, when this noise is too strong, it can cause bizarre distortions on the screen such as the appearance of little square 'frozen' images, contrasting with the rest of the screen which continues to show the on-going full motion video image. Another possible effect is, again, a blank image with an error message, until the impulse noise goes away.

Summary of Propagation Aspects

The effects of the mentioned propagation issues on digital terrestrial TV can be briefly summarized as follows: Either one gets a perfect image on the TV screen, or none at all. The cliff effect described above means that **the quality is mostly perfect** (due to the error correction mechanism), **unless the signal becomes too weak or the distortion too strong**. Compared with analog TV, of which the quality of the image is gradually deteriorating with the quality of the received signal, this is a huge improvement for most viewers.

Additional Benefits

Besides being a solution to the problems of analog terrestrial TV mentioned in previous section, the digitization of terrestrial TV brings along a number of additional benefits.

Flexibility

The DVB-T standard allows broadcasters a huge amount of flexibility in striking a balance between three variables: technical quality, signal robustness and number of services.

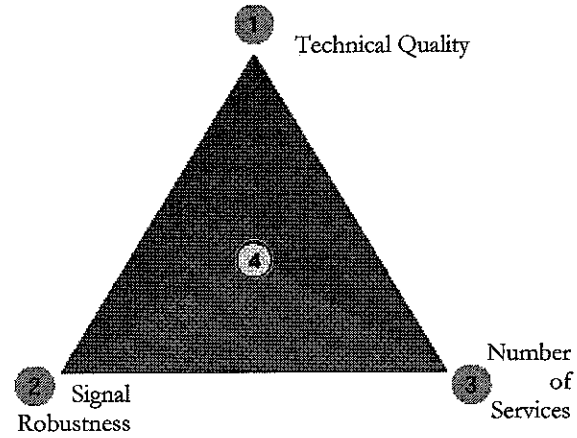

Figure C1-3 Service Trade Off
(Source: CDG Consultants)

To ensure that the digital data is received reliably some of the overall data capacity must be set aside to compensate for noise and distortion affecting the signal between the transmitter and the receiver. This process has been mentioned above and is known as **error correction**. As a greater proportion of the total capacity is set aside for error correction, reception becomes more reliable, or robust (**2** in figure C1-3). A typical example of **robustness** is the possibility for **mobile** and **portable** reception. Unfortunately this leaves less capacity available for the "payload", that is the entertainment, information and other services.

The remaining capacity, the 'payload', is used to carry a multiplex of different services (for example several different television programs). This multiplex can contain a small number of high data rate services (implying higher picture and audio quality; **1** in figure C1-3) or a large number of low data rate services (**3** in figure C1-3) or a compromise including some of each type.

Multiplex and platform operators in cooperation with broadcasters and other service providers must therefore decide how the overall (fixed) data capacity should be split between three objectives:

- the delivery of more services
- the delivery of higher technical quality content
- the correction of errors caused by natural deficiencies in the transmission path

Allocating more of the available data capacity to any one of these objectives leaves less available for the other two. This is illustrated in figure C1-3.

Quality

Besides the earlier mentioned elimination of gradual quality deterioration of analog terrestrial TV, DVB-T offers the possibility of superior image resolution, widescreen picture and multi-channel surround sound.

Enhanced Picture Quality

Television services with high picture quality are, in general, high data rate services; the higher the subjective quality the greater the data rate required. A guide to the data rates required for different service qualities is shown in table below. Audio services and most types of information and data services generally require lower data rates.

Table C1-3 Data Rates and TV Quality

Service Quality	Bit rate (Mbps)
Domestic VCR quality	2
Standard definition (SDTV)	4
Live sports (SDTV)	6
High definition (HDTV)	14+

Note: Bit rates are indicative. Actual quality of image can vary depending upon content.
Source: CDG Consultants Ltd., Digital Terrestrial Television in Europe – The Dynamics of Transition, London, 1998, p. 17

By adopting MPEG-2 digital compression, the DVB standards allow the delivery to the home of very high subjective quality pictures and sound. Although objective measurement of picture quality for digital broadcasting is not yet available, digital transmission is said to be able to provide 'DVD-quality'[66] and higher. Since the introduction of DVD for pre-recorded material, this has become a new (subjective) quality benchmark.

Widescreen Aspect Ratio

A visually arresting difference between digital transmissions and analog ones will be high quality, widescreen (16:9 aspect ratio) pictures on widescreen displays. Digital transmission technology is not unique in its ability to carry widescreen pictures; analog technologies have been used for widescreen transmission for many years using a variety of compromise solutions. Only the most complex of these (D2MAC or PAL plus) have attempted to maintain the quality available from a normal 4:3 aspect ratio transmission. Analog solutions to widescreen broadcasting have always been handicapped by the need to remain compatible with the enormous installed base of conventional 4:3 receivers. The only realistic solution for these receivers has been to display black bands above and below the widescreen picture.

Viewers who have purchased widescreen TV sets in the analog era, have faced a similar problem with the vast majority of current transmissions which are in the 4:3 format. They must either suffer black bars to the left and right of the 16:9 picture or gross geometric distortions of the displayed images. This factor has undoubtedly hindered the introduction of widescreen TV sets and the growth of the widescreen production market.

Digital transmission standards have been formulated from the outset with widescreen capability in mind. Indeed widescreen is generally considered to be the normal aspect ratio for future transmissions and productions. Existing owners of widescreen sets will therefore be much better served by digital transmissions than analog ones.

Either a set-top box or an integrated digital TV set will be required to receive any digital broadcast. The new reception equipment can give a better display of widescreen pictures on a 4:3 display. A wide range of aspect-ratio solutions are available for those broadcasters and viewers who consider them important.

[66] DVB and DVD both use the MPEG-2 standard for digital compression and are therefore comparable in quality. DVD is already adopted by many users and therefore often used as quality benchmark.

Enhanced Sound Quality

Consumers are less tolerant of poor sound quality than of poor visual quality. Most people also have experience of compact disc (CD) audio, and therefore also have a high reference standard against which to compare other systems. This is probably why enhanced audio systems, particularly NICAM (a compressed digital audio system) have gained a degree of market acceptance.

Digital transmission is able to provide enhanced audio quality. The MPEG audio standards adopted within the DVB project also support multi-channel surround sound. Standards used for DVD (such as DTS, Dolby Digital 5.1, AC-3) can also be used for digital TV. Another resemblance with DVD is the ability of digital transmission to broadcast **multi-lingual programming**. This will probably be more widely used than surround sound. It will make it easier for programs to serve several linguistic communities simultaneously. It could also offer viewers the choice of hearing foreign films in a dubbed version, or the original language.

Additional Services

Additionally, the DVB-T standard offers the possibility for broadcasters to offer many services[67] which were not available with analog terrestrial TV. The capacity of the latter to carry information services is limited to teletext. DVB-T allows an enormously greater quantity of information to be delivered along with television pictures and sound. This information may be directly related to the television services or completely independent.

Digital broadcast streams include service information (information to support the programming) and **conditional access** entitlements (information to manage access to the programming). In addition to these, there are many new programming types where the broadcast program is accompanied by **data** which is used to enhance the viewing experience. At the simplest level this can be advanced **teletext**, Internet style information, (multilingual) **subtitling** and an **electronic program guide** (EPG). Other examples of enhanced programming are multiple camera angles for a soccer event or even coverage of two matches at the same event. At a more sophisticated level, **interactive services**[68] may also be included as part of the program concept. Further, as a contribution to the "information society", digital broadcasting can deliver data not only to a TV, but also to a PC or network terminal. These issues are well documented elsewhere and not elaborated here.

Summary

DVB-T offers terrestrial television an improvement in spectrum efficiency and quality. 'Ghosts' and other signal interferences will end as digitization of the TV signals adequately handles these problems. DVB-T also adds some extra features not earlier available with analog TV.

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[67] The DVB specifications are also standardized by ETSI, ISO, IEC, EBU, and/or CENELEC. Please refer to the standards papers of these organizations for detailed information on the mentioned services. A good and comprehensive tool to go through these documents is the DVB CD-ROM v3.0.

[68] Interactive services through DVB-T can be achieved by the specified terrestrial return channel. Condition is that a transmitting antenna is present. Otherwise it can also be achieved by using a telephone line (analog or ISDN) or mobile phone (GSM) as return channel.

Capacity – DVB-T allows the transmission up to 10 television programs in a single VHF or UHF channel (instead of one with analog), thus increasing the content on terrestrial networks.

Quality – DVB-T offers interference-free reception and DVD-quality video and audio (including wide-screen picture and multi-channel surround sound)

Flexibility –DVB-T allows broadcasters a huge amount of flexibility in striking a balance between three variables: technical quality, signal robustness and number of services.

Extra – Other possibilities of DVB-T include:

- Multi-lingual audio and subtitling
- Conditional Access (CA)
- Electronic Program Guide (EPG)
- Interactive and data services

Appendix C2: Experiences with DTT

Other countries have preceded Vietnam in digitizing terrestrial television broadcasts. This appendix focuses on the digitization effort of some countries using the DVB-T standard. Because the Vietnamese government has chosen DVB-T as the standard for digital terrestrial TV, important countries such as the United States and Japan will not be discussed in this appendix.

The world's leading digital terrestrial television services are provided in the UK. In the following, a case study of the DTT in the United Kingdom is presented to the reader, followed by an overview of experience in other countries[69].

United Kingdom

Background

In the UK an important factor was a government desire to encourage new high-tech industry and extend emerging internet technology to a wider spectrum of the population. Competition for the dominant satellite provider was to be encouraged by developing digital terrestrial and cable. The necessary legislation was embodied in the Broadcasting Act of 1996, which molded a finely judged balance between existing and new players.

The encouragement of competition was achieved by a 'multiplex-led' allocation of licenses. This means that multiplexes were licensed – not services. There are six national multiplexes, of which the two best-coverage multiplexes were granted to existing analog terrestrial broadcasters (BBC, ITV, CH4). These broadcasters were therewith given capacity for simulcast plus an extra service for every analog service. The remaining four multiplexes were offered as licenses to new operators.

BBC Transmission was sold to pay for modernization and investment in new facilities. The industry regulator, the ITC (Independent Television Commission), held a beauty parade for new entrants in which the financial muscle of applicants was judged to be an important element to cover the early deficit years. Also, the wealth of existing ITV (analog) companies could be used to underwrite costs of DTT launch.

Two new operators were awarded multiplex licenses. The first one was for three multiplexes, awarded to ONdigital, a consortium of two major ITV companies (Carlton and Granada, two advertising-funded broadcasters). A second went to SDN[70] which was the sole bidder for the multiplex on which its services were gifted. BSkyB was barred from a share-holding in a multiplex operator's license on competition

[69] Information for this appendix is mainly derived from the following sources:

1. DTG, *Business Models for Digital Television*, London, 2000
2. Cahners In-Stat Group, *Digital Terrestrial Broadcast Infrastructure Overview*, January 2001
3. Cahners In-Stat Group, *Digital Terrestrial Broadcast Services*, December 2000

[70] A joint venture between S4C (a Welsh language broadcaster), NTL (a communications company) and United News and Media

grounds, although the ITC was happy that its most attractive program services should add to the terrestrial bouquet.

DVB-T was officially launched on November 15, 1998

Competition

Digital terrestrial in the UK had to compete heavily with digital satellite. BSkyB, the satellite TV operator, had the advantage in a substantial (3 million) analog subscriber base, which meant they had the advantage of experience and a very well tuned operation. Also, they made a very attractive offer to existing Sky analog subscribers to convert to digital, thus boosting take-up. An important method was to subsidize set-top-boxes, reducing the subscriber's up-front cost to zero and further investing heavily in Premiership, Champions League and UEFA Cup broadcast rights so as to claim to be the best platform for soccer fans.

ONdigital, the major DTT operator, also promoted 'free' set-top-boxes. However, in order to qualify for the 'free' set-top-box, consumers must sign up for a minimum subscription service that costs about USD 15 per month. If subscribers choose to receive only free-to-air signals, they must purchase the set-top-box for about USD 500.

Infrastructure

The UK has chosen for a multiple frequency network (MFN). With the chosen parameters[71] the available bit rate is 24 Mbps, which means that with 6 multiplexes the aggregate bit rate is 144 Mbps. Table below summarizes the deployment of DVB-T transmitters in the UK. In total, approximately 485 DVB-T transmitters are deployed in 84 separate sites[72], covering about 80% of the British population. The transmitters are sorted according to ERP (Effective Radiated Power). The nationwide chain of transmitters is jointly operated by Crown Castle International (CCI) and ntl on behalf of the broadcasters.

Please note that the majority of transmitters are lower-powered, which are used primarily to fill in gaps where communities are far away from the main (higher-powered) transmitters. Low power transmitters are also used to provide solid signal coverage in areas that have many 'shadows' (see appendix C1).

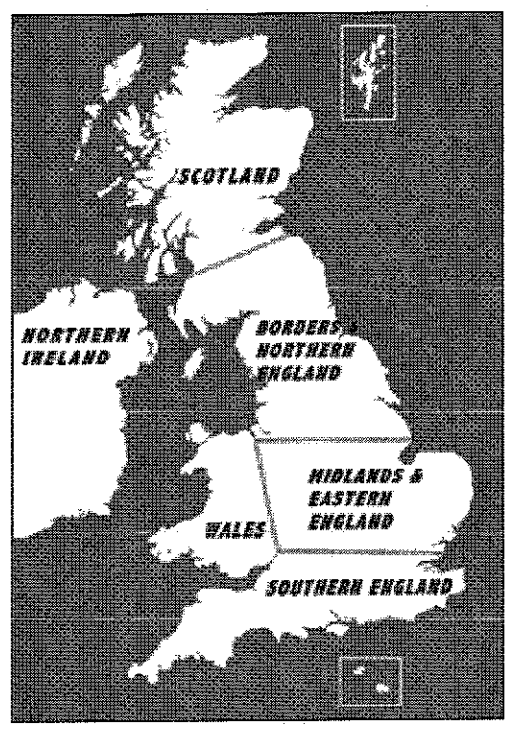

Figure C2-1 UK Map

[71] MFN, 2k, 64QAM, code rate 2/3, guard interval 1/32

[72] Info as of January 2001. For more recent info, please see http://www.itc.org.uk/divisions/eng_div/digital_transx/index.asp for a complete and updated list of transmitters.

Table C2-1 UK DVB-T Transmitters by ERP

Region	10 kW	9.9-5 kW	4.9-1.1 kW	1 kW	<1 kW
Borders & Northern England	12	18	18	0	60
Midlands & Eastern England	6	24	12	10	37
Northern Ireland	0	0	6	0	12
Scotland	18	0	24	18	18
Southern England	12	6	42	24	61
Wales	6	0	12	12	17
Total	54	48	114	64	205

See map for region

Sources: Cahners In-Stat Group and ITC

Content

The six multiplexes carry nine free-to-air programs (including the five current analog), 32 subscription programs, eight text/info/games programs and five pay-per-view services. Interactive services are also increasingly accompanying "event" programs such as UEFA Champions League football, Wimbledon tennis and the general election night coverage. Table below shows the content of the six multiplexes in England (in Wales and Scotland different content).

Table C2-2 UK DVB-T Program Content

Mux	Operator	Pos	Program/ Service	Mux	Operator	Pos	Program/ Service
1	BBC	1	BBC Choice	B	ONdigital	1	UK Horizons
		2	BBC News 24			2	ITV Sport Plus
		3	BBC Text			3	ITV Sport Select
		4	BBC Parliament			4	ITV Digital Info
		5	BBC Two			5	Cartoon Network
		6	BBC One			6	Sky Premier
						7	Sky Sports 1
						8	Carlton Cinema
						9	Sky One
2	Digital 3 & 4	1	ITV1	C	ONdigital	1	wellbeing
		2	ITV2			2	Adult Channel
		3	FilmFour			3	TwoWayTV
		4	Channel 4			4	Sky Sports 2
		5	FourText			5	MTV
		6	Teletext			6	Sky Movie Max
		7	E4			7	Granada Breeze/Men & Motors
		8	ITV Sport			8	Granada Plus
		9	ITV Text +			9	UK Gold
A	SDN	1	Channel 5	D	ONdigital	1	British Eurosport
		2	BBC Knowledge			2	Nickelodeon/ Paramount
		3	Shop			3	Sky Sports 3
		4	ITV Select Info			4	Discovery Kids & Wings
		5	ITV Select 1			5	Taste CFN
		6	ITV Select 2			6	UK Style
		7	ITV Select 3			7	UK Play
		8	ITV Select 4				
		9	ITV Select 5				
		10	ntl				
		11	TV Travel Shop				
		12	ITN News				
		13	Television X				
		14	Adults Only 1				

Source: http://www.jaura.freeserve.co.uk/muxes.htm

Subscriptions

Out of 24 million UK households, about 5.5 million households have taken subscriptions of the digital satellite service of BSkyB, although at least half of those were already subscribers to the analog service. ONdigital, the main digital terrestrial pay-tv operator had about 1,217,000 subscribers using set-top-boxes in November 2001. Integrated digital televisions are also being sold in increasing numbers (more than 100,000 so far). A campaign has been launched to highlight the difference between analog and digital TV sets, which will guide consumers towards sets with the kite mark-style digital video broadcasting (DVB) label[73]. Digital cable has around 1.7 million subscribers (mostly via conversion of their analog subscribers). Thus a total of around 8.4 million households in the UK now have digital television, making up about a third of all UK households.

Table C2-3 UK DTV Penetration

Platform	DTV households (millions)	% of UK households
BSkyB (digital satellite)	5.5	22.2%
ONdigital (digital terrestrial)	1.2	4.8%
Telewest (digital cable)	0.6	2.4%
ntl (digital cable)	1.1	4.4%

Source: ERO (http://www.ero.dk)

Analog closure

The UK Culture Ministry has given an indicative timetable (2006-2010) for the start of the digital switch-over process. Three criteria regarding affordability (equipment should be cheap), coverage (at least 95%) and penetration (at least 70%) must be met before the process can begin. The UK government has published a white paper[74] laying out options for future broadcasting and telecommunications legislation.

The UK Government has also published a draft Digital Action Plan which outlines the steps and actions required to facilitate digital switchover. Details of the digital action plan can be found at http://www.digitaltv.culture.gov.uk/pdfs/draft_digital_TV_action_plan.pdf

[73] Kite mark-style DVB-label:

[74] See http://www.communicationswhitepaper.gov.uk/

Other Case Studies

Sweden

Sweden has about 4 million TV households and was one of the early adopters of digital terrestrial, launching in April 1999. At launch, two multiplexes carrying eight services and covering over half of the country. In the (service-led) licensing, the state broadcaster Sveriges Television (SVT) was reserved three national licenses (for SVT1, SVT2 and SVT24, a 24-hour news and sports program). SVT secured additional finance from the government in order to fund its transition to digital.

Other existing analog broadcasters such as TV4 filled up the remaining space in the multiplexes. With only simulcast services at launch, the program line-up was far from impressive. Many license-holders were waiting to see if digital terrestrial was successful before committing to the platform. The set-top boxes were only available at full price and the result was not surprising in retrospection; the take-up was minimal. Seeing this situation the government permitted the early introduction of two additional multiplexes and issued new licenses to all the most popular program providers, giving Swedish DTT quite a competitive channel bouquet. In addition, a rental scheme was introduced to provide a low cost entry.

The four operational multiplexes cover about 90% of the Swedish population. The growth in rented DTT receivers is picking up, although the number of digital terrestrial receivers in use (sold/rented) is still low at about 90,000[75].

In March 2001 the Swedish Government decided that two additional multiplexes were to be coordinated. The coordination of these multiplexes is in progress and the licensing process for the additional services has been initiated. A fifth multiplex with 50% population coverage is expected to be operational in March 2002. The Digital Television Committee, appointed by the Government, has recently proposed that analog terrestrial transmissions should cease in 2007.

Spain

Spain has about 12 million TV households, and was also one of the early adopters of digital terrestrial, launching in May 2000. There are five national multiplexes and one additional regional multiplex in some regions. Four of those national multiplexes are strict national multiplexes, while one national multiplex is used for regional programming.

The main licensed multiplex operator, Quiero TV ("I love TV"), offers nation wide services by operating 3.5 multiplex in UHF channels 66, 67, 68 and 69 (Single Frequency Networks). The remaining 0.5 multiplex is shared by two new operators licensed since November 2000. The new operators are Veo TV ("I Watch TV") and Net TV. One multiplex is shared by all existing national analog broadcasters: TVE 1, La 2, Tele 5, Antena 3 TV and Canal+. The renewal of their current analog license is linked to start digital transmissions in the referred multiplex before March 2002.

[75] Estimate for November 2001 by ERO (http://www.ero.dk/)

Again, initial take-up was slow, with competing satellite operators taking a major share of the pay TV market. After additional service provider licenses were awarded, and a new subscriber promotion, offering six months subscription for the price of one month, the DTT market has taken up a little. Since digital terrestrial is only operational so shortly, no reliable data on the DTT penetration figures can be found.

Singapore

Singapore deserves special mention as the first implementation of DVB-T in a mobile application. Here, 1,500 buses have been fitted with receivers to provide a special service of short items for commuters. Whilst it can be argued that Singapore is a special situation, slow moving public service vehicles carrying commuters are clearly a common feature of most big cities in the world and, if successful, the model is likely to be copied elsewhere. It is an example of making use of the unique properties of DVB-T that deserves close interest in the way it develops.

Conclusions

Although each territory has different situations and DTT solutions must be tailor-made, there are some common lessons that may be drawn from the examples quoted:

- A dense network of transmitters is needed to assure a wide **availability**;
- Subsidized or rental STBs can help initial take-up since it enhances **affordability** by lowering the entry cost;
- The government can play an important role in ensuring that certain services are still **accessible** for as many people as possible (e.g. by regulating simulcasting and FTA-broadcasts)
- New platforms need a good **content** proposition including both free-to-air and conditional access programs in order to attract the viewer.

Appendix D: Country Profile

Vietnam is located in Southeast Asia. It is a long, thin, S-shaped country stretching from below the 10th northern latitude at its southern tip nearly to the Tropic of Cancer along its northern border. Its neighbors are China, Laos and Cambodia. To Vietnam's west is the Gulf of Tonkin and the South China Sea. Vietnam's land area is 329,556 square kilometers. At the April 1999 census, the country counted a population of 76.3 million with a growth rate of 1.70 per cent. In spite of government efforts to reduce fertility, population growth remains high. The government now finds itself in a situation whereby it needs to create social programs that effectively serve the growing needs of the Vietnam population.

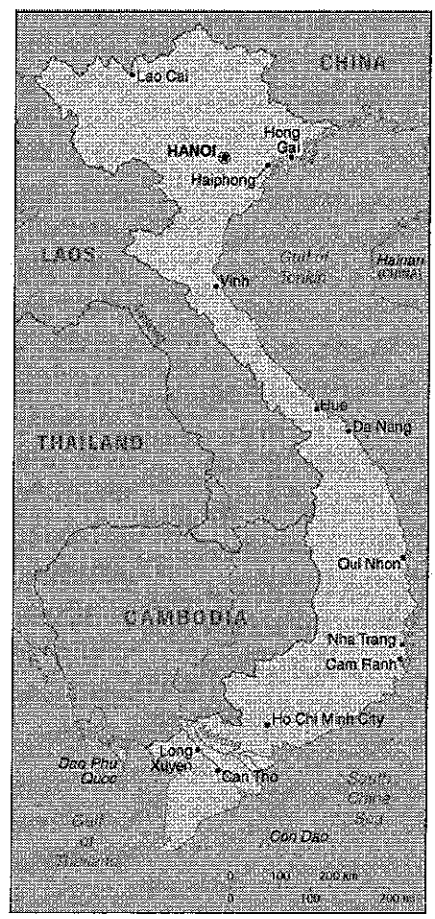

Figure D-1 Vietnam Map

Vietnam is divided into eight regions: Red River Delta, North East, North West, North Central Coast, South Central Coast, Central Highlands, North East South and Mekong River Delta. These regions are subdivided into 61 provinces[76], the provinces into 560 districts and the districts into 10,320 communes.

Vietnam has a topography of hills and densely forested mountains, with level land covering no more than 20 per cent of the country. Mountains account for 40 per cent of total land areas, hills 40 per cent and forests 75 per cent. Due to the difficult terrain and the lack of resources, Vietnam has very limited infrastructure. There are very few paved roads and highways[77]. Vietnam has 17,702 km of navigable waterways. The railway system is very limited with only 3,259.5 km of railroad.

Although Vietnam's telecommunication sector lags far behind other countries in Southeast Asia, the country has made considerable progress in upgrading the system. Since 1991, Vietnam has digitized all provincial switchboards, while fiber-optic and microwave transmission systems have been extended from Hanoi, Da Nang and Ho Chi Minh City to all provinces. The density of telephones nation-wide increased incredibly fast from 750,000 in 1995 to over 2 million in 1998. The number of fixed telephone lines reached 4.0 million in September 2001, which comes to tele-density of 50 per 1,000 inhabitants. However this is still far behind other countries in the region.

[76] More precise, there are 58 provinces and 3 "municipalities at provincial level": the capital Hanoi, Ho Chi Minh City and Haiphong

[77] There is no reliable source on the length of paved roads, but it is estimated that in 1995 it was about 100,000 km.

Political System

A new constitution, approved in April 1992, states that the Communist Party of Vietnam (CPV) should operate within the framework of the constitution and the laws of the country and that it should no longer be allowed to direct the day-to-day operation of the government. It also promulgates government reorganization and increased economic freedom.

The National Assembly (450 seats), which was granted an increase in its power and independence, is designated as the highest representative body of the people and the only body with legislative powers. The constitution promulgates an expansion of the body's oversight powers as well as an extension of choice in the balloting process for elections to the National Assembly, which for the first time permitted non-party members to be elected in 1992. These non-Party members however, are subject to approval by the CPV. The official results of the last election (July 20, 1997, next to be held in 2002) by party were as follows: Communist Party of Vietnam 92 per cent, other 8 per cent.

The revised constitution replaced the Collective Council of State with an Office of the Country's President. The President, elected by the National Assembly from among its members, is the head of state. He has the overall command of the armed forces and holds the office of Chairman of the National Defense and Security Council. Besides these and other administrative powers, he has the power to recommend the dismissal of government officials (subject to the approval of the National Assembly). The Vietnamese president is Tran Duc Luong.

The new constitution also revised the composition of the Central Government. The cumbersome Council of Ministers was replaced with a cabinet headed by the Prime Minister, accountable to the National Assembly. The constitution also states that "the government shall make its reports to the National Assembly, its Standing Committee, and the Country's President". The cabinet is composed of three Deputy Prime Ministers as well as the directors of the country's 15 ministries, and five "organizations of ministerial rank". The Prime Minister of Vietnam is Phan Van Khai.

Except for the administration of the ministries and "organizations of ministerial rank", the government is responsible for the administration of "organizations under central government" (containing general departments, committees, centers). These organizations carry a different name, but in fact act on the same level as the ministries. All these organizations can have "large state enterprises" under their authority. These enterprises on their turn govern other state enterprises.

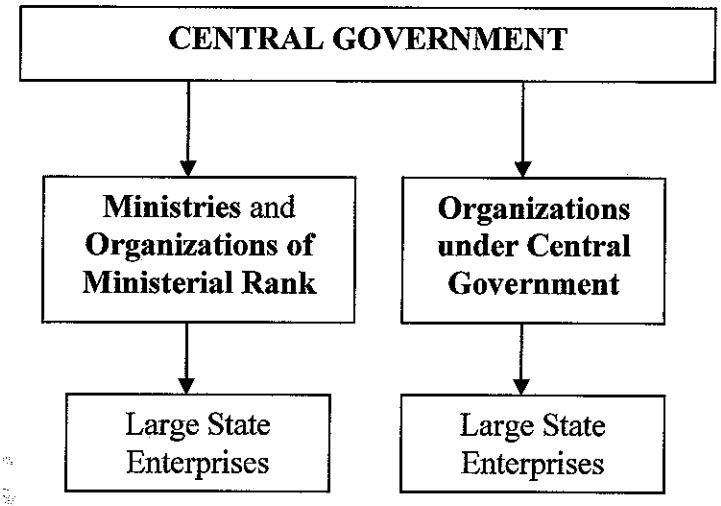

Figure D-2 Administration Diagram for Central Level

Further, the Central Government manages and directs the 61 Provincial People's Committees, which are responsible for the governing on provincial level. On their turn, these Provincial People's Committees manage and direct the People's Committees on district level and so on. Also, the Provincial People's Committees are responsible for state enterprises at provincial level.

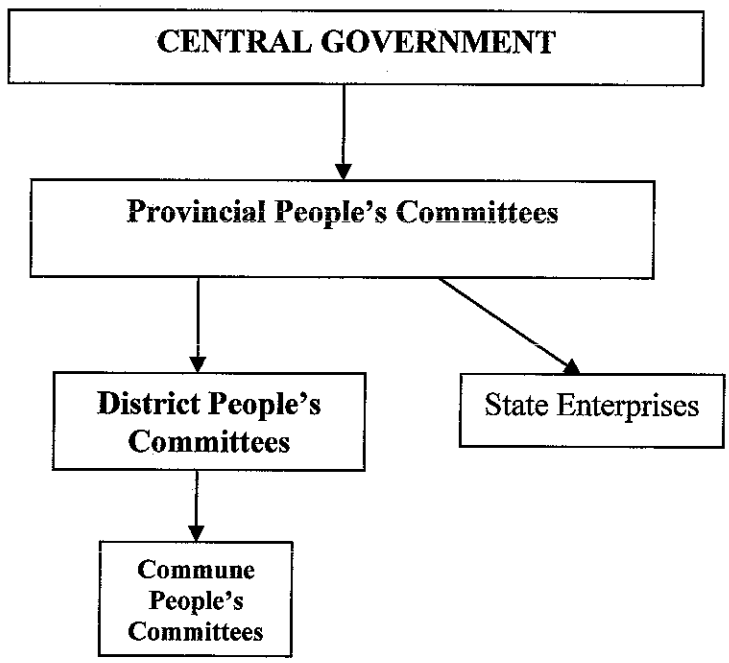

Figure D-3 Administration Diagram from Central to Lower Levels

In Vietnam, governmental policy is largely the prerogative of the communist leadership, with policy being set by the Politburo (15 members) and its five-man Standing Board, which oversees day-to-day policy implementation. The most important political institution in Vietnam is the Communist Party of Vietnam

(CPV) headed by Secretary General Nong Duc Manh since April this year (ninth Party Congress). The role of the Party is amply expressed as follows:

The Communist Party of Vietnam, the vanguard of the Vietnamese working class, the faithful representative of the rights and interests of the working class, the toiling people, and the whole nation, acting upon the Marxist - Leninist doctrine and Ho Chi Minh's thought, is the force leading the State and society. All Party organizations operate within the framework of the Constitution and the Law.[78]

Many major policy directives are issued as Central Committee (150 members) resolutions but are formulated by the all-powerful Politburo; many others emanate directly from the Politburo. Overlapping party and state positions continue to be held even though there has been some effort to discourage both that practice and direct party interference in government affairs.

Many of Politburo members concurrently hold high positions in the government and 85 per cent of the deputies in the National Assembly are Party members. This is also the case at lower levels, where provincial, district, and village party officials dominate the administrative councils[79].

Facing the dire economic consequences of the Asian Crisis, representatives of the Vietnamese Government at the Consultative Group Meeting for Vietnam held in Paris in December of 1998, stated that the Vietnamese government was committed to accelerating further structural and sectoral reforms. They indicated plans for a comprehensive state enterprise reform program, a restructuring of the banking system and a comprehensive three-year trade reform program. These governmental reforms have the specific purpose to move Vietnam towards a free and open market economy and to attract foreign investment. While the leadership says it is committed to reform, the pace of that reform continues to be debated. Though Vietnam remains a one party state, adherence to ideological orthodoxy has become less important than economic development as a national priority.

Economic Situation

Vietnam is one of the poorest countries of the World today, occupying the 120th position (between Ghana and Lesotho) in a global list of 162 economies on GDP[80] per capita in the latest Human Development Report of the United Nations Development Program[81]. In the same report, the UNDP ranks Vietnam significantly higher at the 101st place in the so-called "Human Development Index", a broad composite index of social and economic indices concerning human development.

The period after reunification from 1975 to 1985 was marked by economic stagnation. The Vietnamese made little progress in raising output and living standards beyond the levels of the 1960s. Distortions in the Vietnamese economy resulted in the onset of an economic crisis by the mid-1980s. With inflation running at 700 per cent in 1986, Vietnam recognized the pressing need to reorient its economic policy. That year, the sixth party congress approved strategies for substantial reforms in areas such as the exchange rate,

[78] Source: http://www.batin.com.vn/vninfo/asv/cpv.htm

[79] Source: http://www.tradeport.org/ts/countries/vietnam/bnotes.html

[80] At purchasing power parity

[81] UNDP, *Human Development Report 2001 – Making New Technologies Work for Human Development*, New York, 2001

foreign investment, and government budget management. This marked the beginning of a major economic reform effort, which the Vietnamese refer to as "*Doi Moi*" or renovation.

Major reforms undertaken during the decade 1986-96 included: de-collectivization of agriculture; land reform that created greater security of land tenure; a reorientation of investment away from heavy industry to agriculture, light industry and exports; price reforms, including elimination of virtually all administered prices; liberalization of foreign trade and foreign investment; interest rate liberalization; exchange rate unification; and progress toward establishment of a legal framework for the encouragement of private-sector led growth.

Table D-1 GDP by Industrial Origin – Growth Rate

	1994	1995	1996	1997	1998	1999
Total	**8.8%**	**9.5%**	**9.3%**	**8.2%**	**5.8%**	**4.8%**
Agriculture(i)	3.4%	4.8%	4.4%	4.3%	3.5%	5.2%
Industry and Construction	13.4%	13.6%	14.5%	12.6%	8.3%	7.7%
Services	9.6%	9.8%	8.8%	7.1%	5.1%	2.3%

(i) includes agriculture, forestry and fisheries

Source: General Statistical Office

Vietnam became one of the fastest growing economies in the world. As it can be seen from table D-1, the average annual GDP growth from 1994 to 1997 was about 9 per cent. Vietnam's inflation rate, which stood at an annual rate of over 300 per cent in 1987, fell steeply to less than 4 per cent in 1997. During this same period, there was a three-fold increase in investment and a five-fold increase in domestic savings. Agriculture production doubled, transforming Vietnam from a net food importer to the world's second largest exporter of rice. Economic reforms also resulted in a dramatic increase in foreign trade, which in 1997 represented about 80 per cent of the GDP, and foreign direct investment inflows, equivalent to 8 per cent of GDP in 1997.

Progress that has been made away from a centrally planned economy towards a more market-oriented economic model has resulted in an improvement in the quality of life for many Vietnamese. As table D-1 shows, significant gains were made in all sectors of the economy. Per capita income, which was USD 220 in 1994, rose to USD 320 by 1997 with a related reduction in the share of the population living in acute poverty[82]. GDP per capita is estimated to be about USD 400 for the year 2000[83].

The situation in Vietnam has changed radically in 1998. The external shock of the East Asia Crisis, together with weakness in management, and the natural disasters that have hit Vietnam in the last years, have all combined to reduce the growth rate of the economy, from an average of 9 per cent between 1994 and 1997 to an average of 5 per cent in the years 1998 and 1999. Despite the slowdown of growth in the US and the rest of the world, forecasts from various sides predict a recovery for the years 2000 to 2002.

[82] Source: www.tradeport.org/ts/countries/vietnam/bnotes.html

[83] Source: VET Research in *Vietnam Economic Times*, June 2001 (88), p. 33

Table D-2 GDP Growth Forecast

	2000 (est.)	2001 (forecast)	2002 (forecast)
Government	6.7%	7.5-8%	N/A.
World Bank	5.5%	5.5%	N/A
Asian Development Bank	6.1%	6.4%	7%

Note: These forecasts are from before "September 11"
Source: VET Research in *Vietnam Economic Times*, May 2001 (87), p. 7

Currency and Exchange Rate

The unit of currency of Vietnam is the 'new dong'. Its international acronym is VND, like EUR for the Euro, USD for the United States Dollar and SGD for the Singapore Dollar.

Currency: 1 Dong = 100 Xu

In spite of the Asian crisis, the Vietnamese dong has been relatively stable against the US dollar and other international currencies. The exchange rate of the dong (VND) per USD 1 depreciated from VND 11,500 at the end of 1996 to VND 14,280 at the end of 2000.

Table D-3 Changes in Currency Prices

Country	% change on September 1998 from June 1998
Indonesia	-78
Korea	-36
Malaysia	-33
Philippines	-40
Thailand	-39
Vietnam	-17

Data as of September 18, 1998
Currency: USD/local (-) is devaluation
Source: Philips Nederland B.V.

As table 3-3 shows, in 1998, the Vietnam had the most stable currency compared to other countries involved in the Asian Crisis. An economic report of the World Bank[84] states: "The effects of the regional crisis have made Vietnam less competitive, for two reasons. First, there have been substantial currency devaluations in crisis countries. The Dong on the other hand, has been devalued by much less, (however this is) not enough to restore competitiveness to pre-crisis levels."

[84] World Bank, *Vietnam: Rising to the Challenge, An Economic Report for the World-Bank Consultative Group Meeting for Vietnam*, 1998, p. 6

Official Exchange Rates as of September 28, 2001 (Vietcombank rates)
1 EUR = 13,960.29 VND
1 USD = 15,004.00 VND
1 SGD = 8,526.39 VND

The World Bank report also states that the impact of the crisis is changing the nature of foreign investment flows. More than half of foreign investment in 1998 came from outside Asia. This reflects a sharp decline in Asian investment and a growing interest in western investment projects.

The Role of Television in Vietnam

Television in Vietnam has always had the primary purpose to educate and inform the people. Private television is forbidden and the advertising limit is 5 per cent of the airtime. The attitude of the Vietnamese government with regard to television is amply expressed in a governmental decree[85]:

"Vietnam Television is a central Television, an organization under the administration of the Government. It has the functions of an agency for disseminating Party and State's policies"

Besides this, the decree also states that Vietnam Television is "responsible for state management of television technical development throughout the country".

The position of Vietnam Television within the political-regulatory framework of Vietnam gives a clear image on the role and importance of television in Vietnam. Vietnam Television is an institution under the direct administration of the Vietnamese government, meaning that they are equal in administrational rank as for example the General Department of Posts and Telecommunications.

However, due to the power of the television medium as a propaganda tool, in practice the political role of Vietnam Television might be even greater. A saying in the political scene is that "Vietnam Television is the Government, and the Government is Vietnam Television".

Television has become more and more important in the daily lives of the Vietnamese. Showing an incredible growth, Vietnam Television has managed to successfully build a television network in a few years. According to formal figures, the Vietnamese (terrestrial) television network reaches 65 million potential viewers (see table E-1 of appendix E). Television penetration is high at 10 million TV sets for a country with a per capita income of USD 400 per annum. Between 1991 and 1995, the number of TV households quadrupled to an estimated 60 per cent penetration of the population. Except for some remote rural areas, this figure is rising to 90 per cent[86].

Emphasizing today's role of television in the lives of the Vietnamese, on the priority list of luxury goods to be purchased whenever one can afford them, the number one spot is occupied by the TV set, followed by

[85] Decree No. 52/CP dated August 16, 1993, issued by the Government
[86] Sources: DV Consultants, Philips Nederland B.V., Vietnam Television

the refrigerator and the motorcycle. Further, allover the country, in almost every family, the TV is always on (provided that there is one present). Television has become an inextricable part of Vietnamese culture[87].

Freedom of the Press and Media

Throughout the history of communist Vietnam, there has never been a shortage of newspapers. Currently, there are over 500 newspapers and magazines devoted to diverse subjects. The commonality is that the Vietnamese Communist party or one of its affiliate organizations publishes them all. The newspaper with the widest printing is 'People" (Nhan Dan), which is the official daily of the Communist Party. Other publications with wide distribution include the "Labor" (Lao Dong), published by the State-sponsored Labor Organization; the "Youth" (Tuoi Tre), published by the state-sponsored Youth Organization, and the "Saigon Liberation" (Saigon Giai Phong), published by the Ho Chi Minh City Party Committee.

All of the official publications in Vietnam practice a policy of self-censorship. The Ministry of Interior has a press wing devoted to monitoring and controlling media coverage. In its 1993 annual report, Freedom House, a non-profit New York-based human rights organization, put down Vietnam as one of the worst rated countries in freedom of the press. In recent years however things have slowly began to change in Vietnam with regard to the freedom of the press. Ever since "Freedom Forum", a bold attempt to start an independent media in Vietnam, efforts to achieve an independent media in Vietnam have become more frequent, achieving greater recognition inside the country and abroad[88].

In an article dated 18 November 1998, prepared by 'The Free Vietnam Alliance' states, "The communist leadership in Vietnam today finds itself in a bind. On the one hand, to jump start the flow of foreign investment (and manage tensions within society), it has to tackle seriously the issues of corruption, accountability, and transparency. Any real solution to these problems would have to include a free press as an independent watchdog". The Communist government of Vietnam fully recognizes this and has been making considerable steps to achieve the changes needed[89].

Close monitoring of the press is an ideological issue, which the Vietnamese government cannot toss aside without serious consideration. It is enshrined in their concept of communism and good government. Although change will not come quickly or easily, there were some developments in the provision of independent media that were very promising. As from July 1st, 2001, the television programs of CNN, TV5 and Deutsche Welle were broadcasted free-to-air in the Hanoi area. This was done through digital terrestrial television broadcasts, the subject of this research. Although it is still a long way to complete freedom of press and media in Vietnam, the (free) provision of independent foreign media to Vietnamese citizens is a first and necessary step towards this goal.

[87] Source: DV Consultants

[88] Source: Philips Nederland B.V.

[89] Source: Philips Nederland B.V.

Conclusions

With a per capita GDP of only USD 400 in the year 2000, Vietnam is among the world's poorest countries. However, with a population of 80 million people and a growing economy, Vietnam promises to be an important market for the future. The present broadcast of digital terrestrial television services in Vietnam proves that besides economic considerations, there are other important considerations in Vietnam. The political environment puts the medium of television in a peculiar position. On the one hand it is warmly welcomed by the political leaders as it can serve as a propaganda machine for party and state. On the other hand however, the government limits the possibilities of the television medium by strongly controlling and monitoring of the press and media.

Digital terrestrial TV finds itself in the same position. Technological progress is warmly welcomed but is resisted when it brings too much change in the political status-quo. A typical example is the forced cancellation of the digital broadcast of CNN, TV5 and DW in Hanoi, a few weeks after the start of the trial. More on this subject follows in chapters 4 and 5.

Appendix E: Sector Profile

Regulatory Environment

As indicated in appendix D, Vietnam Television has the role of "propaganda machine" for State and Party. Whereas in some other countries a convergence between television and telecommunications sectors has taken place, in Vietnam the convergence of technologies have not lead to a convergence of these sectors, nor affected the legal framework.

Broadcasting was regulated and governed by the Ministry of Culture and Information till 1993. In that year, as a consequence of and based on the 1992 Constitution, Vietnam Television was placed directly under the authority of the Prime Minister as an "organization under central government" by Governmental Decree No. 52/CP (August 16, 1993). In practice this meant that Vietnam Television became the regulator, supervisor and executor of laws and regulations involving broadcasting and propaganda.

Information and communications is regulated and governed by the General Department of Posts and Telecommunications[90], which also has the status of an organization under central government.

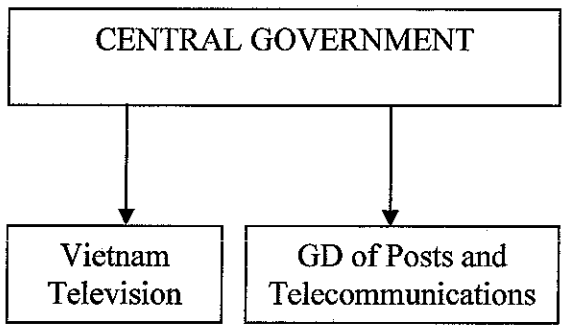

Figure E-1 Position of Vietnam Television

Laws, regulations and policies for telecommunications and broadcasting are strictly separate. Even with all the possibilities of digital television that make the boundaries somewhat vague, the classical difference between telecommunications and broadcasting legislation will likely continue to exist for many years. Reasons are largely political, and are beyond the scope of this research.

[90] Decree no. 12-CP, dated March 11, 1996, issued by the Government

Activity Allocation Model

Figure E-2 illustrates the "Layer model of sectors and actors". This model can be used in Europe to allocate the activities of the parties involved in digital television[91]. Vertically, the model shows a chain of activities, from the production of information to the manufacturing of terminal equipment.

Horizontally, a distinction is made between the information & entertainment ('infotainment'), telecommunications and transaction sectors. In Europe and some other countries, these traditionally separate sectors have been converging towards each other. As mentioned before, in Vietnam this horizontal integration has not taken place.

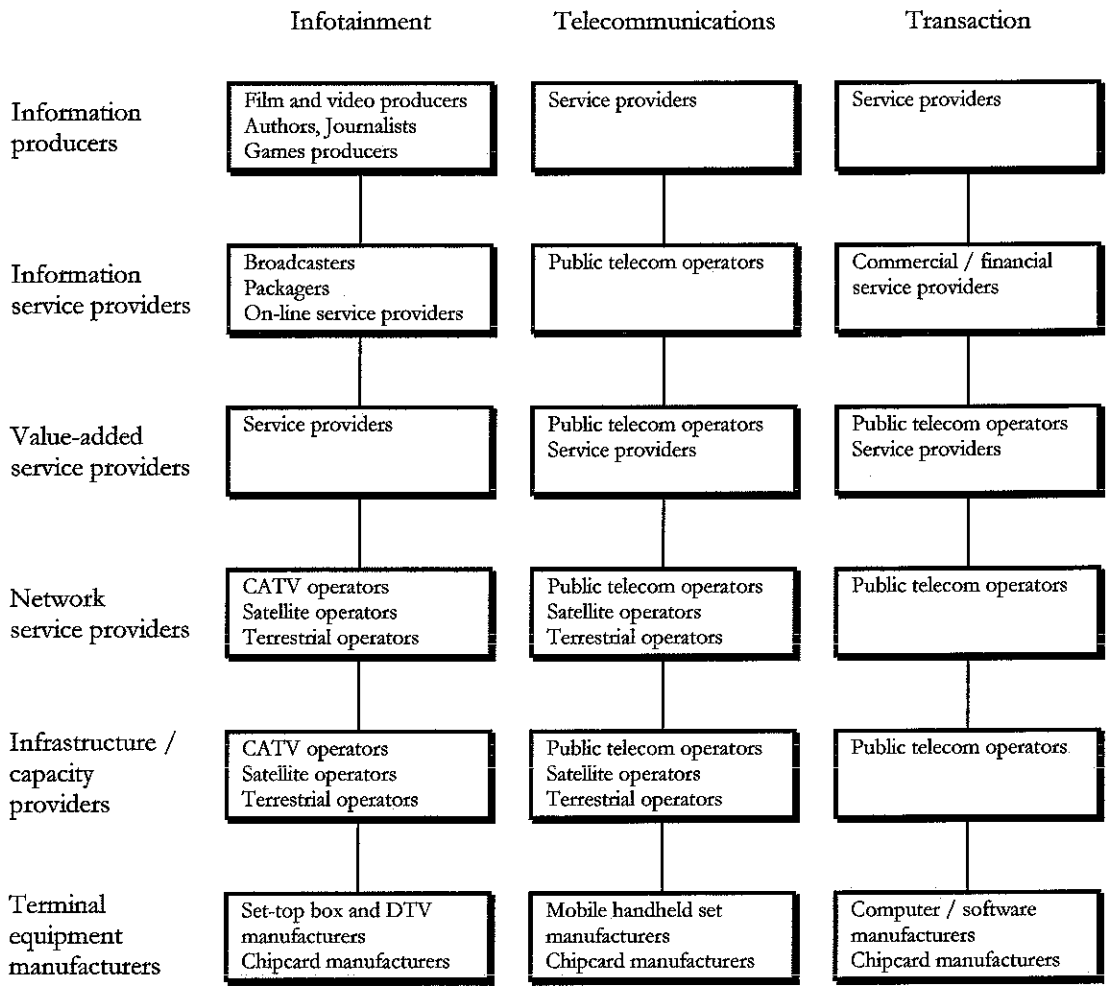

Figure E-2 "Layer Model of Sectors and Actors"

(Source: De Bruin and Smits, 1999)

In Vietnam, the parties involved in television are all in the above called 'infotainment' sector. The digitizing of television does not change this, at least not in the near future. Also, the situation in Vietnam is not as

[91] Source: De Bruin, R. and J. Smits, *Digital Video Broadcasting: Technology, Standards and Regulations*, Boston: Artech House, 1999, pp. 35-47

layered as the figure above. Only a few major parties can be distinguished, and their activities can be classified into only three layers in the economic value-added chain for digital television.

Below, a simplified model is used to allocate the activities of the players in the Vietnamese broadcast and television sector.

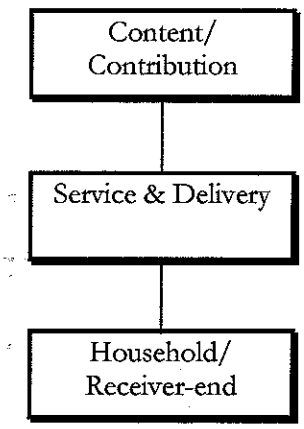

Figure E-3 Value-added Television Chain

Content / Contribution

This layer contains the "information producers" and "information service providers" of figure E-2, and refers to the producers of content (film and game show producers, authors, journalists, news reporters, etc.) as well as the broadcasters / TV stations.

Service & Delivery

This layer contains the "value-added and network service providers" of figure D-2, as well as the "infrastructure providers". In a nutshell, the service & delivery layer is involved in bringing the content to the households.

Household / Receiver-end

The third layer refers to the last layer of figure D-2, the terminal equipment manufacturers.

Analog Terrestrial Television

Above described model will be used to explore the present situation in the television and broadcast sector.

Content / Contribution

In Vietnam, the provision of content is largely taken care of by the TV stations. Although there are independent film-producers that contribute their part of content to the TV stations on contractual basis,

most of the film producers belong to Vietnam Television. In the following an overview of the contents of the main TV stations will be presented.

Vietnam Television

Vietnam Television, the central television agency, broadcasts three terrestrial programs, and is good for a total of 36 hours of broadcasts per day.

VTV 1 is good for 11 hours of daily broadcasts (from 5:30 am to 10 am and from 5 pm to 11:30 pm) of mainly general and political information. Its most important program, the daily seven o'clock news, is estimated to have an audience of 23 million people. VTV 1 has a national coverage through Vietnam Television's terrestrial network.

VTV 2 broadcasts educative, scientific and foreign-language (English, French and Russian) programs for 13 hours per day (from 10 am to 11 pm). VTV 2 covers only the Hanoi area.

VTV 3, on the air since 1996, is the most popular TV station of VTV. Broadcasting 12 hours (14 hours on Sundays) per day (from 12 am to 12 pm), VTV 3 provides the Vietnamese the necessary amusement. Its diverse programming consists of games, sports events (e.g. international soccer matches), films, documentaries, but also cultural and economic programs. VTV 3 has a national coverage through re-broadcasts.

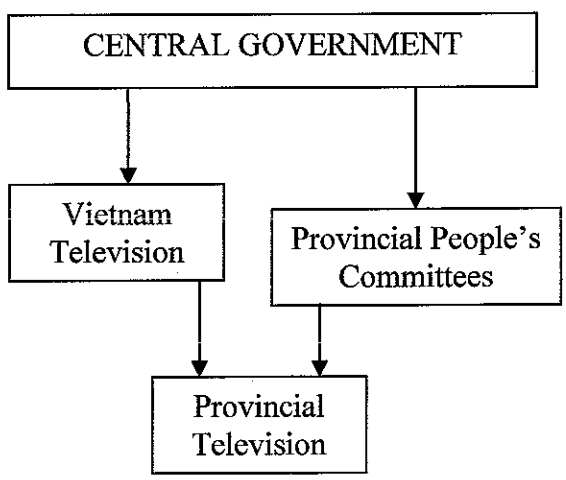

Figure E-4 Position of Vietnam and Provincial Television

Provincial Television

Besides national television, every province has a local TV station, placed under the supervision of the Provincial People's Committee and Vietnam Television. There are 61 local TV stations, but most of them have a rather poor local contribution, relying heavily on national programs. The most important and dynamic local stations are in Hanoi and Ho Chi Minh City.

Hanoi TV is a local TV station that covers the Hanoi area and the surrounding provinces, and has 10 million potential viewers. Broadcasting 18½ hours per day (from 5:30 am to 12 pm), Hanoi TV provides a diverse programming of actualities, sports, foreign movies, Asian series, cartoons, et cetera.

Ho Chi Minh TV consists of two stations which, thanks to the relatively high advertisement revenues, has become a competitor to Vietnam Television in the whole Mekong delta (18 million potential viewers). One station, HTV 9, has a programming comparable to VTV 1 and 2 (general and educative programs). The other station, HTV 7, is a more commercial station, and has a programming comparable to VTV 3 (amusement, sports). Both stations broadcast 18 hours per day (6 am to 12 pm).

Service and Delivery

This part of the chain is taken care of by Vietnam Television and the local TV stations. Vietnam Television takes care of the service and delivery of its own programs, as well as the standardization and regulation of the broadcasts[92]. Vietnam Television's terrestrial network has a national coverage for VTV 1, its propaganda program. The other two terrestrial programs, VTV 2 and 3 are directly broadcasted by Vietnam Television in the Hanoi area only.

The national programs of VTV 1, 2 and 3 are also transmitted to satellites THAICOM and MEASAT. The main purpose of this is to distribute the programs to the local TV stations. In areas other than the Hanoi area, the programs of VTV 2 and 3 depend on the local TV stations to be re-transmitted. This applies partly to VTV 1, since the terrestrial network of Vietnam Television still has gaps. In practice, the most re-transmitted program is VTV 3.

The administration of the state television in Vietnam is managed vertically (from national level to provincial to district to commune), and so are the broadcasts. In the provinces, the local TV stations are allowed to produce their own programs, and are obligated by Law to broadcast the VTV 7-o'clock news on their channel. Independent program provision (as opposed to that supplied by Vietnam Television) in the provinces is simply a question of economics and local production facilities. The local TV stations are free to edit the material supplied to them, and add local programming. Local advertisements are often substituted for national ones supplied by Vietnam Television.

Most local TV stations rely heavily on national programs provided by Vietnam Television. This is especially the case for provinces where the VTV programs are not re-transmitted through a separate channel; hence a selection of VTV 1, 2 and 3 is re-broadcasted through their local channel.

Most provinces transmit their local program centrally, and retransmit this program through district and commune relay stations (less then 0.1 kW transmitting power). Depending on whether a local TV station has the capacity (financially, technically) and willingness, (some) VTV programs are picked up from satellite, and retransmitted (again in the same hierarchical way).

[92] One of its standardization efforts is for example the gradual change from SECAM to PAL color system in all of Vietnam in the 1980s and 90s.

As a result of the hierarchical organization of television in Vietnam, as well as the topography of mountains, hills and forests covering 80 per cent of the area, the terrestrial television network consists of a large number of (low-power) transmitters (see table E-1).

Table E-1 Number of Analog Transmitters in Vietnam

Year	Main analog transmitters	Analog relay transmitters	Coverage (% of population)
1998	128	531	77.75%
1999	156	596	78.75%
2000	172	666	80.75%

Sources:
Dai Truyen Hinh Vietnam, *Cong Tac Thi Dua va Phat Trien Su Nghiep Truyen Hinh Nam 2000-2001*, Hanoi, 2001, p. 5
Dai Truyen Hinh Vietnam, *Cong Tac Thi Dua Nam 1999*, Hanoi, 2000, p. 5

The situation of terrestrial services is illustrated in table E-2 below.

Table E-2 Terrestrial Television Services

	Number of main programs	Main programs	No. of additional programs(i)
Hanoi area	4	VTV 1, VTV 2, VTV 3, Hanoi TV	0-1
HCM City area	4	VTV 1(ii), VTV 3, HTV 7, HTV 9	2-3
Larger cities	3	VTV 1(ii), VTV 3, local TV station	0-1
Smaller cities	2	VTV 1(ii), local TV station(iii)	0-1
Rural areas	1	Local TV station(iii)	0-1
Remote rural areas	0	n.a.	0

(i) Programs that are broadcasted in adjacent provinces that can be received when having the right conditions (location, antenna)
(ii) VTV 2 (picked up from satellite) is re-broadcasted on times VTV 1 is off air
(iii) In these situations, the local stations often re-broadcast a selection of the national programs (picked up from satellite).

The financial attractions of advertising revenues[93] have moved some local TV stations that are near a large population center to use high power transmitters (5 kW and higher), in order to reach a coverage past the provincial border into the city. As can be seen in table E-2, the number of additional receivable programs from TV stations of the adjacent provinces can be up to three in Ho Chi Minh City. This brings the total number of receivable programs to seven. However, it must be mentioned that the received signal quality at site is often low and it heavily depends on the location in the city whether one can receive the program or not. On top of that, to receive all additional programs properly, a multidirectional or movable directional antenna might be needed.

[93] In 2000, USD 72 million was spent on television advertisement (Source: Taylor Nelson Sofres)

Receiver-end

The receiver-end of the economic value-added television chain concerns the producers of the equipment for the individual households. For analog TV, this mainly concerns the TV manufacturers. The number of television sets in Vietnam is estimated at 10 million, while the estimated annual sales are presented in table below.

Table E-3 Estimated Market Size for Color TV

Year	Quantity ('000 sets)	Value (million USD)
1997	800	208
1998	600	159
1999	700	189
2000	800	216

Source: Philips Vietnam

Annual sales of color TV (CTV) sets have been around 700,000, of which the majority is produced (assembled[94]) locally. As can be seen from the table below, most CTVs are produced in joint-venture with a Viettronics company. All Viettronics companies belong to **Vietnam Electronics and Informatics Corporation** (VEIC), which on turn belongs to the **Ministry of Industry**.

Table E-4 Estimated CTV Market Shares (by Value)

Company (Brand)	Industrial Business Model	1998	1999	2000
Sony	JV (Viettronics Tan Binh)	22.9%	29.4%	30.5%
Matsushita (Panasonic)	JV (Viettronics Thu Duc)	21.0%	18.1%	16.1%
Samsung	JV (District 10 E&E Imp/Exp Co.)	10.6%	11.9%	9.7%
LG	JV (SEL)	9.4%	7.2%	8.7%
JVC	JV (Viettronics Tan Binh)	10.4%	10.1%	10.2%
Toshiba	JV (Viettronics Thu Duc)	6.4%	4.5%	6.1%
Hanel	Hanel		2.5%	3.6%
Bien Hoa (Belco)	Viettronics Bien Hoa	1.2%	2.4%	3.3%
Daewoo	JV (Hanel)	5.8%	2.7%	1.7%
Philips	3rd (ST Electric)		0.9%	2.0%
Hitachi	3rd (Viettronics Tan Binh)	1.9%	3.1%	2.3%
Sharp	3rd (Viettronics Bien Hoa)	0.8%	2.8%	1.7%
Other		9.2%	4.3%	4.2%

JV: Joint Venture
3rd: Third Party, Subcontractor
Sources: Philips Vietnam, GfK

[94] The majority of the local CTV production implies the assembly in CKD (complete knock-down), SKD (semi-complete knock-down), or IKD (incomplete knock-down) form.

The Status Quo of DTT in Vietnam

In 1998, the government, through the Ministry of Science, Technology and Environment, initiated a project team that would be responsible for investigating the possibilities of digital terrestrial television (DTT) in Vietnam. Presiding over this project team was the Hanoi People's Committee, through Hanoi Electronics (HANEL); Vietnam Television was appointed the "main contributor".

At the end of 1999, this project team held a seminar on the "first impressions". At that stage, the team had studied the three digital standards for terrestrial broadcasting, ATSC (United States), DVB-T (Europe) and ISDB-T (Japan). A strong preference was spoken out for the European standard, DVB-T. However, due to the slow decision making process of the Vietnamese bureaucracy, it lasted until April 2001 that Vietnam Television officially chose DVB-T as the standard for Digital Terrestrial Broadcasting.

Together with the seminar, the project team brought out a report[95] to the government on the advantages of DVB-T for Vietnam. The reported advantages were about the same as those identified in section 2.2 of this thesis.

Meanwhile, in 2000, the team had had a number of tests using the DVB-T standard. Digital broadcasting equipment for these experiments has been purchased from ITIS (modulators; France) and Tiernan (compression system, multiplexer; US). Also in 2000, a delegation of the team, including representatives of HANEL and VTV as well as representatives of the Vietnamese government made an extensive visit to Philips Digital Networks and Philips Semiconductors in the Netherlands.

After the visit, a conference was organized (December 2000), with one of the issues the recommendation of the following milestones:

- First DVB-T commercial trials in Hanoi and Ho Chi Minh City at the end of 2003;
- Digital broadcasting in larger cities from 2005;
- Digital broadcasting in the rest of the country and phasing out of analog broadcasting between 2015 and 2020.

As of now, these recommendations have not yet been translated into policy by the Vietnamese government. As a matter of fact, the milestones above are continuously changing. Further, from political scenes it is emphasized that the Vietnamese government is determined not to lag behind other countries in the region and encourages Vietnam Television to speed up the implementation schedule.

In the present situation, the Vietnamese government is examining proposals for the implementation of DTT in Vietnam. One important condition for the proposals is that they have to include the total infrastructure, containing the head-end (above described service and delivery) as well as the receiver-end. In practice this means that the project proposal needs to include a transmission system as well as a set-top-box production line.

[95] Bo Khoa Hoc Cong Nghe va Moi Truong, *Tai Lieu KHCN-01-05B: Truyen hinh so mat dat, nhung quan niem ban dau*, Hanoi, December 1999.

Trial

The forced combination head-end and receiver-end, plus the political competition between various parties, has lead to a peculiar situation. The player landscape has changed compared with analog, (see chapter 5). Initially, two parties have been submitting proposals for the trial broadcasting in the Hanoi area to the Vietnamese government. First objective was to get the government's approval as well as the attached loan for this trial.

However, there has been a change in the situation. One of the parties, VTC, has started a trial in the Hanoi area as from July 1, 2001. VTC is doing this without the approval of the government (VTV), but with a test license for UHF channel 26 for the Hanoi area. This license expires in March 2002.

The VTC trial consists of eight free-to-air programs in one single channel, covering greater Hanoi with one transmitting antenna. When the trial started, the broadcasted programs included VTV1, VTV2/HanoiTV, VTV3/VTV4[96], CNN, StarSports, MTV, TV5 and Deutsche Welle. However, because VTV had serious objections against the broadcast of DW, TV5, CNN (political issue) and MTV (cultural issue), VTV threatened to sue VTC. The two parties have reached a compromise: VTC will be allowed to continue the broadcast, but the content must be changed. The present content is now: VTV1/2, VTV3, VTV4, HanoiTV, Cartoon Network, StarSports, ESPN and "VTC" (a selection of international programs).

VTC has already set up an SMT[97]-line for the production of digital set-top-boxes, in co-operation with Benjamin, a Taiwanese STB manufacturer. At the same time as the trial-start, VTC started to sell their STB at a price of USD 225. Six weeks after the start, sales had reached 3000 units[98]. Unit price has been relatively stable at about USD 215.

The other party, HANEL, is preparing a trial, but is still waiting for the government's final approval since it needs the government loan to finance the trial.

Available Spectrum for Digital Terrestrial Television Broadcasts

In order to "fit" new DTT broadcasts into the spectrum, in many countries the new DTT signals need to be "squeezed" into channels that were previously considered to be "taboo". The number of available DTT channels is then limited by the number of taboo channels that are available for use.

In Vietnam however, with an average of only one or two occupied channels throughout the country, no "squeezing" is necessary. Even in the largest cities, Hanoi and Ho Chi Minh City, there is no need to squeeze either.

In Vietnam, the following VHF and UHF channels are available for TV broadcasts:
VHF: channels 6-12
UHF: channels 21-51

[96] VTV4 is the program broadcasted on satellite for Overseas Vietnamese

[97] Surface Mounting Technology

[98] Source: VTC

Practically the whole UHF spectrum is available for digital broadcasting, since per site a maximum of two or three UHF channels are in use. This aspect is a relative advantage for Vietnam compared with other countries. A re-planning of the broadcast frequencies and a stronger regulation regarding the transmitting powers, especially in the south, can further boost the capacity for digital broadcasting and simulcasting with the existing analog programs.

Conclusions

The Vietnamese television broadcast sector is not a business, but a propaganda instrument for the central and provincial government. All TV stations belong to the government. Besides being the central broadcaster, Vietnam Television (VTV) is also the regulator, supervisor and executor of laws and regulations involving broadcasting and propaganda. Therefore, VTV can be identified as the most important party in this sector.

Although the infrastructure for analog terrestrial television is far from complete, there are already developments in digital terrestrial TV. This does not need to be a problem; chapter 2 has even identified it as a possible advantage, by skipping the investment in analog technologies and start digitizing terrestrial TV. This process has already started, and the question is now in which direction it will proceed.

Spectrum scarcity as in other countries is not the case in Vietnam. The amount of available content is small and the number of available channels is large. This implies that the potential capacity of digital terrestrial TV is huge, even with simulcast. It also implies that capacity, one of the four benefits mentioned in section 2.2, is not the decisive reason for Vietnam to digitize terrestrial television.

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